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The Future of Urban Technolgy

Exploring Smart Cities and Transportation through Game Theory and Scenario Planning

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May 13th, 2022
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Abstract

Technological innovation is occurring at a rapid pace in the world of personal devices. This trend of change has not been able to occur as fast in the city infrastructure. The consumers are curious about the next generation of technology and integration of artificially intelligent technology in transportation and the urban fabric. In this project I study the motivations and values of a set of characters involved in the integration and innovation of Smart City Technology. These characters create potential future scenarios of the city from there actions and reactions to specific decisions.

This body of work can provide a visualization of possible futures of the city. The games and scenarios, show potential outcomes based on a set of actions taken by players, not the certain future. The replicable method created in this work allows readers to use the characters, and their backgrounds, to carry out their own game that yield a variety of results that looks to broaden the amount of possible future situations of the city and quality of life with this next generation of technology.

Introduction
Value

Smart City - Integration of new technology into the existing city to increase the flexibility, efficiency, and sustainability of city operations

Systematic connection between the physical world and the digital world

The projects replicability allows for readers to perform their own games that broaden the realm of potential futures for the city

Literature Review

Smart City Goals
Mobility, Society, ***Quality of Life***
Environment, Government, Economy

Cities are **laid out around the use of transportation** and the automobile

A majority of **transportation methods go unused** in the city becuase of a mass amount of **people who drive alone** everyday

Increase in the amount of vehicle = **congestion**

City **real estate lost** for the use of parking vehicles

Integration of technology increases efficiency of the vehicles and the safety of passengers - connection of vehicles / infrastructure to the IoT

Method / Approach
Game Theory + Scenario Planning

Organized and produced through **2 portions of the project**

Character Development
(Research)

Scenario Planning
(Exploration)

Character Research

Goal
To understand the background, motivations, and values that each player represents

Research of players allows for future potential actions taken by each player in a game to create the possible scenarios

Anatomy
(Components)

Internet of Things

Artificial Intelligence

Data

User Interface

Chracters
(Motivations / Values)

Public Authority

Vehicle Manufacturer

Technology Company

Consumer
Variable Character

Scenario Planning

Goal
To establish games and series of interactions amongst players to yield potential situations based on actions and reactions of players

The goal is to not predict the future correctly, but rather to explore potential possibilities of what the city could look like with this innovation

Scenario 1
Age of Early Adoption
2030

Narrative

Matrix
List of Possible Actions

Scenario Tree

Drawings
Isometic / Perspective

Demographic Usage

Scenario 2
Era of Blended Technology
2045

Narrative

Matrix
List of Possible Actions

Scenario Tree

Drawings
Isometic / Perspective

Demographic Usage

Scenario 3
Time of Technological Adaptation
2060

Narrative

Matrix
List of Possible Actions

Scenario Tree

Drawings
Isometic / Perspective

Demographic Usage

Conclusion
Resolution of Questions

How can game theory and scenario planning help to produce a replicable process to create different possibilities of future realities?

How does the innovation of smart city transportation system impact the design adaptation and implementation in the urban fabric and the quality of life of the user's experience?

Introduction

The future of technology is already in the hands of citizens across the world. Technology draws people in, creating a reliance on intelligent systems. People's lives continue to build and revolve around the digital world. In the past 20 years technology has happened rapidly in mobile devices but has yet to take off on a more urban level. Consumers are curious about the future of technology and the newest innovations that they can use in their daily lives. The integration of technology into the urban environment is no longer a question of 'how', but rather a question of 'when.'

A Smart City plan aims to integrate new technology into the existing city to help people move and understand the city more efficiently with new methods of transportation and the use of real-time data. The Smart City connects its citizens, visitors, governments, transportation, and infrastructure in a data-rich system powered by the Internet of Things. The next generation of technology in the urban fabric looks to focus on the establishment of a smarter transportation system. This system includes the integration of artificial intelligence along with renewable electric vehicles. The goal of the technology is to make a better quality of life for the city-dwellers in an efficient and sustainable manner as the population of urban centers continues to rapidly increase.

In this project I establish a base set of research about how the components of smart transportation system operates and the characters involved in a variety of partnerships to establish this reality. The development and understanding of each character will help to guide the exploration of game theory and scenario planning to create possible future realities of living with the next generation of technology. The game theory games will be set up to explore interactions amongst characters as the technology is integrated and then assessed based on the intuition of what the quality of life would be for the citizens of the city.

Is this technology impacting their lives in a positive or negative way? And how can it still be improved?

The world and its technology are going through constant innovation. This new era of transportation technology and the way in which consumers interact with it and the city will help to improve the quality of life of the people in the city. The consumers strive to increase their quality of life and their efficiency when traveling in a place of a lot of people. An Intelligent Transportation System allows for a more reliable, informative, and sustainable network of vehicles in urban fabric to increase the efficiency and in turn the quality of life for the consumers.

Background / Literature Review

Smart Cities are a systematic connection between the physical world and the digital world. "A Smart City is a place where traditional networks and services are made more flexible, efficient, and sustainable with the use of...technology to improve city operation for the benefit of the inhabitants"[1]. The system connectivity is powered through the Internet of Things (IoT), which is the interconnection via the Internet of computing devices embedded in everyday objects that enable them to send and receive real-time data. The Smart City integration becomes the backbone for a city through the system, network, and technology to help control the efficiency and quality of life of the urban environment.

1 S. P. Mohanty, U. Choppali and E. Kougianos, "Everything you wanted to know about smart cities: The Internet of things is the backbone," in IEEE Consumer Electronics Magazine, vol. 5, no. 3, pp. 60-70, July 2016.

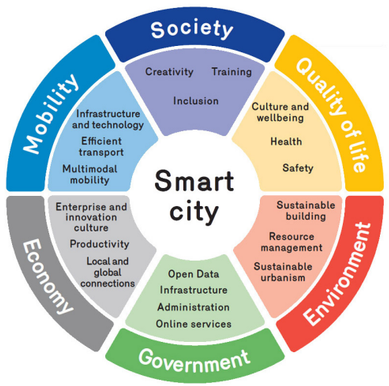


Fig 1. City, Brussels Smart. "About: Brussels Smart City." About | Brussels Smart City, smartcity.brussels/the-project.

Smart Cities operate off the goals of mobility, society, quality of life, environment, government, economy, and mobility. The goals, laid out in the diagram, correlate and impact one another based on change in other sectors. This project and research focus on the variability and innovation in the 'Mobility' category. 'Quality of Life' is assessed in future scenario studies to learn how specific actions of people have impacted changes in the city – positively or negatively.

The business and large interest in smart city technology integration and the innovation of the associated technology are a driving factor in this project. Creating and understanding characters helps to build scenarios of interaction that yield potential views of the city. The curiosity that the city agencies, companies, and consumers have is with how this technology is going to impact their lives, businesses, and infrastructure.

The twenty-first century urban fabric, in many cities, is based and laid out around the use of transportation and the automobile. The city is made up of the people. The transportation network is the nervous system that connects people around the city. David Levinson, a civil engineer, transportation analyst, and a professor at the University of Sydney, suggests that "transportation systems serve the people, and are created by the people...traveler's time depends both on the free flow time, which is a product of infrastructure design, and on delay due to congestion"[2]. The project takes time and efficiency of people into account to determine a positive quality of life for the consumers.

People take a variety of different methods of transportation both Privately and Publicly. These modes, in the public right-of-way of the street can included: bus, rail, cars, taxis, motorcycles, bicycles, and on foot. A majority of these methods go unused, on a day-to-day basis because a large sum of people drive alone every day. This adds to the number of vehicles on the road that impact congestion and traffic within cities, there seems to be a necessity for people to own a personal vehicle - maybe because of the direct method of transportation – but the problem of having too many vehicles persists. As the urban population continues to

2 Levinson, David. "Fundamentals of Transportation/Introduction." *Fundamentals of Transportation/Introduction - Wikibooks*, Open Books for an Open World, 2019

rapidly grow so does the number of vehicles. The United States Bureau of Transportation[3] lists that in 2017 there were 272 million registered highway vehicles. This creates a large amount of congestion in more densely populated areas. Data shows an increase of about 5 million newly registered vehicles per year. Donald Shoup, a distinguished professor of urban planning at UCLA, shows that a vehicle's life averages about 5% use and 95% of time being unused and parked[4]. Most of a personal vehicle's life is idle due to people driving a short distance to ultimately park the car and return to it at the end of the day. With the bottleneck of downtown traffic, about "30% are [people] just looking for a place to park"[5]. By moving people to use more public means of transportation the roadways are able to free up space to become more efficient. Along with the decrease of personal vehicles, the decrease in parking lots and infrastructure allow new real-estate opportunities to open to businesses and the city. The parking lot is a large amount of space to house vehicles not in use, and do not add much benefit to the experience of the city. Opening these spaces, impacts the physical urban fabric and the experience that people have in the city.

People are still dependent on the automobile for daily travel. Brookings, an American research group, reported that over 76% of Americans drive alone to work every day[6]. The American Community Survey reported 150 million workers in 2016, there is at least 115 million vehicles driving on the streets every day. This data shows an abundance of traffic that can be more efficient through the integration of real-time data, the IoT, and a smarter

3 United States, Congress, Bureau of Transportation Statistics. "Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances." *Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances*, United States Department of Transportation, 2018, pp. 1–2.
4 Shoup, Donald. "The High Cost of Free Parking - Summary." Tri-State Transportation Campaign, 1997.
5 Hancock, P A, et al. "On the Future of Transportation in an Era of Automated and Autonomous Vehicles." *Proceedings of the National Academy of Sciences of the United States of America*, PNAS, 14 Jan. 2019, www.pnas.org/content/116/16/7684.full.
6 Tomer, Adie. "America's Commuting Choices: 5 Major Takeaways from 2016 Census Data." *Brookings*, Brookings, 9 Feb. 2018, www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.

network of transportation. Research from the Bureau of Transportation[7], in a national household travel survey, shows that 87% of daily trips take place in personal vehicles. Americans take about 1.1 billion trips a day which is about 4 trips for every person in the United States per day. Vlope Center[8] has conducted research that shows that Americans spent a total of 84 billion hours using transportation (2015), in both public and private sectors. This is a large portion of our daily lives. Narrowed down, this data shows that the average American spends about 1.1 hours per day in transit. The data may not seem daunting, but that one hour a day adds up to 15 days per year, just in a car or on public transit. People rely heavily on the use of transportation, either public or private, in their daily lives.

Intelligent Transportation Systems (ITS) can help the city's transportation network function at its optimum level. An ITS uses the Internet of Things (IoT) as a backbone to connect new innovation of technology that is able to send and receive mass amounts of real-time data. Partnerships between the public agencies and private corporation is necessary for the success of the system. These new applications of digital technology are able to communicate with each other to create a more coordinated network of vehicles and roadways to allows transportation to move more efficiently through the city.

Artificially intelligent vehicles have the capability of increasing efficiency and safety of passengers on the road. The vehicles and the integrated technology in the city can speak to each other to make the best decisions for the system. Newly innovative vehicles are able to

7 United States, Congress, Bureau of Transportation Statistics. "National Household Travel Survey: Daily Travel Quick Facts." *National Household Travel Survey: Daily Travel Quick Facts*, United States Department of Transportation, 2017, pp. 1–2.
8 Vlope Center. "How Much Time Do Americans Spend Behind the Wheel?" *Volpe National Transportation Systems Center*, United States Department of Transportation, 9 Dec. 2017, www.volpe.dot.gov/news/how-much-time-do-americans-spend-behind-wheel.

utilize faster networks and real-time data to continually learn and adapt to specific scenarios in the city. In this type of system, it is vital to consider the consumer's integration into the network. Multiple forms of data are to be accessible to the public to gain knowledge and information about the vehicles to increase the citizens reliability in the system.

The integration of smart technology into the urban environment does not rely just on innovation, but also the relationship and goals of the public agencies and private stakeholders. The private sector is able to catalyze the deployment, innovation, and use of smart transportation systems. In this project and associated research I look to understand the duties and motivations of players in both the public and private sectors. This understanding allows for interactions amongst players to take place and help to give ideas for future scenarios with a new Intelligent Transportation System.

The blending of Smart City technology into the urban fabric is a contemporary endeavor. There are benefits that can put cities at a competitive advantage that includes less travel time, more available real estate, a more sustainable environment, and a high quality of life for the city-dwellers. These relationships benefit the city and its occupants as they can "provide more efficient procurement and focus on consumer satisfaction"[9] through the integration of this new technology. Transportation is used at a less efficient rate causing unneeded congestion and density within cities. Innovation is a necessity for growing cities and just building new roads is not a long-term solution to the congestion of rapid urbanization. Public authorities and private companies need to work in tandem to integrate new innovative technology into the transportation infrastructure.

9 Marrques de Sa, Isabel. "How Do You Build Effective Public-Private Partnerships?" *Yale Insights*, Yale Insights, 16 May 2017, insights.som.yale.edu/insights/how-do-you-build-effective-public-private-partnerships.

Project Development Plan

The project was set up as a 2-semester capstone. This was to ensure that both questions of the project to conclude results from the project. The first semester was set up as player research and establishment. This research was to focus on understanding the players that would be involved in the game theory scenarios along with the components that make up a Smart City transportation system. The research followed data of the current period about motivations of city officials/agencies, private corporations, and the consumers to assess positive and negatives about transportation in the city. This research help to establish a background understanding of each player and their intentions with technology, operations, or integration. The semester also included research about future studies in order to comprehend potential future predictions based on previous data trends. This background would eventually help to establish a base line for the scenarios that the project creates.

The second semester was dedicated to conducting the games/scenarios with the players that I learned and understood in the previous portion. These scenarios used game theory to test interactions and reactions of players within each other in a specific scenario. Payoffs for actions could be positive or negative, but with the previous research, reactions can be based on the intentions of a specific player. The games created in this portion of the project used the research done prior with intuition to creatively create scenarios based on quality of life rather than scenarios based on analytical research. The scenarios, produced by the project, are a few potential outcomes in an exploration of method. These outcomes are not 'correct' or 'incorrect' – they are possible. The goal for this portion was to explore game theory and scenario planning to try to answer the question of the project while being able to create a replicable system for people to follow and add to the possible outcomes based on the interactions and events of the players.

Method / Approach

The project is broken down into 2 separate semesters: one for the initial research of the character and components of the system and another to use that research to create scenarios of interaction to yield potential outcomes for the city. In this project I look to identify positive quality of life increases out of the integration of technology in an intelligent transportation system through a guiding question of:

> **How does the innovation of a smart city transportation system impact the design adaptation and implementation in the urban fabric and the quality of life of the user's experience?**

The response to question is revealed through a method of game theory and scenario planning. Game Theory is a modeled situation as a game with players, actions they can take, and payoffs that they receive in different situations. This method helps to build out intuitive and creative scenarios based on the values of the players, identified in the initial research of the characters. Game Theory creates a set of options where different actions and reactions can take place to yield a different scenario of possible future situations and development paths. This set of varying results are one of driving factors to answer and explore the second question of the project:

> **How can game theory and scenario planning help to produce a replicable process to create different possibilities of future realities?**

This question, posed for the project, an inquiry to which to analyze the experimental method of game theory in combination with scenario planning. The exploration of future possibilities and being able to test ideas, helps the project suggest new results that vary from one another. In this project I pose new ideas of the future, maybe not 100% correct ideas, but potential outcomes base don the actions of the players in each scenario.

Character Research and Development

Introduction to the research about each player and the components included in an Intelligent Transportation System

Format of Research

Text:

Describes the function of the elements and characters as a form of basic information to understand the basic motivations and goals.

Drawings:

The drawings depict a micro-story of each anatomical element / character to supplement the details given in the text

Context (Isometric / Perspective):

Visually being able to see the elements or the realm of intervention of each character within the context of the city

Anatomy

Internet of Things (IoT)

Artificial Intelligence (AI)

Data

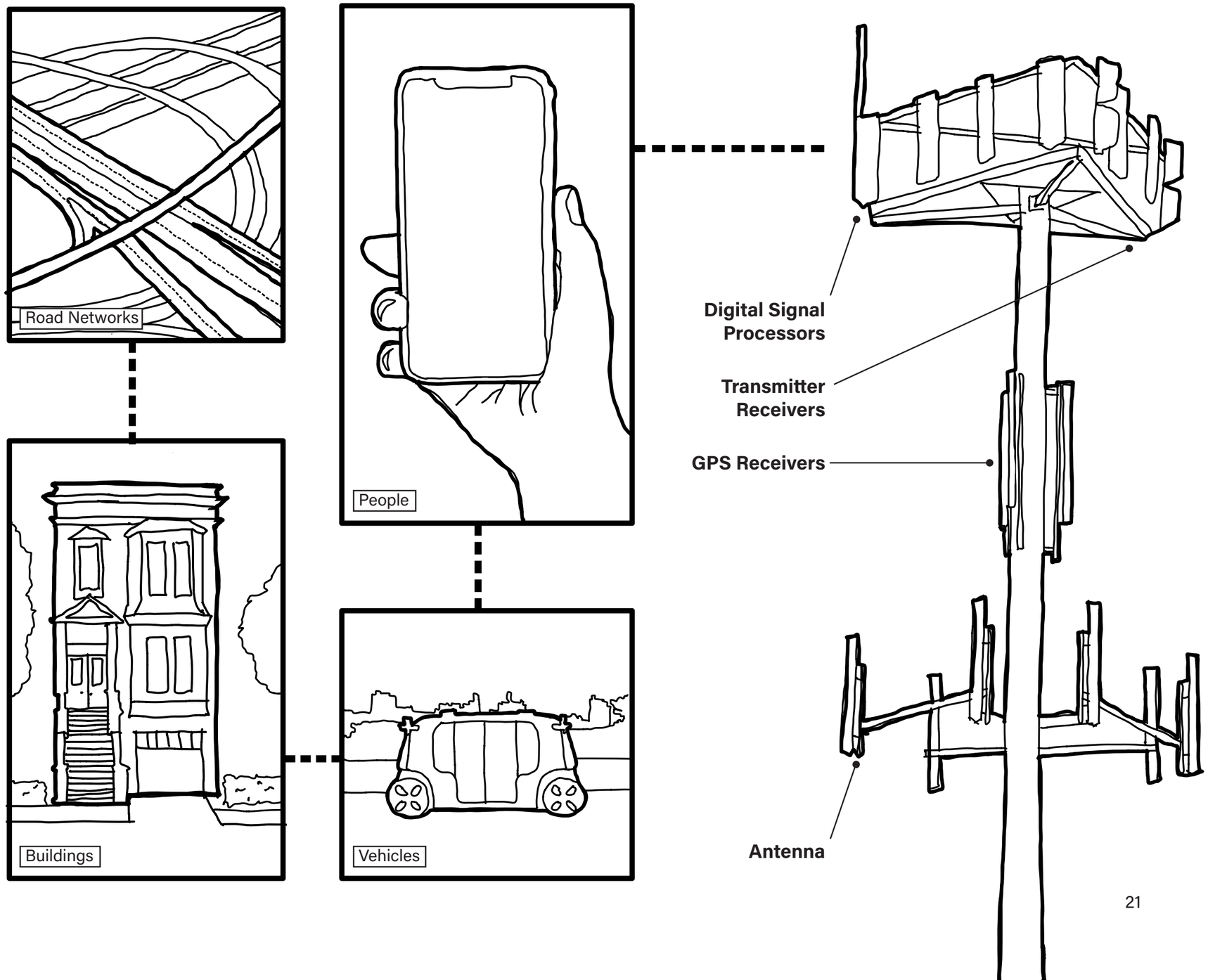
User Interface (UI)

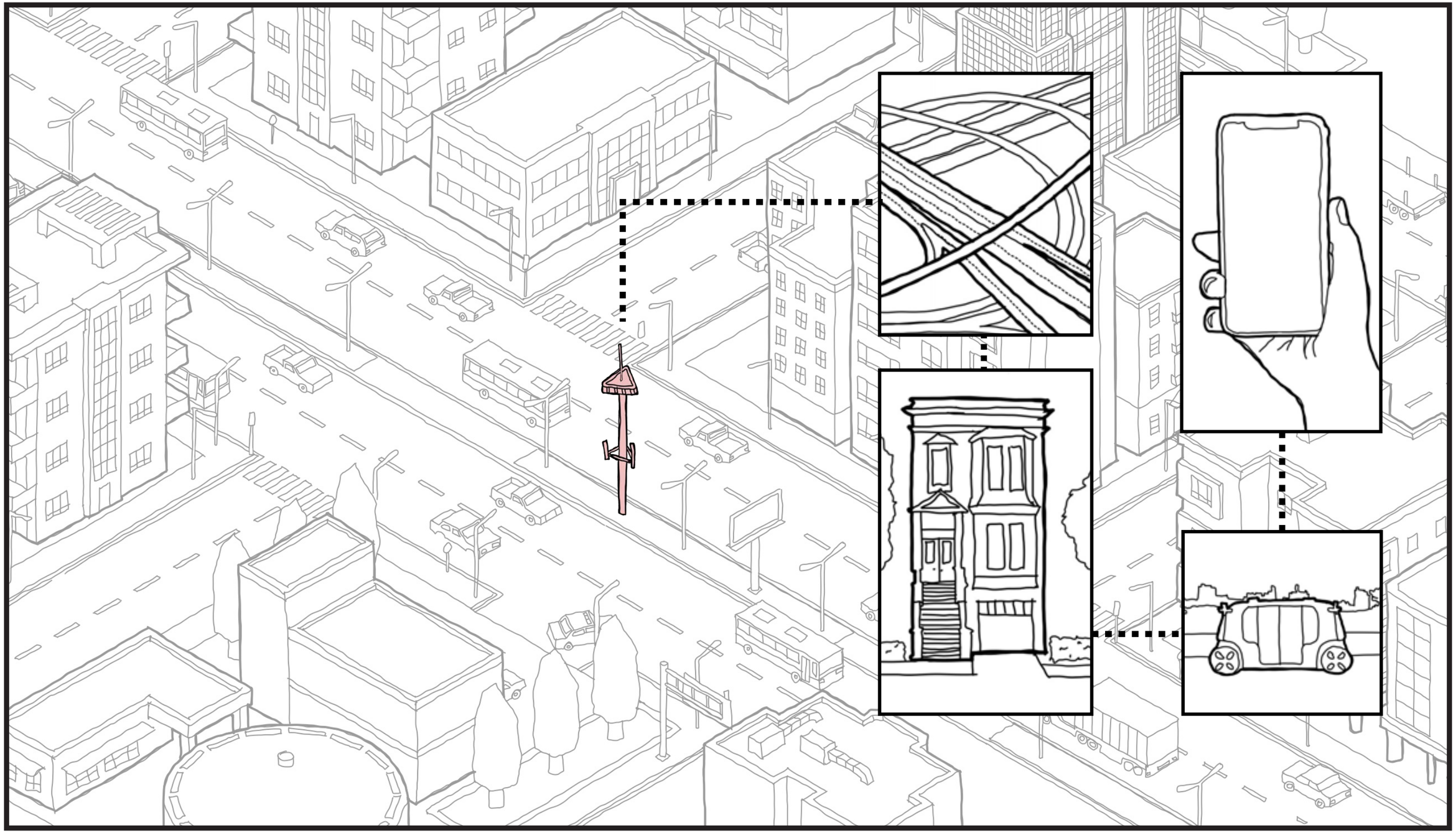
Internet of Things

A digital network of physical objects or “things” embedded with sensors and softwares. A majority of everyday digital objects are connected to the Internet of Things - smartphones, watches, everyday personal technology.

The objects are able to communicate and exchange information through the digital network. Objects send and receive data across the network to function.

The network is progressive in its innovation and constantly being updated to be faster along with being able to handle more data and more devices being connected to the system. The goal for the Internet of Things is to connect all aspects of everyday devices and infrastructure.





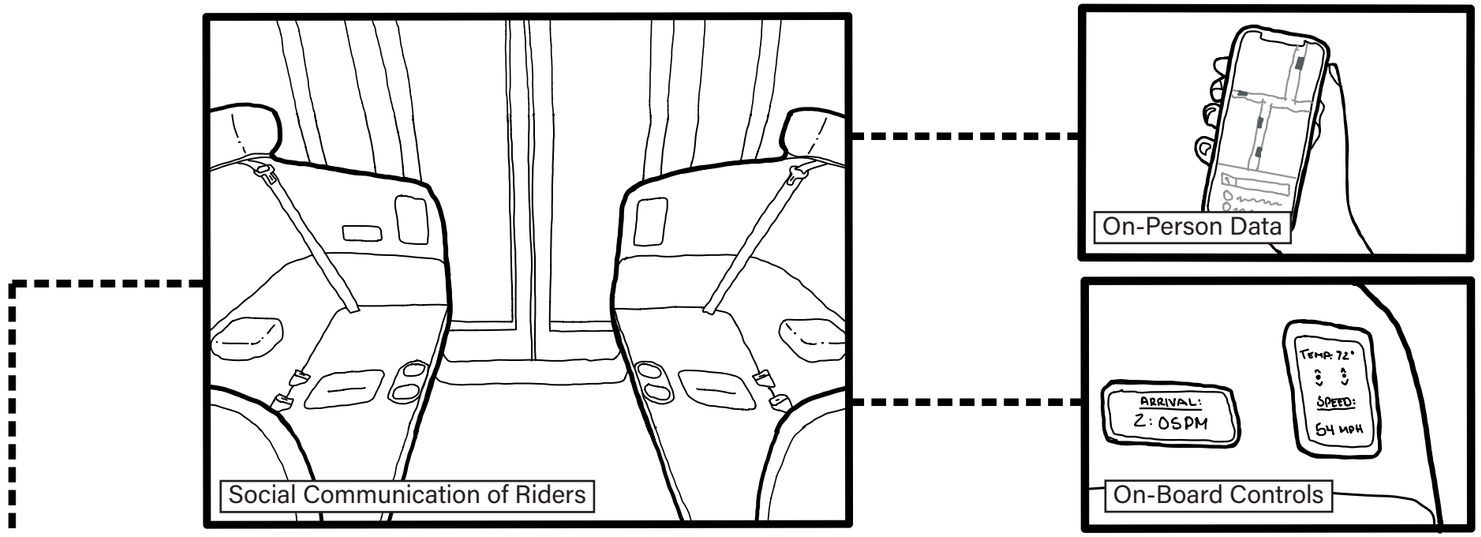
Artificial Intelligence

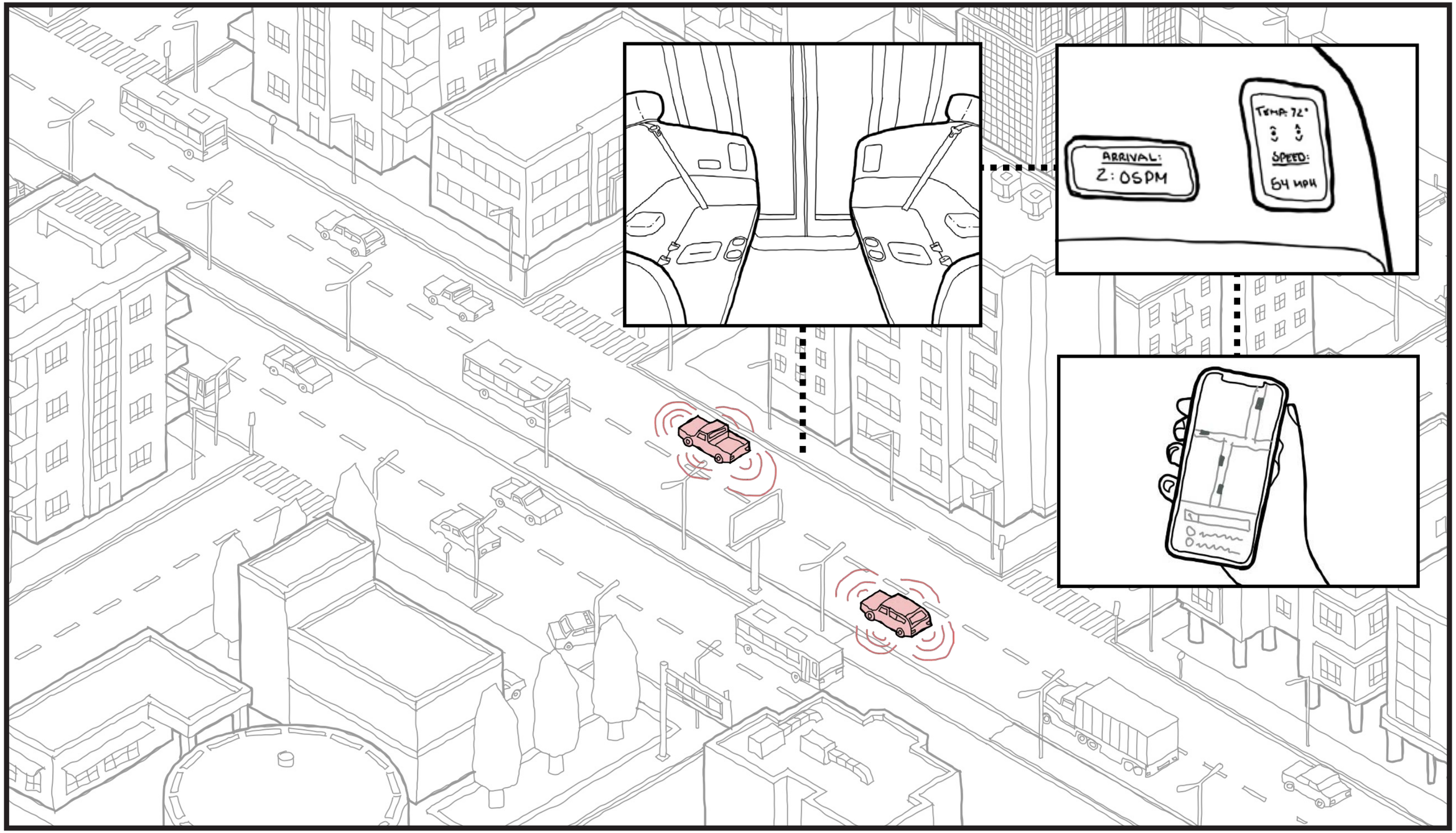
Computer and software engineering have computers to perform tasks that normally require human interaction.

Machine learning allows this technology to make independent decisions based on its past and current data. As the technology continues to develop, the computer software begins to learn how to make better decisions with the real-time data that it is sending and collecting from an input or system.

Communications:

- Vehicle to Vehicle (V2V)
- Vehicle to Infrastructure (V2I)
- Vehicle to People (V2P)
- Vehicle to Data Hub (V2DH)

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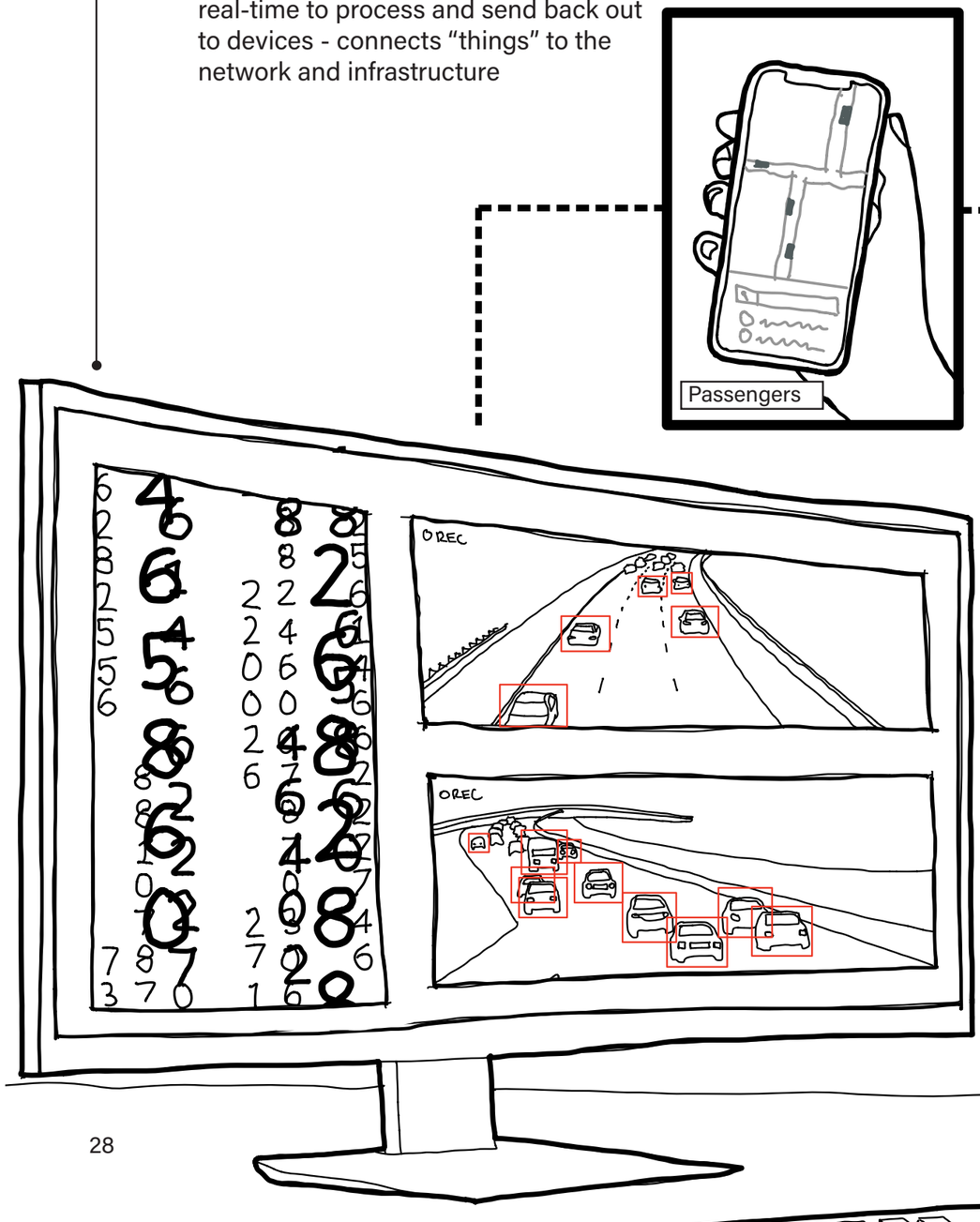
TEMP: 72°
SPEED:
64 MPH

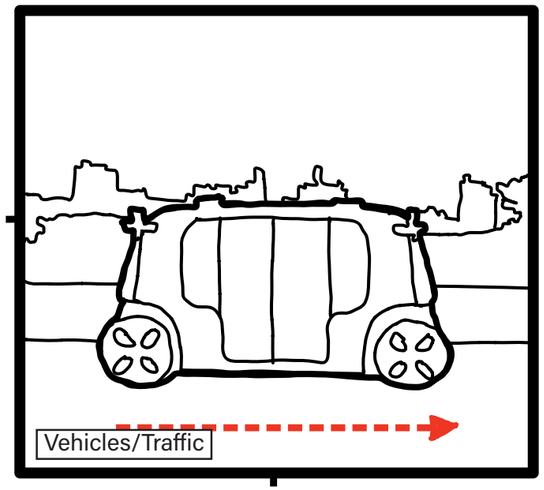
Data

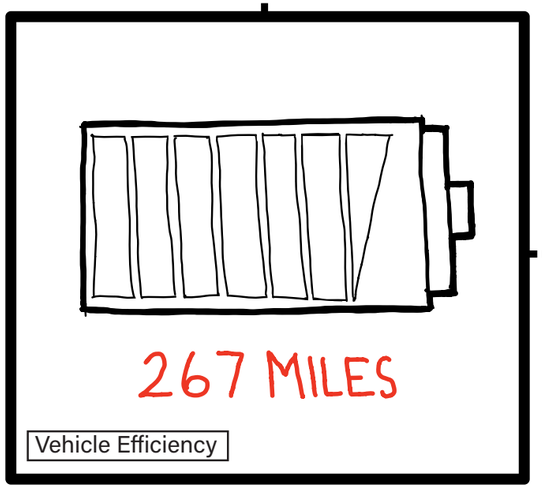
Facts and Statistics transferred through a connecting network. The data is the component that is used by personal technology to display information to consumers and used by artificial intelligence to learn and make decisions.

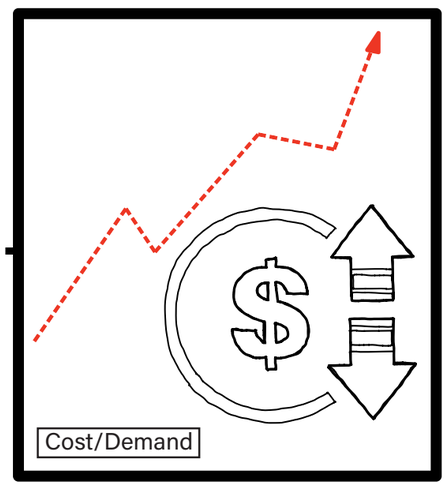
Micro-atoms of the digital network that allow it to function. They are the building blocks that allow a system to function.

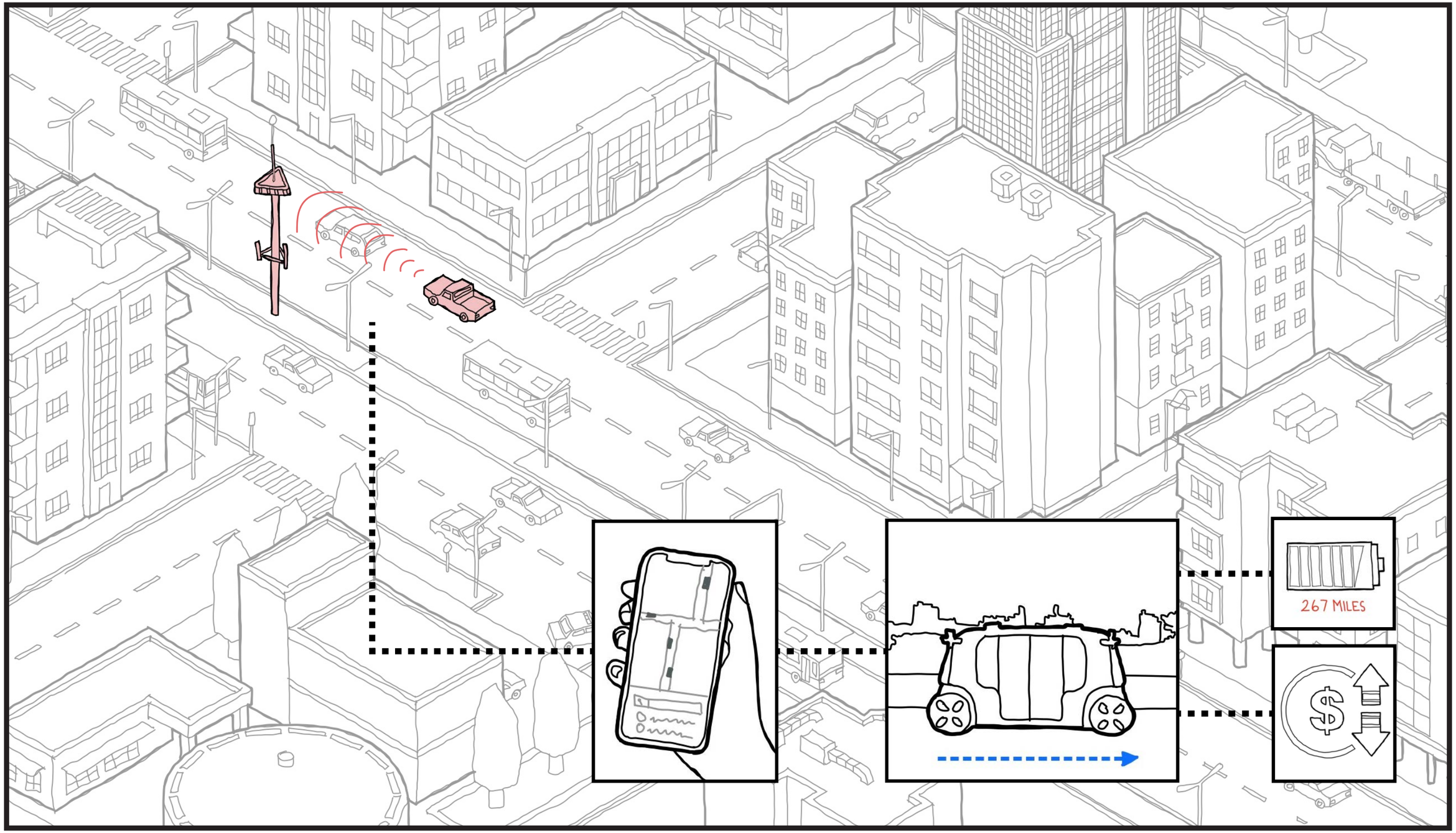
Transit Agency
Data Hub to collect information in real-time to process and send back out to devices - connects “things” to the network and infrastructure







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User Interface

The direct human interaction with the digital network. This is a network of devices that connect people to the Internet of Things using data and personal devices.

The goal of a good User Interface is about the ease of use to operate and understand for an average person. The interface is able to display large sets of complex data in a very understandable way to the consumer.

Devices:

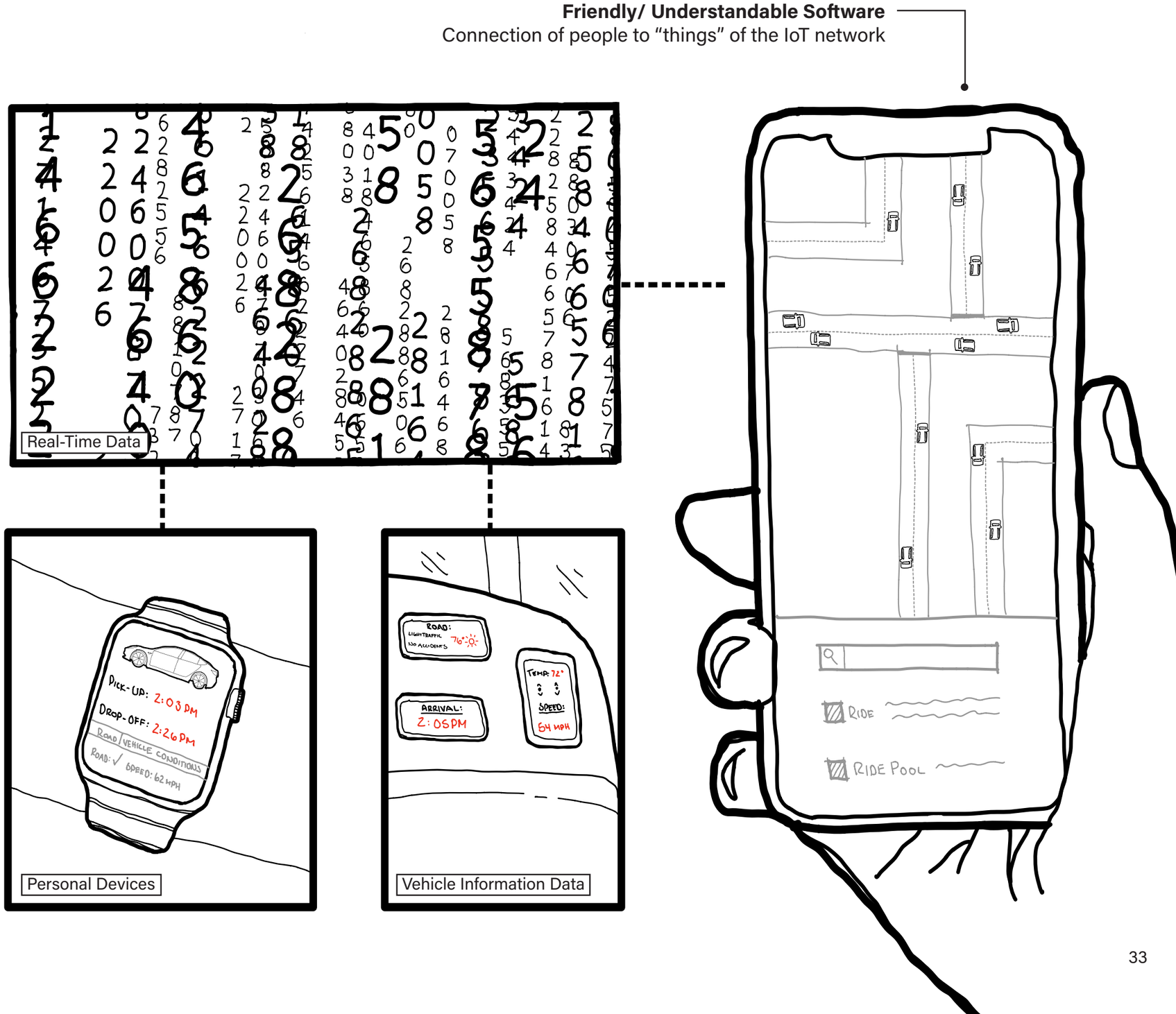
Smartphone

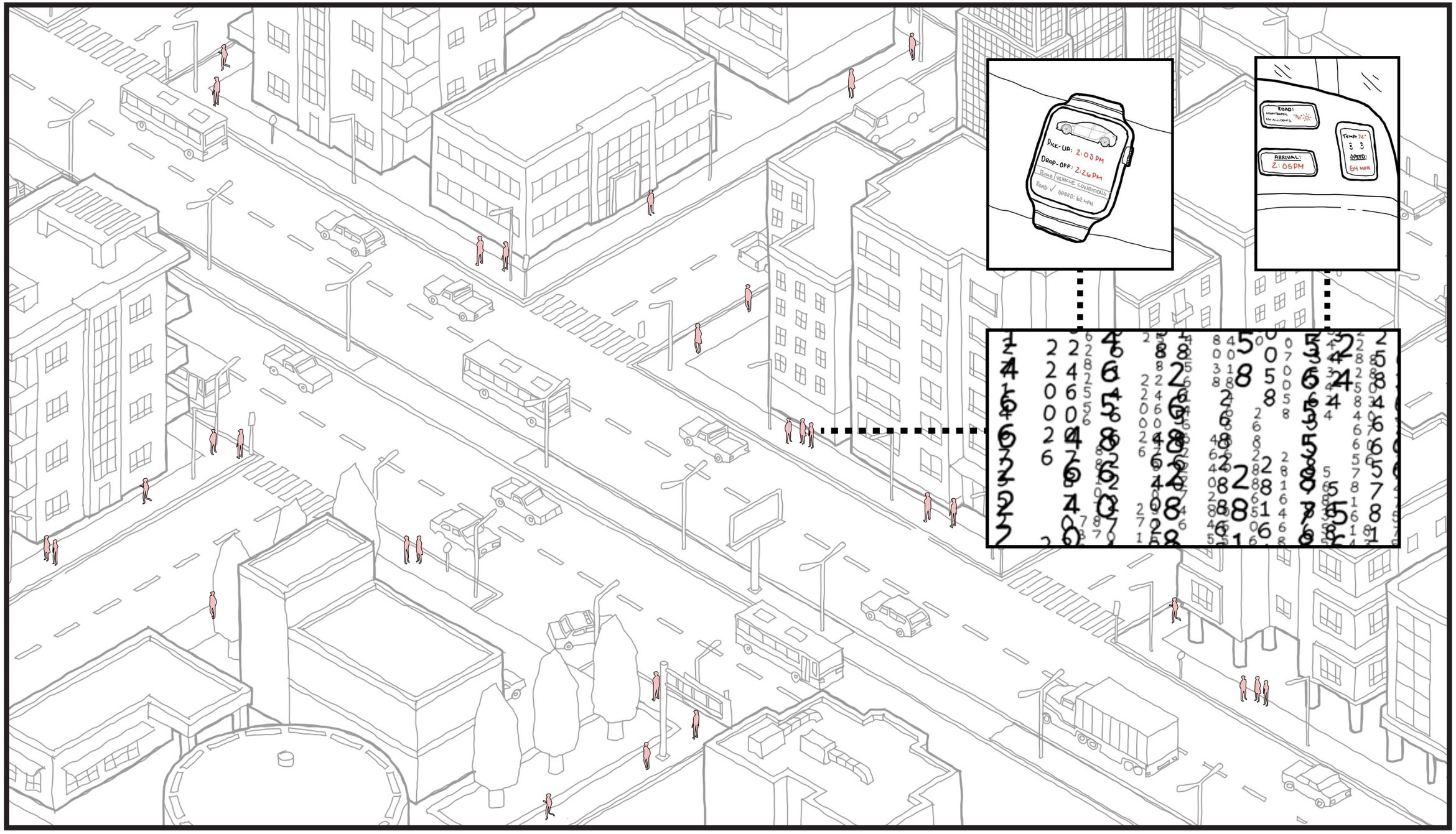
Smart Watch

Tablet

Laptop

Other Personal Devices




Pick-up: 2:03 PM
Drop-off: 2:26 PM
Road/Vehicle Conditions
Road: ✓ Speed: 62 MPH
Road:
Temp: 72°
Arrival:
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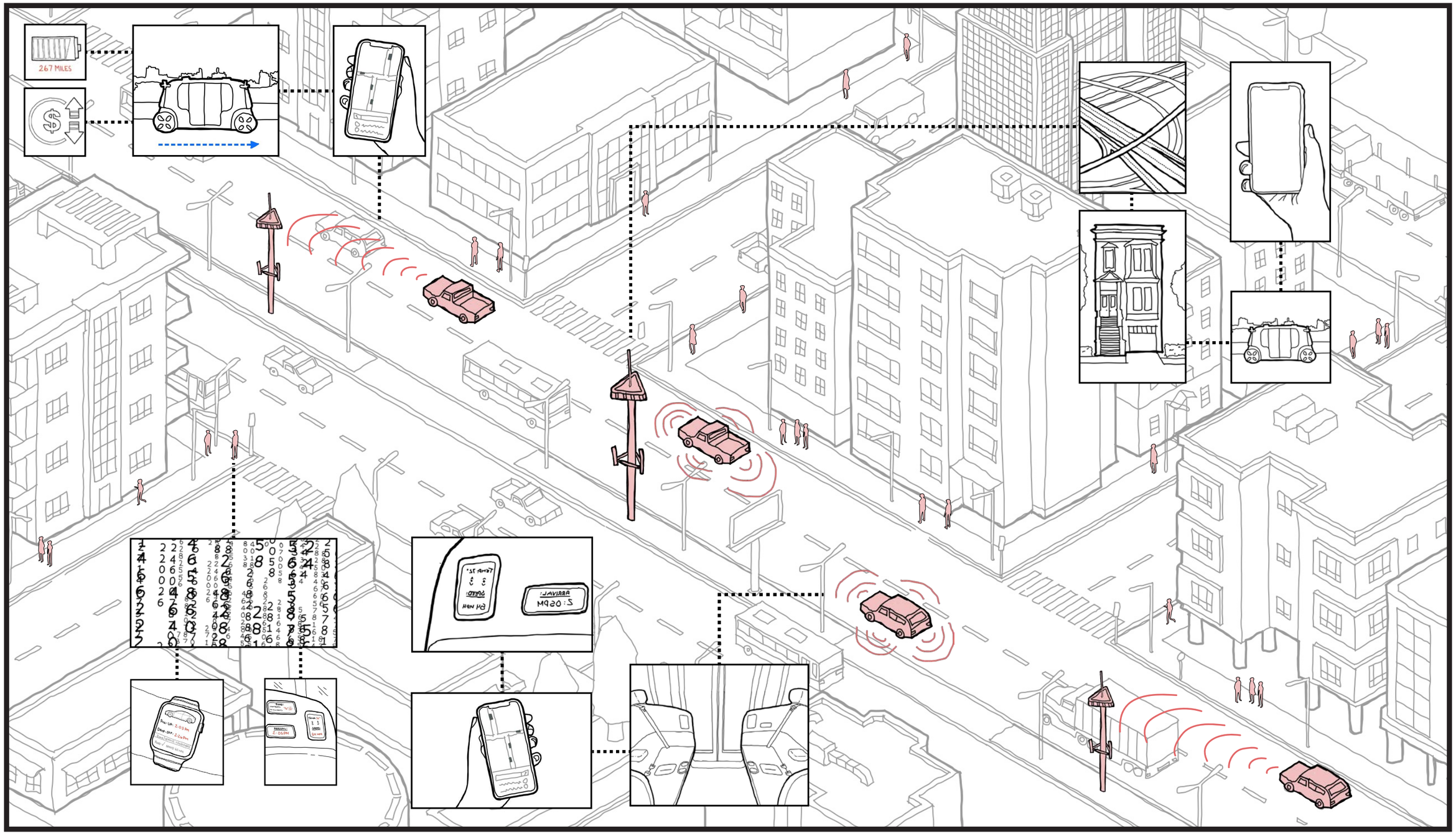
Speed:
64 MPH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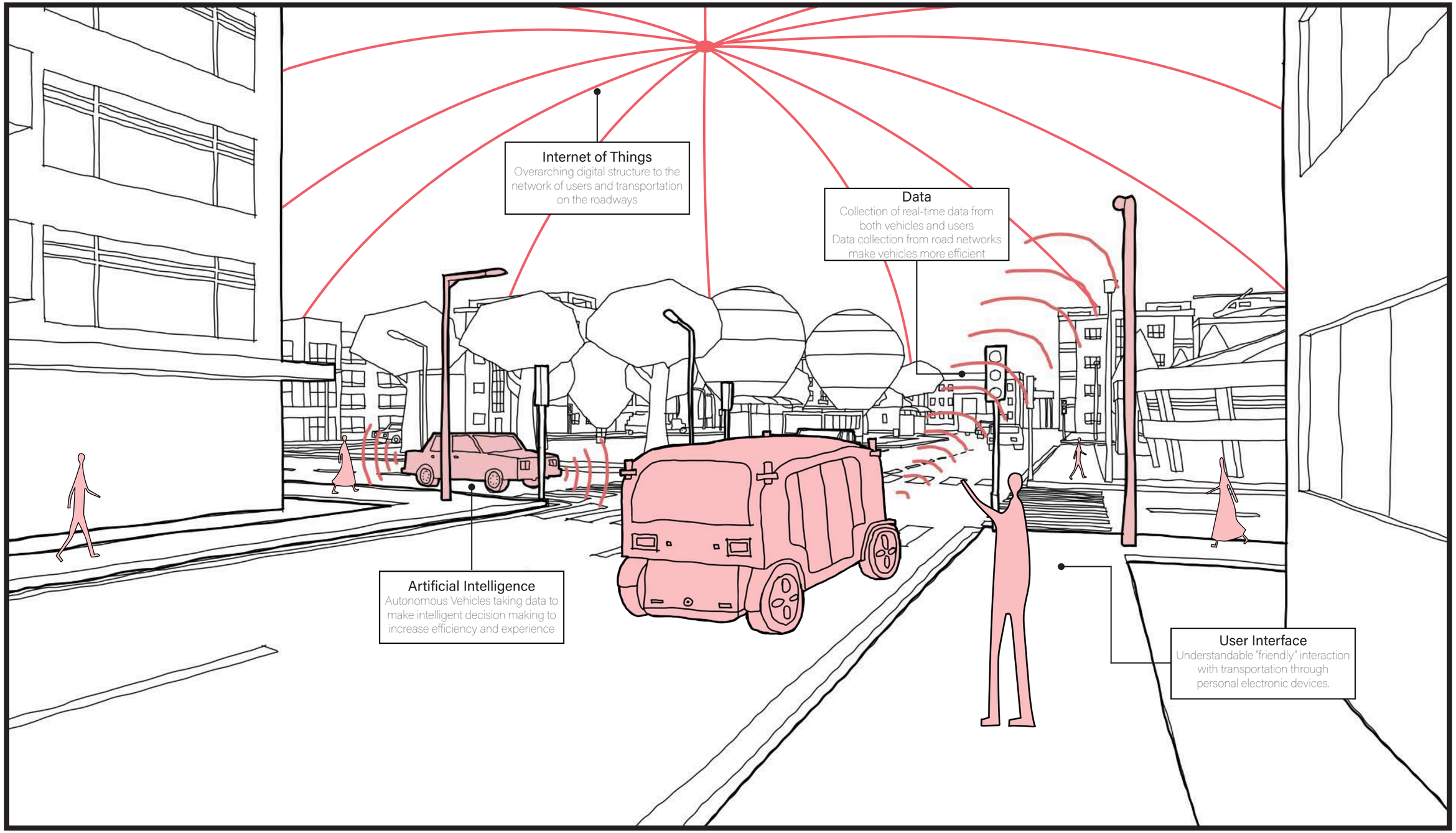

Internet of Things
Overarching digital structure to the network of users and transportation on the roadways
Data
Collection of real-time data from both vehicles and users
Data collection from road networks make vehicles more efficient
Artificial Intelligence
Autonomous Vehicles taking data to make intelligent decision making to increase efficiency and experience
User Interface
Understandable "friendly" interaction with transportation through personal electronic devices.

Characters

Public Entity + Authority

Vehicle Manufacturer

Technology Company

Data Company

Citizens + Consumers

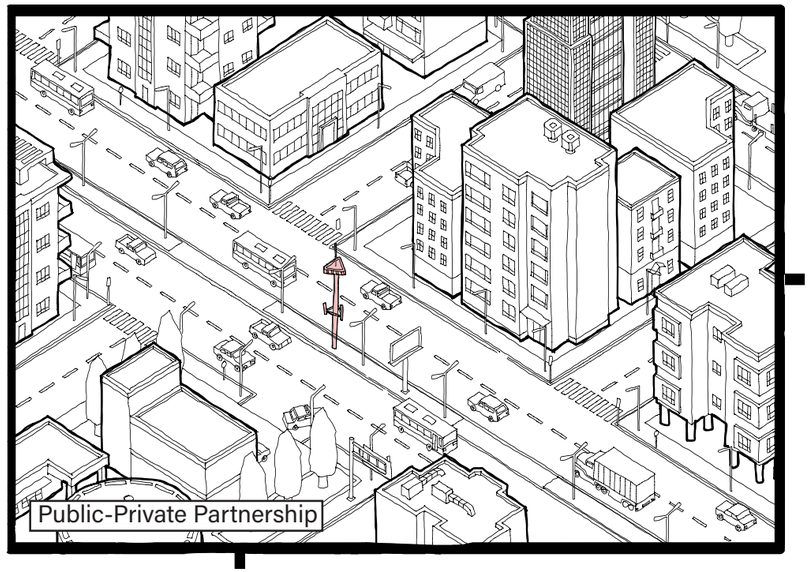
Public Entity / Authority

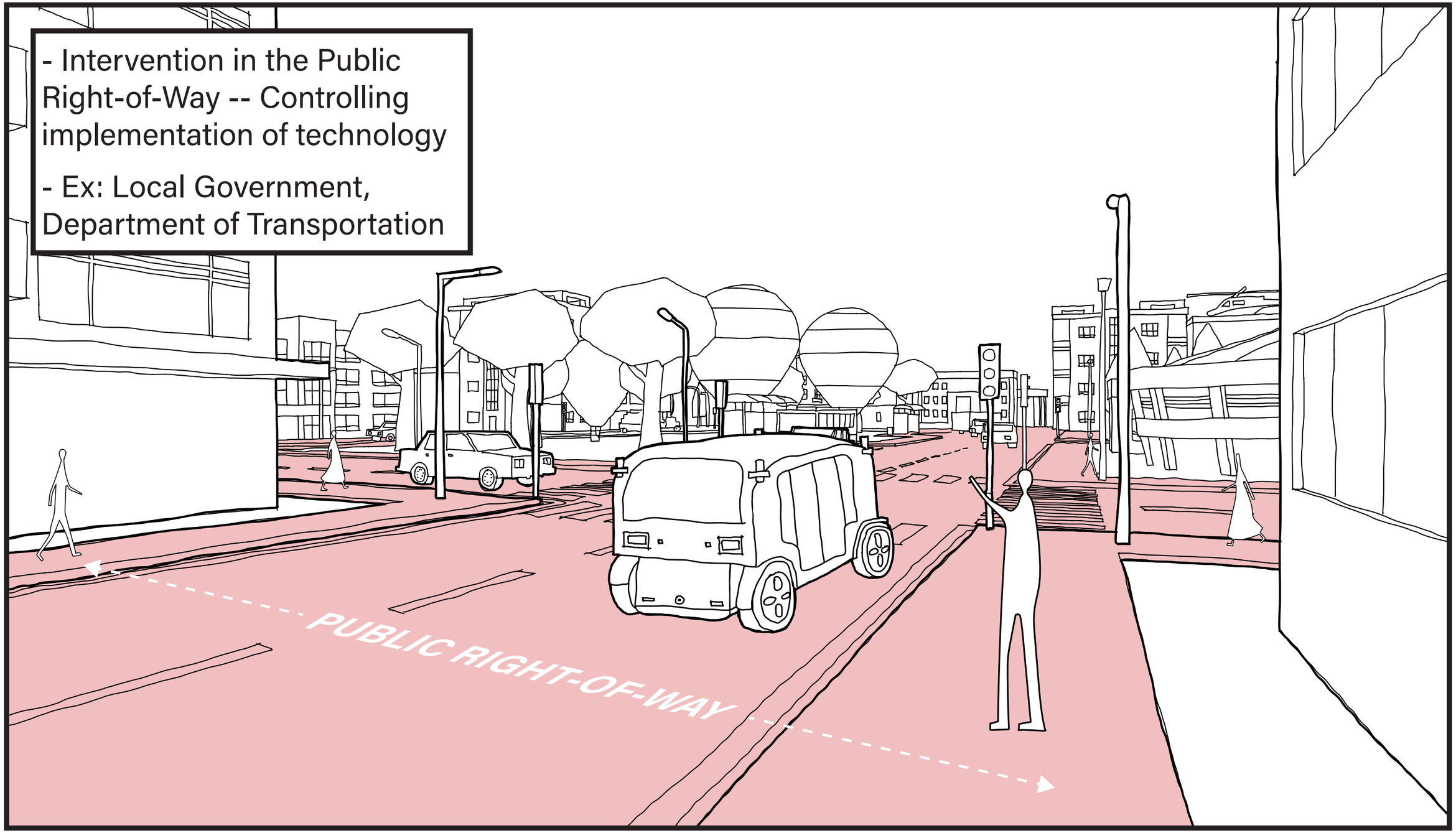
The public officials are trying to increase the efficiency of their city while keeping people safe.

Working with the private companies, through a Public-Private Partnership, to implement technology into the public infrastructure. The city looks to use the skills of the companies to operate or help operate the new system.

Use of policy making and legislation to implement this technology. The close partnership with private companies, allows the public authorities to regulate the new network of technology along with incentives for the public to use the technology in their daily lives.

The public officials are also cost conscious on how much money it will take to implement the technology into the city. The city has to choose how to budget their funding to make integration happen in the urban fabric.



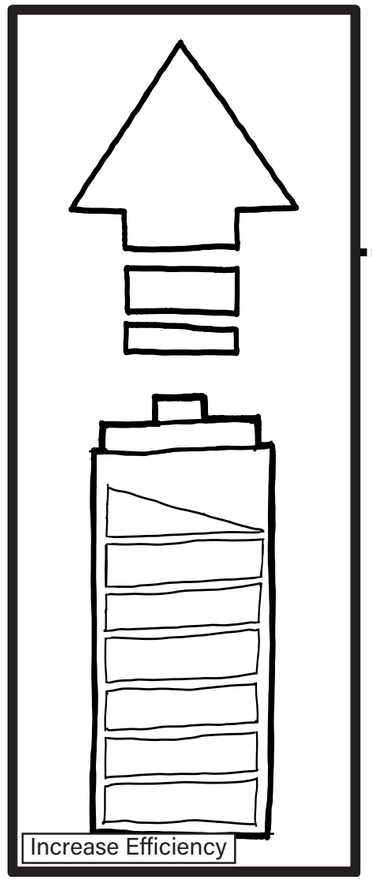

- Intervention in the Public Right-of-Way -- Controlling implementation of technology
- Ex: Local Government, Department of Transportation
PUBLIC RIGHT-OF-WAY

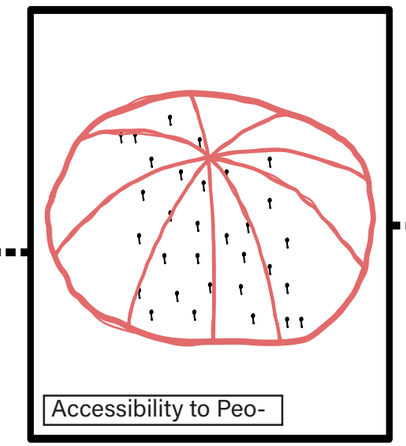
Vehicle Manufacturer

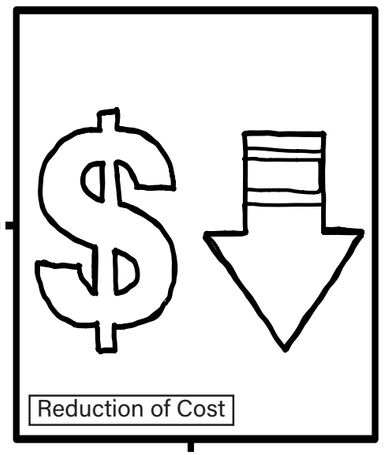
The goal of the vehicle manufacturer is to create cost effective and increase the efficiency of vehicles to the populous and for the public transportation system. The vehicles look to innovate on the sustainable impact of their vehicles along with having the latest technology.

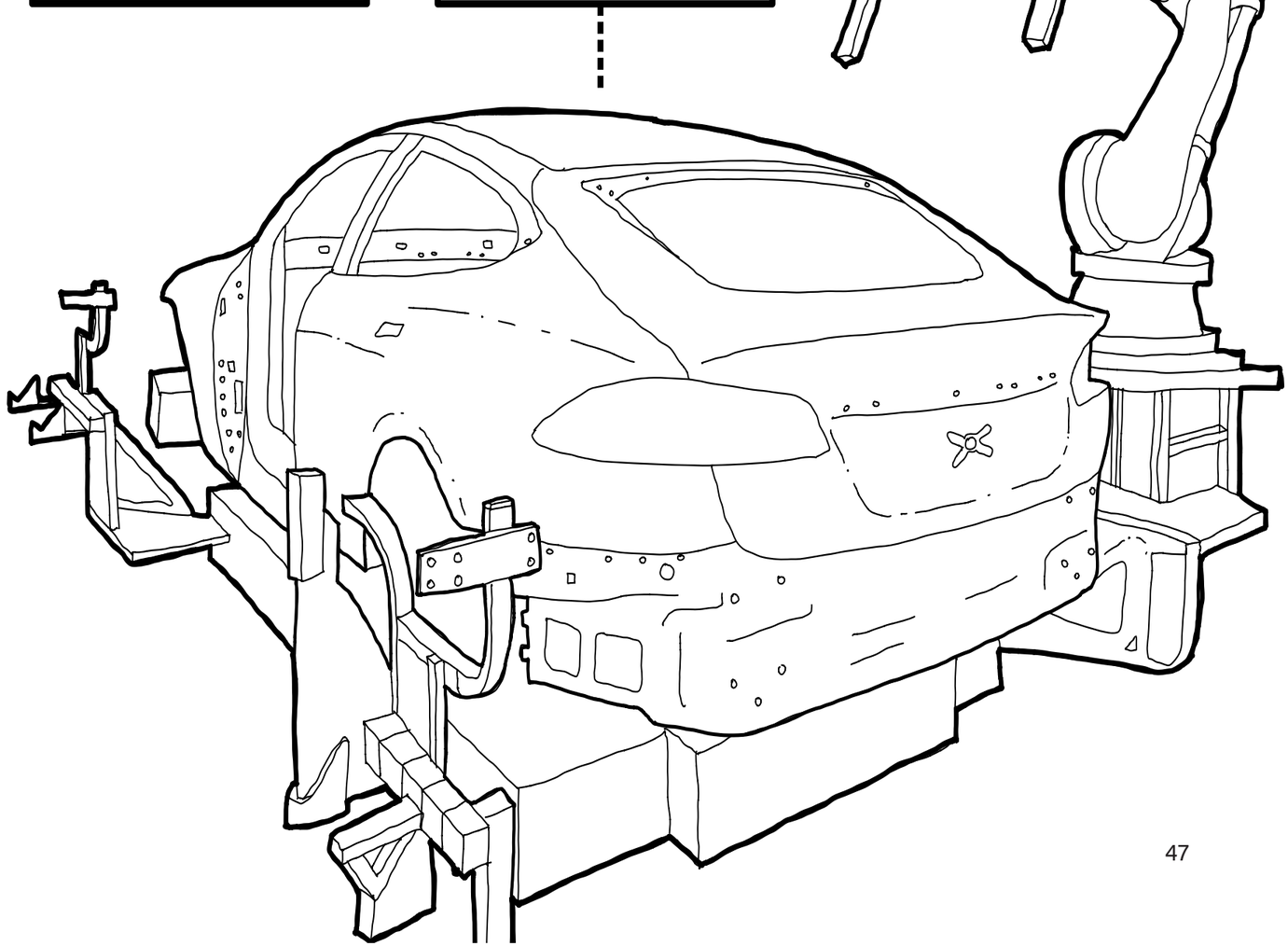
This player also want to create attainable vehicles for the larger public. They want to increase the reach of the manufacturer to get more of their vehicles on the road. Brand awareness is key for the company for future innovation to become the go to vehicle for consumers.

The company also looks to create seamless communication between their vehicles, other vehicles, and the road way.



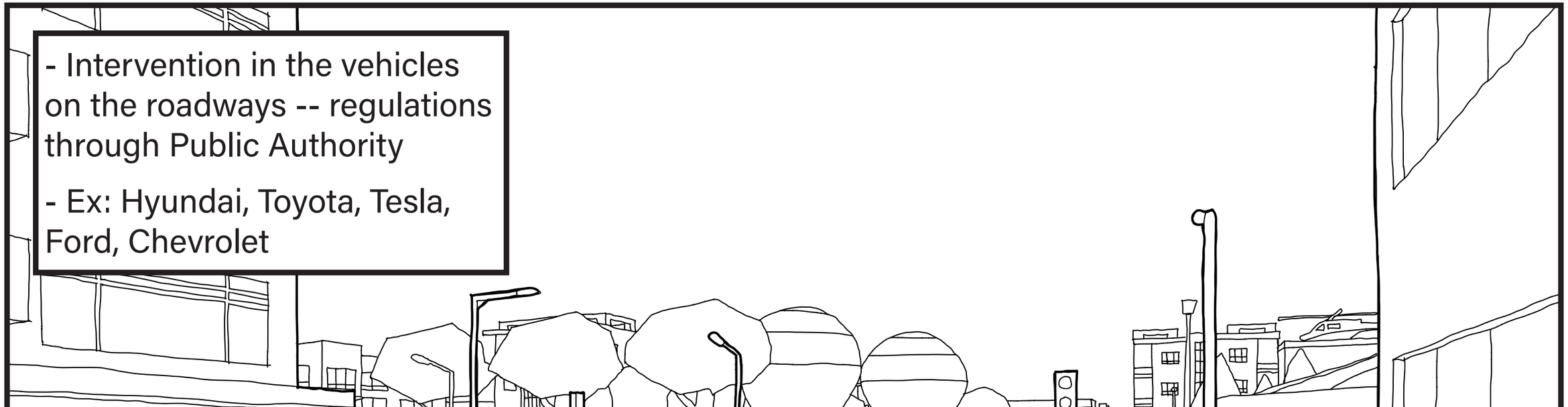






- Intervention in the vehicles on the roadways -- regulations through Public Authority

- Ex: Hyundai, Toyota, Tesla, Ford, Chevrolet



Technology Industry

Being able to work closely with multiple players within the scenarios -- Vehicle Manufacturers, Data Company, and Public Agencies. The technology portion of the system is what drives the efficiency of the transportation system and the quality of life with the relationship between people and technology.

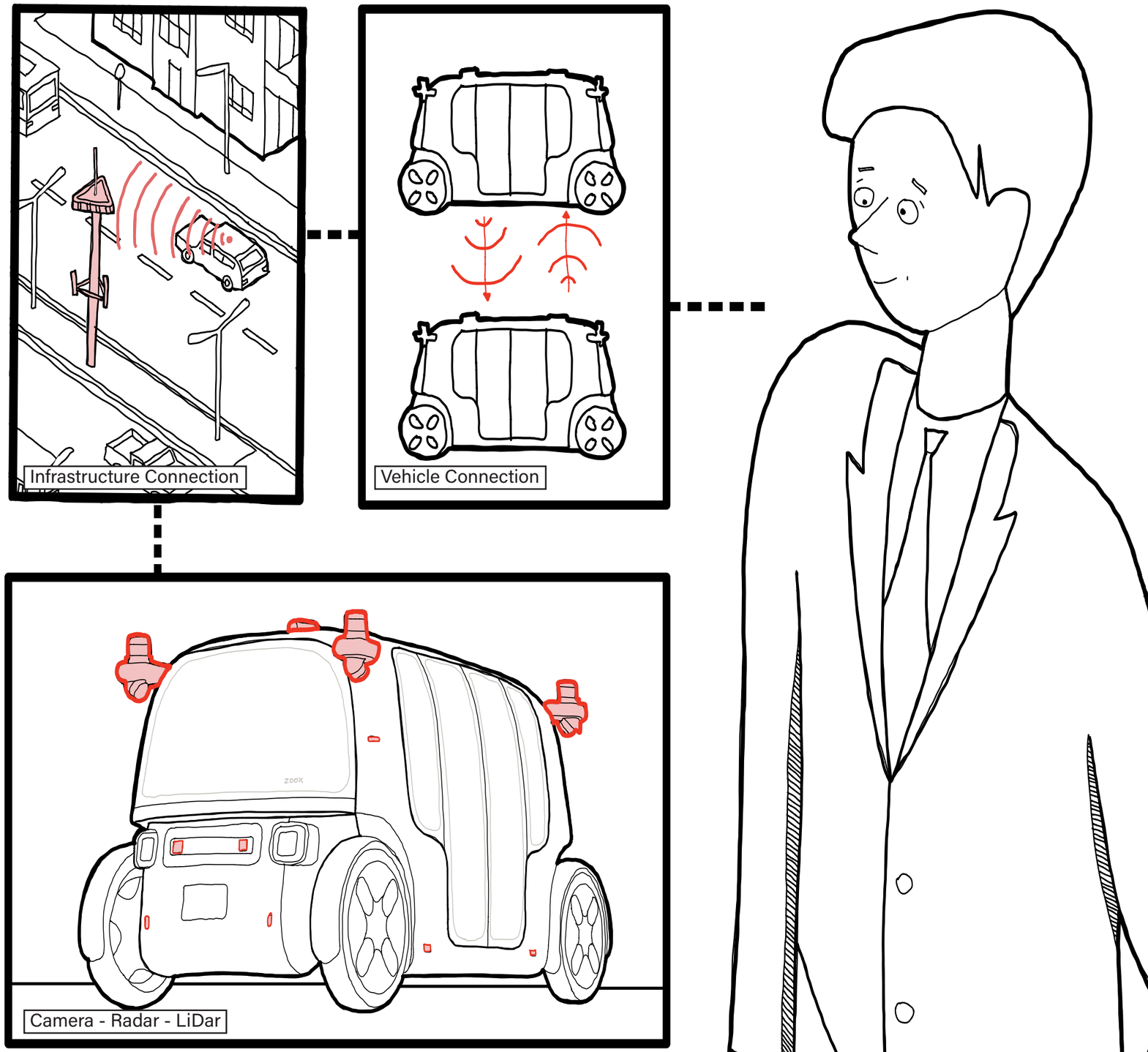
Connecting vehicles and people to each other and to the city's infrastructure. The data industry operates, innovates, and manages the digital realm of the technology. They also play a big role in the management and transferring of data between objects connected to the Internet of Things.

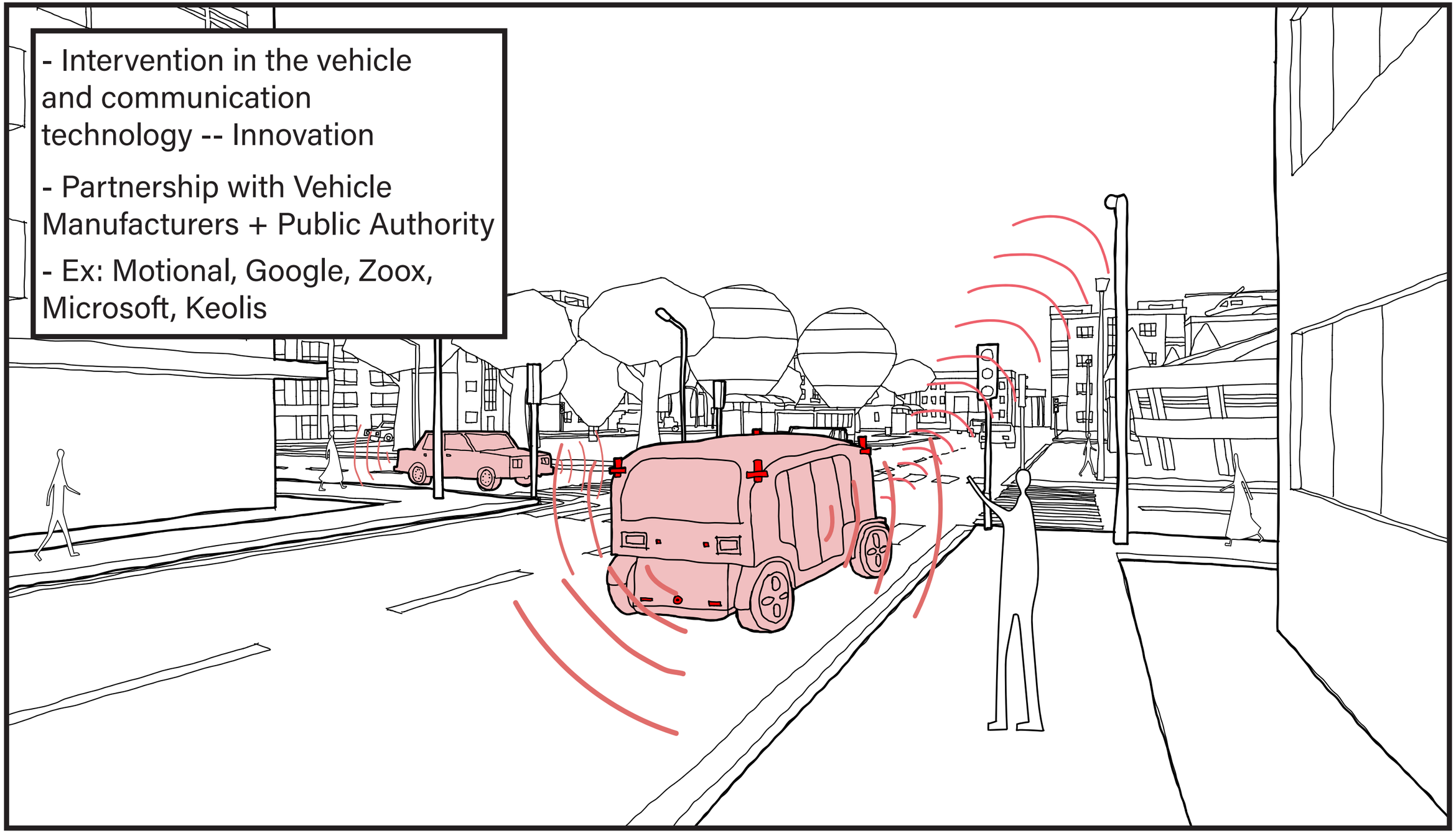
Technological Devices - On Vehicles:

Cameras: Seeing What Things Are (Color)

Radar: Where Things Are (Distance and Speed)

LiDar: Where Things Are (3D Environment)




- Intervention in the vehicle and communication technology -- Innovation
- Partnership with Vehicle Manufacturers + Public Authority
- Ex: Motional, Google, Zoox, Microsoft, Keolis

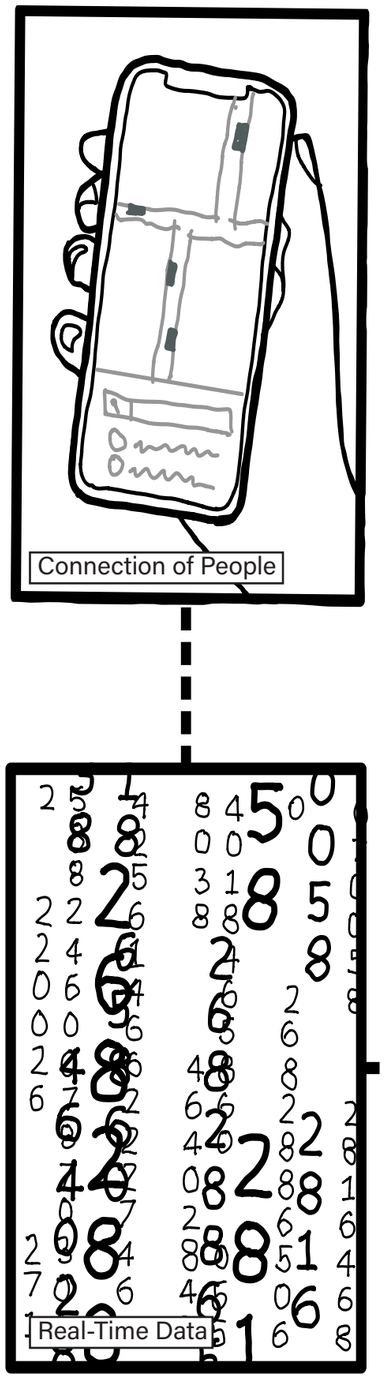
Data Industry

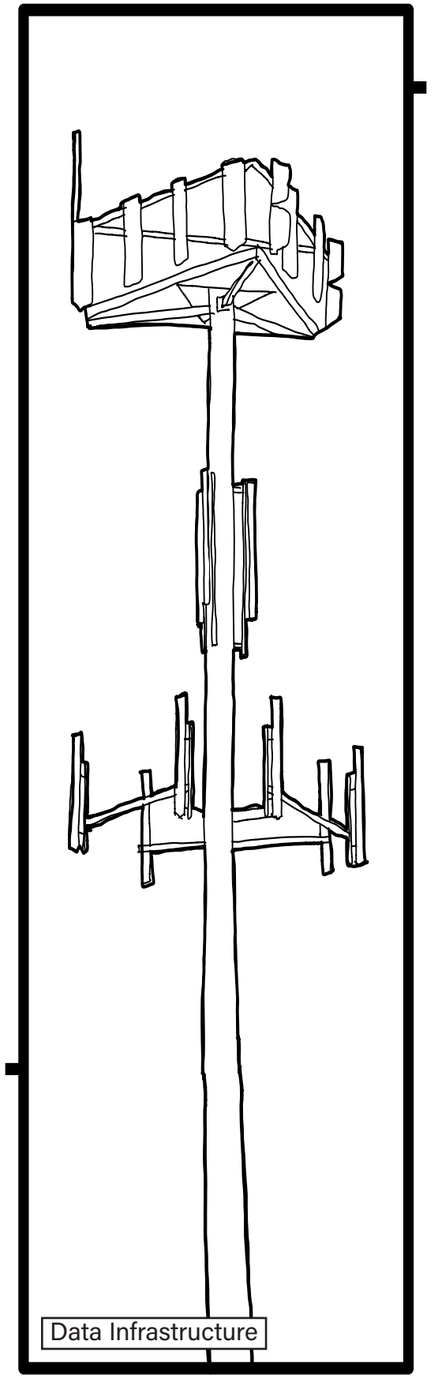
Control and setup of the infrastructural system to connect the “things” to the Internet of Things. The infrastructure is able to be operated by the private company to continually innovate the system as more people and more devices are connected over the IoT to send and receive data.

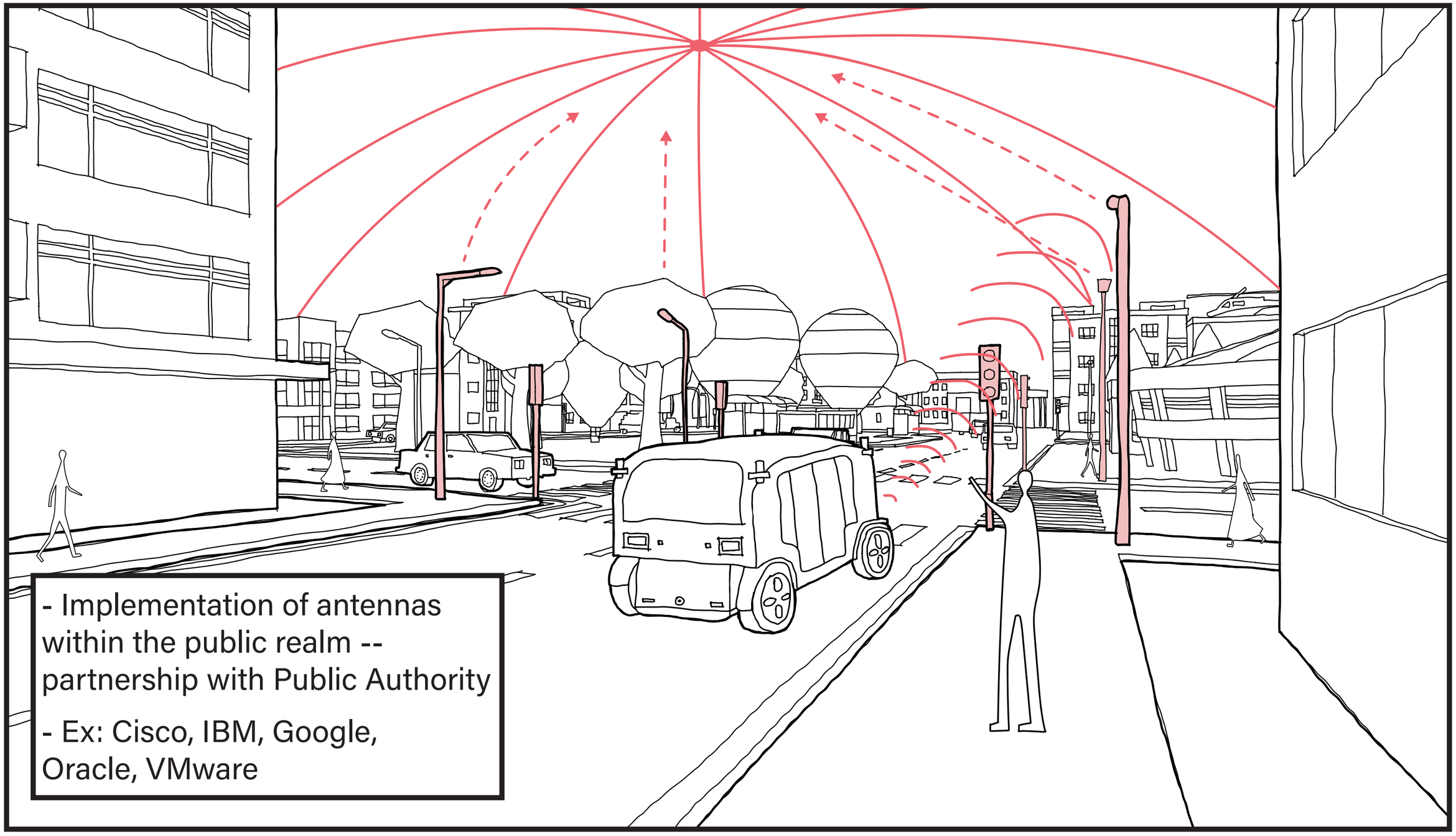
Closely working with technology developers and more importantly the public authority. The city officials are able to partner with the data industry to establish a network system in the public right-of-way in order to operate mass amounts of objects over the Internet of Things.

Implementation of private technology within the public realm. Regulations established by the city help to guide the implementation and use of the digital system.

The company is connecting people with the vehicles of the roadway to increase the quality of life. The system that they establish needs to be reliable for the people.






- Implementation of antennas within the public realm -- partnership with Public Authority
- Ex: Cisco, IBM, Google, Oracle, VMware

Variable Character Group

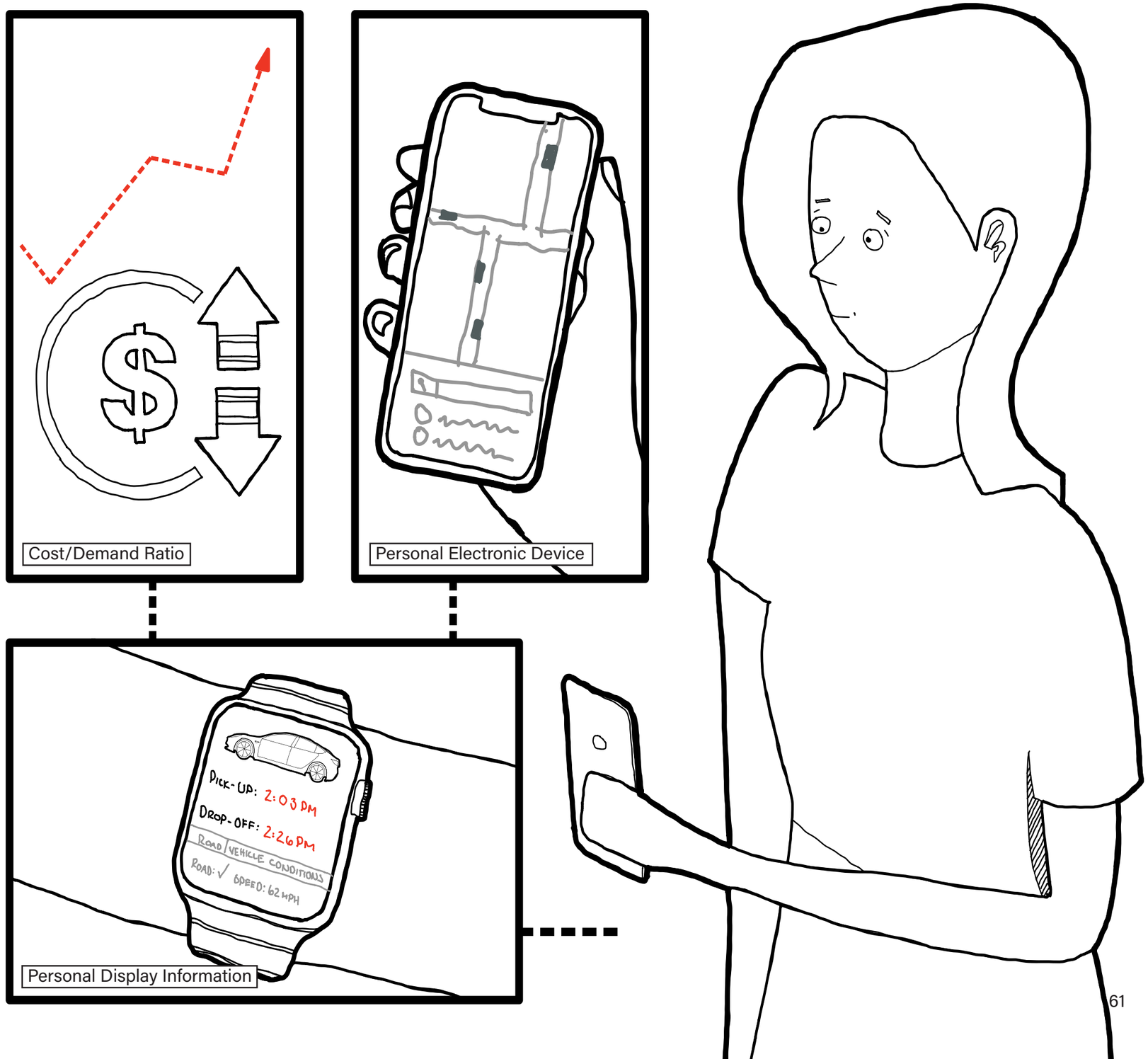
This group is used to determine change in the quality of life in order to understand the success of certain interventions with the transportation system in the city and from the actions of other players

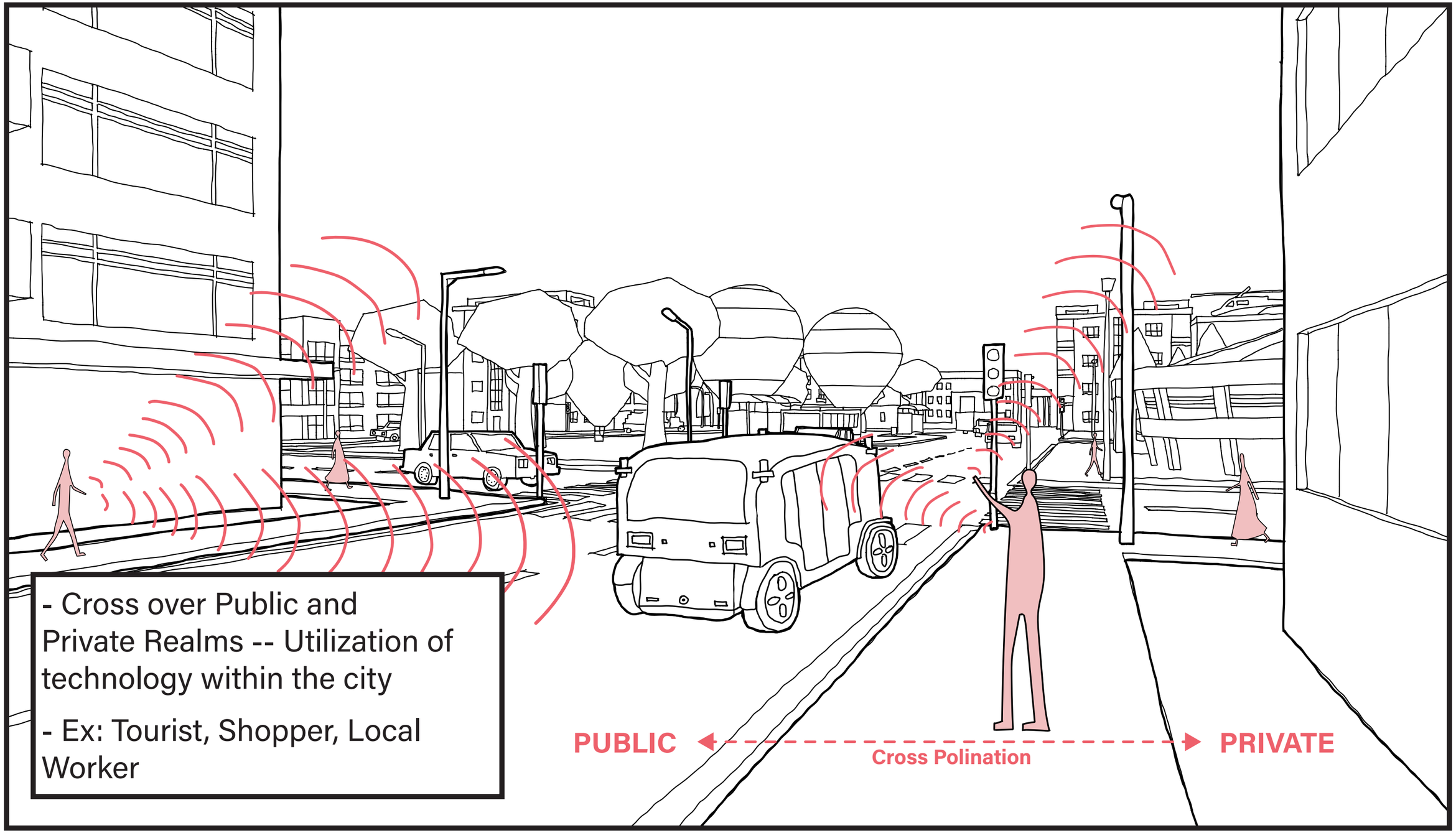
Citizens / Consumers

The primary goal for this group is to have a positive experience getting from Point A to Point B safely and efficiently. This efficiency is what people want out of transportation along with other motivations for being accessible to the public.

Consumers want an understandable and friendly user interface to connect them to the Internet of Things. It is important that the mass amounts of complex data are shown in this way to be inclusive of all people's knowledge of the data along with making it easier to understand.

The consumers have ambitions for consistently reliable transportation - timing and price based on demand of vehicles (ride share). This form of reliability also extends to their connection to the Internet of Things. Consumers get frustrated when connection is unstable and not working properly.




- Cross over Public and Private Realms -- Utilization of technology within the city
- Ex: Tourist, Shopper, Local Worker
PUBLIC
Cross Polination
PRIVATE

Reflection of Research

The research portion of the project yielded a constant flow of new information. When the process began the project back in 2020, the world was ever changing before COVID-19 and a lot of this innovation was being brought the public with new research and data. The goal of the first portion of research was to establish a base set of knowledge about how these new Intelligent Transportation Systems function along with the associated technology. This research helped to be able to comprehend how this new integration of technology can positively impact the lives of the consumers that use them.

Throughout the course of the first 3 credit hours, the project became more complex with many different players that had a hand in the innovation of the Smart City and its transportation systems. This day-to-day research lended itself to an ever-adapting list of players that was narrowed down to 4 main players and the consumer, which stood as a variable player. This variable player would be the reaction to a set of actions taken by the others and assessed the quality of life as positive or negative.

The goal of the first portion of research was to establish a base set of knowledge about how these new Intelligent Transportation Systems function along with the associated technology. This research helped to be able to comprehend how this new integration of technology can positively impact the lives of the consumers that use them.

In order to use the characters with Game Theory and Scenario Planning, it was important to know a timeline of past events along with future predictions relating to the innovation of the technology. These futurist predictions were able to guide the project's scenarios of something that is likely to happen with the technology. During this process, I was able to learn about how future events are primarily predicted based on past events in a timeline. By just looking at future predictions of the technology, it was apparent that the world did not work like this and there is always an element of surprise in the real world. This is where wildcards and caveats were to come into the timelines and future scenarios.

Wildcards were used as levels to assess the probability and plausibility of a prediction – when a prediction get too far into the future the plausibility decreases because of the loss of data that extends that far. On the other hand, a prediction may become more plausible with the help of ample amounts of data. Caveats were more difficult to assume. Caveats are events on a timeline that come as a surprise that not many people were able to predict with a lot of data. A primary caveat that I was able to assess within the system was the increased widespread use of scooters and bike to get around the city.

Game Theory / Scenario Planning

Players actions are put with one another to yield a scenario of possible future situations

Background

Game theory is about a modeled situation as a game with players, actions they can take, and payoffs that they receive in different situations. The goal of this method is to test different ranges of potential actions and reactions amongst players to then evaluate responses in the game. The previous research of players is used to understand each players individual motivations and values to intuitively determine actions or reactions based on the moves of other players in the game. The payoffs for actions, taken by the players, are assessed to be positive, negative, or neutral in a game.

Scenario Planning is a strategic planning method which can be employed to explore possible future situations and development paths. This method of planning accounts for the complexity and uncertainty of the environment and the specific scenario. In this project's instance of scenario planning, it is not to accurately predict the future, but rather to look at the idea of different possible pictures of the future.

The actions and reactions of the players can be laid out in two different ways:

Matrix:

Used primarily within a multiplayer game - showing outcomes of individuals players based on a set of numbers or actions that describe the negative, positive, or neutral outcome of multiple paths of decisions for each player.

Tree:

A game tree is a directed graph with nodes and edges. Nodes represent a player's action or payoff (what happens). Edges are the connections that lead to the nodes - representing the linkage of actions and reactions.

The game and players actions are set up in a multiplicity of ways in order to understand specific actions a player takes in the scenario and using a tree format to understand how the interaction link together. The scenario tree helps to visualize the potential future situation and reactions are added based on the intuition and knowledge of the player in each scenario.

The scenarios that are established in this project are of a complex story with many interactions. The scenarios are designed around the understanding and knowledge of players, covered in the first portion, to make intuitive decisions that impact the quality of each potential scenario. The games, that yield scenarios, are guided by the background narrative of what has led up to the game. The projects looks towards data and research to establish more probable futures and interactions that would take place in the reality of the physical environment.

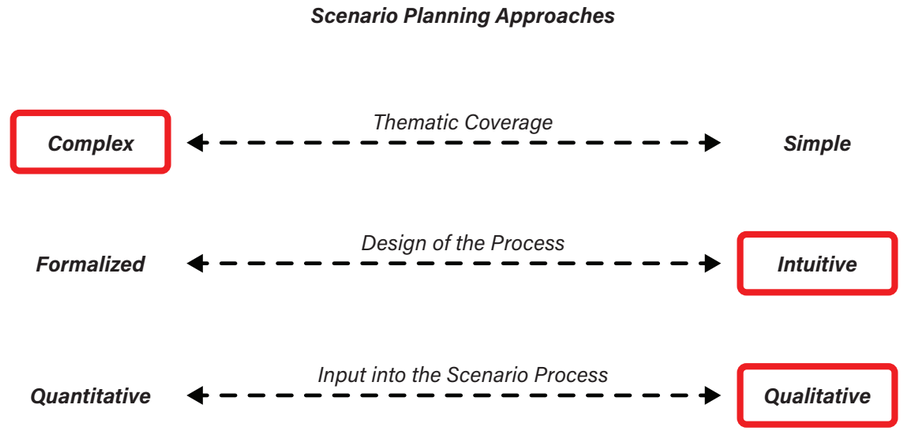


Fig 2. *Scenario Planning Approaches* - Diagram adaptation of Van Notten (2006)

Matrix of Options

Through the method of game theory, the project lays out a matrix of possible scenarios that players take during the game. The understanding is that there are a theoretical infinite amount of options that players can take in order to yield different scenarios from the game. Different routes to link actions and reactions together help to add depth to the stories and interactions of each game.

Routes are able to be changed and adapted. The scenarios and games in this project are meant to show potential possibilities of the future environment. The goal is not to create and predict the correct future, it is about changing the process of the game and exploring a variety of possibilities that can occur. The replicability of the games allows readers to understand the method to perform their own game which adds to the body of potential scenarios.

Fig 3. Array of potential options for each player

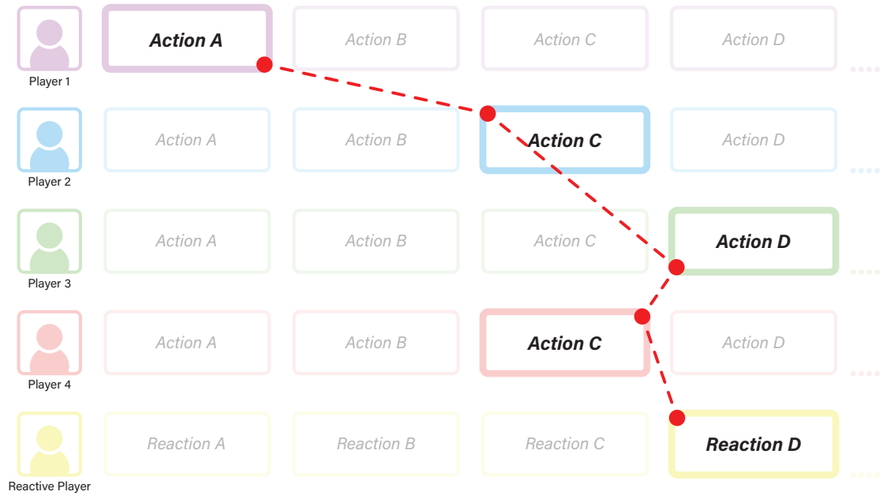


Fig 4. Possible route that can be take - just one option

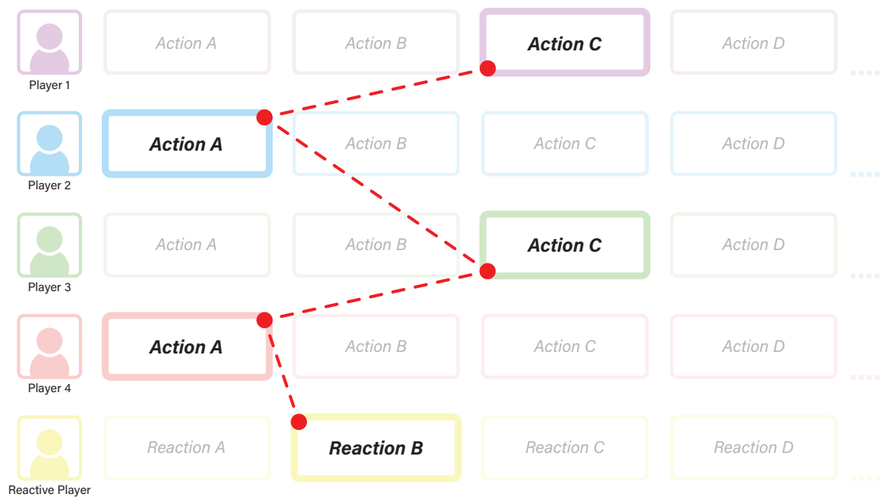


Fig 5. Different route taken to yield a different scenario

Reorganizing Actions

Unlike a simple scenario, the more complex games that make up this project need boundaries to help organize and focus the games to help guide the actions and reactions of players. Based on importance in the story - the integration of an Intelligent Transportation System - specific categories are set in place to help understand and think about how players can interact with each other and how actions cause reactions amongst more that one player. Rather than thinking about every detail in the potential scenario, the project focuses on specific portions of the character's actions.

Physical Implementation

Physical Implementation:
Interventions and actions taken by a player physically in the environment or can be interacted with or seen in the urban fabric. These options are able to translate to physical reality of 'things' within the city - shown in perspective and isometric.

Cost

Cost:
The cost associated to each player shows options that deal with more of the intangible actions taken by players. The options in this category also correlate to payoffs from physical implementations by each player.

Are They Happy?

Are They Happy?:
This category helps to layout options that describe the quality of life for each player in the specific scenario. This helps to determine intuitive reactions they might have to other players' actions.

Negatives

Negatives:
This categorization of actions helps to realize the potential drawbacks and negative impacts that certain actions might have on other players.

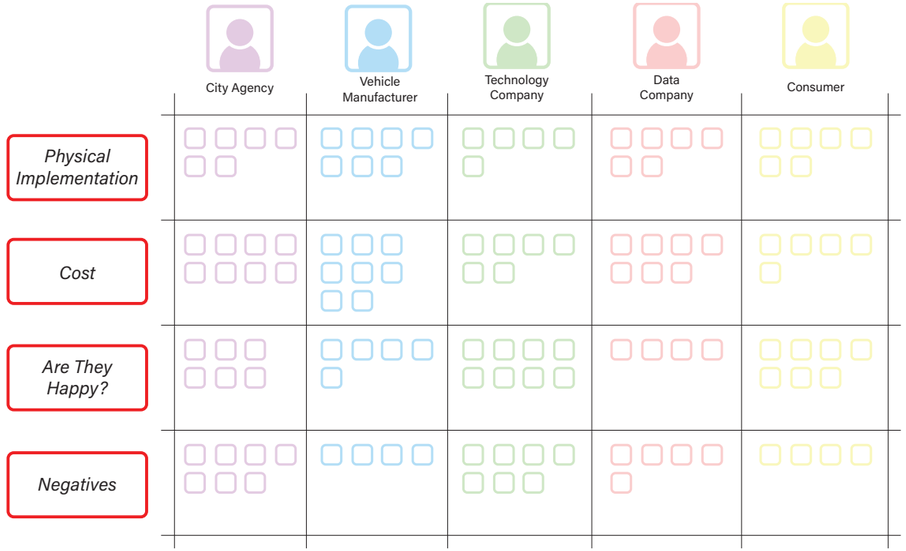


Fig 6. Actions / Options categorized in a matrix

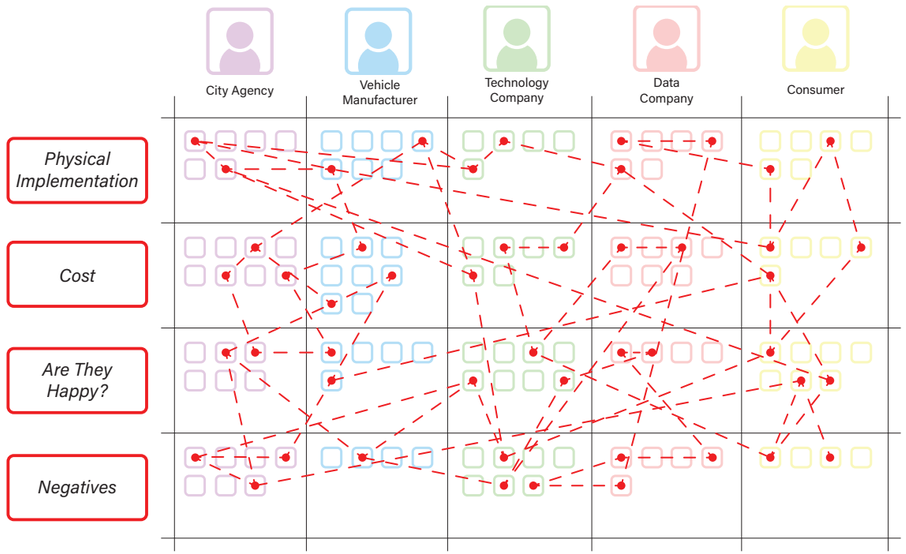


Fig 7. Diagram of a more complex route that links actions and reaction - moved to tree diagram

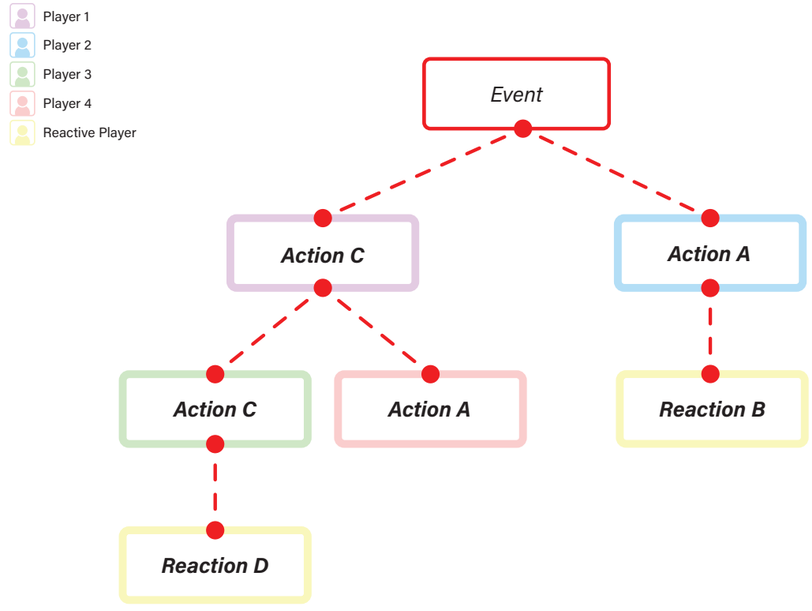
Scenario Tree Background

The matrix options are threaded and linked together in a tree format to help connect the actions and reactions of players in a more understandable format. Actions are taken from the matrix along with the addition of reactions of other players to create a scenario of multiplayer interactions.

The format of tree diagram helps readers to understand the process of organization of actions. The previous diagram - figure 7 - show the tangling of connection when formatted in the matrix.

Exploration of method happened with the inclusion of a variety of different events to be able to test players and their responses to the event. These events helped to establish surprise caveats in the scenario. Caveats, as mentioned before, help to make the scenario become more plausible since reality is never for certain.

The nodes of the trees are outline based on the color of the player whose action or reaction it was. The edges help to connect these interactions with one another to help tell the story of the scenario and show the interactions among the players.



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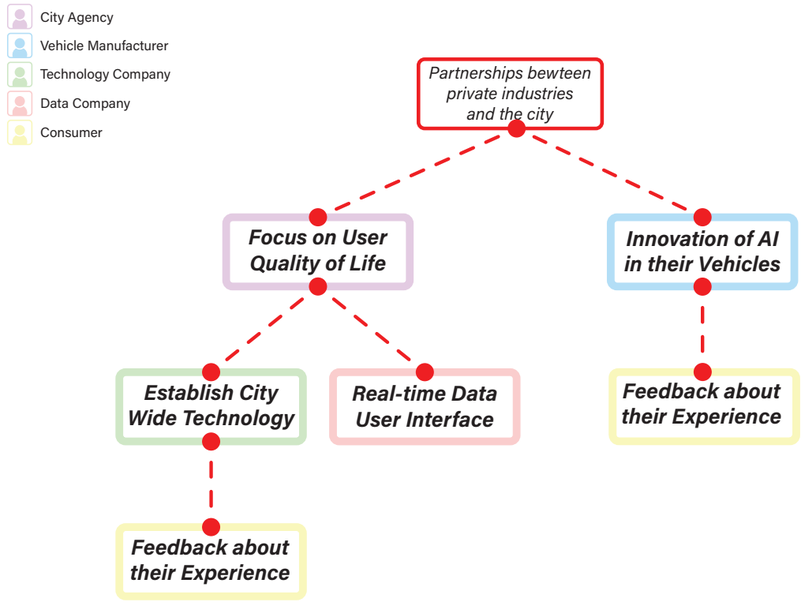


Fig 7. Diagram of a more complex route that links actions and reaction - moved to tree diagram

Background Narrative

Background events that lead to 2020 before scenarios begin

Background Narrative: 2000 - 2020

The city has seen a **rapid development in the vehicle and technology market** between the year 2000 and 2020. From the start of the century there have been **major environmental concerns with how vehicles impact the atmosphere and climate change**. As this begins to come to the forefront, vehicle manufacturers begin to address this by investing in the **innovation of electric vehicles and new technologies in the current vehicles**. Corporations began to incorporate assistive technology into many vehicles such as reverse cameras, automated parking, blind spot, and lane detection systems and more very rapidly up until 2010. These technologies are becoming more of the car doing a lot of the work for the driver of the vehicle. **This innovation in technology has also caused an increase in the quality of life for the people because of the safety features and ease of use to operate a vehicle**.

During this first decade, a very rapid increase in **Internet development** had taken place. The use of the Internet spiked from 300 million users in the year 2000 to having 1 billion people connected to the Internet by 2005. Along with this newfound trust in innovative technology, the **use of data and connecting people all over the world** was the front runner for the ambitions behind many technology companies. The world very rapidly started to connect to the Internet of Things along with their personal devices – **1.96 billion people are connected to the Internet by 2010**. This connection to the Internet and source of data transfer through the Internet became very important for the technology that was being implemented into vehicles. The **cars that people drove in were being connected as "things" to the Internet** to be able to access and communicate with other forms of data (such as navigation).

With these two main forms of innovation present, over the course of the next decade (2010 – 2020) vehicles started to become forms of technology. Their trajectory for innovation became closer. **Vehicles were now being able to collect data and transfer data**. This allowed for technology to be improved within the vehicle to allow for fully **accessible electric vehicles** for the public. This was a big move by the market to provide a sense of innovation towards the environmental concerns that came up in the year 2000. Tesla was the first mainstream manufacturer to bring the electric vehicle to the public at a relatively affordable price point, but Tesla did not stop at just bringing an electric car. These new vehicles set a precedent for how vehicles are a new form of technology with **on board computers and sensors** to run these 0 emissions vehicles through **artificial intelligence**.

The innovation of **artificial intelligence** really **blew up** in 2009. This was the first year of the Google Waymo program being able to **test autonomous driving vehicles** using artificial intelligence. From here, companies received **feedback and projections on how AI can increase the quality of life** for the people to make their lives easier. Through a plethora of commercial objects with Artificial Intelligence, it was Tesla that took this technology to bring to the public in a form of transportation. As many car companies began to see the **impact, and revenue**, Tesla was making **from this new introduction** of innovation and technology into the hands of the people, **many more companies had to get in on it**.

Many **well-established car manufacturers are working with smaller technology corporations** to compete with Tesla's success and bring a **fully electric and autonomous vehicle to the public consumer market**. It also brings to light many small businesses at the forefront of this technology in vehicle manufacturing. This creates a **lot of competition** in this market as these three categories of innovation start to blend into one.

The city and the people move at much more rapid pace today than they did 20 years ago. The **public right-of-way is shared amongst manual vehicles** – controlled by people – **as the majority along with many more electric cars** with autonomous capabilities, but still years away in being fully autonomous modes of transportation. This **new era of electric vehicles** combined with the innovation of technology and the Internet of Things boasts the **plausible reality of living with AI controlled vehicles** on the roadways in the near future.

Scenario 1 - 2030

Age of Early Adoption

Background Narrative - 2030

As the city's vehicle begin to blur the lines between a manual mode of transportation and becoming a personal device, the innovation in the components become increasingly more autonomous. Over the course of the decade, until 2030, vehicles are becoming more autonomous and sustainable for the environment. The environmental impact is a crucial step in finding alternative fuel sources to implement into the transportation sector of the city. Many people are becoming more aware of the necessity to act which puts more electric vehicles on the roadways. Gas is becoming an obsolete fuel as more and more electric vehicles are put on the road with the latest and greatest technology packed inside to meet the wants of the consumer market. The **increase in electric vehicles** on the roadway is also due to the city government's net zero initiative. This movement speaks for the city and the people in providing incentives for people to by and use electric transportation to tackle climate change.

With all the new technology being implemented into vehicles, the **established 5G network and an accurate GPS network** can connect all the vehicles on the roadway to send, receive, and utilize information using the on-board systems. The system is **widely still being tested to be able to build trust** within the eyes of the consumer to change the way they go about their daily lives. Over the course of the 5 years (2025 – 2030) there will be more commercial vehicles that become autonomous to reduce costs for the companies utilizing the technology. This is also a safer way to test the technology and artificial intelligence of the system on the public road networks, driving side-by-side with manually controlled vehicles.

The interaction of people with the "things" connected to the Internet of Things becomes increasingly more important. The development of the IoT and the digital realm of the system is constantly improving to provide people a connection with the objects that they use on their daily basis. The city that people live in is **becoming more interconnected between people and objects**. Establishing this connection for the people is an important step in how the user experience is assessed – is this connection increasing or decreasing the quality of life for the individuals. As a reaction to more objects being connected to the IoT, this means there needs to be a strong development in the accessibility, storage, and usability of data on the network. How do the objects use and feed the system data?

Within this decade of innovation, **artificial intelligence is at the forefront of how people interact with objects** and receive information. As more money is being invested into the technology, AI will begin to be in almost all the things that people interact with on a day-to-day basis. The system will begin to make intelligent decisions based on data and precedent that it has learned – this will allow the technology to be able to make the best and most intelligent decisions when implemented into vehicle technology.

From this increase in technological development, the **city remains to function in a similar way** to what it had been in the past. With Autonomous vehicles still new and untrusted by the public, most of the vehicles on the roadway will remain manually controlled, however the lives of the consumers will be more efficient with the implementation of artificial intelligence into most technology.

Road networks and data will be able to use AI to understand **mass amounts of data** coming in from the cloud and being able to disperse that information out the public through **new methods of interaction with city**. People can speak with objects, connected to the Internet of Things, to be able to be fed data from the system in an intuitive and understandable user interface. This decade becomes a time of trusting the technology and understanding how it works on the most basic level and how AI can be implemented and used by the public through transportation and making the city more efficient. All this innovation is targeted and helping to increase the efficiency of the public and to increase the quality of life that the people have while being a part of the system.

City Agency

- The **public officials are working with vehicle manufacturers** and tech companies to be able to establish a **test loop** of AI vehicles

- In the era of early adopters, this test loop with AI technology to **receive feedback and data** of the operation of the vehicles and **feedback from consumers** on the system and their quality of life

- The city is spending money to start to **integrate solar into buildings and parking lots** to adopt a new source of renewable energy for the city and the people

- The city has also put into effect an **incentive based program** to reward people for buying and **driving electric vehicles** that are powered from the city's renewable energy

- The city is happy during this time because of its **integration of partnerships and new technology** providing for the increase in quality of life and happiness of its citizens

- Because the system is fee based and new **OLED screens are really only being put up in the more expensive high traffic areas** - people of lower-incomes feel more excluded from the "public" system

- The city is trying to make parking lots in the urban fabric more useful because there are still a large number of vehicles parked for a majority of their lifespan

- Since **more people younger people** are moving to the city - so the city needs to start thinking about and adapting to the more people that are moving to the city and using **public transportation along with other methods of transportation** such as bikes and scooters

Vehicle Manufacturer

- The vehicle manufacturer is **marketing their brand** to the public by putting out new technology and **selling more electric vehicles** to the consumers

- These electric vehicle sales are important for the company to **gain more customers and increase the positivity** of the company for being environmentally friendly which is important to city officials and the citizens

- The **partnership with the technology industry helps to showcase the future of autonomous transportation** along with being able to receive feedback from consumers in order to **continue to adapt and innovate** the technology

- The vehicle manufacturer is also gaining more revenue from selling electric vehicles but are still not happy since the **AI technology is still in the infant stages of development** - this causes a dip in the market but the company is **marketing their brand in advance for when the technology does become readily available**

- The vehicle manufacturer is running into the issue of **more younger people** are moving to the city, but **a lot of them are not wanting the burden of owning a private vehicle** - this is causing the vehicle manufacturer to adjust on how to sell their vehicles in the future and how to get more consumers to use their vehicles and technology

Technology Company

- The technology company is **establishing a partnership with the city to integrate new technology** on the updated system to receive and display **real-time data to consumers**

- The company is setting out to establish and test **a network of OLED displays throughout the city** to display times and information about the city to the consumers - this is important because the **new sensors and data allow the city, vehicles, and buildings, to become "things"** connected to the Internet of Things

- The technology industry has also **established a partnership with the vehicle manufacturer** to utilize their technology to connect vehicles to the system to be able to feed and receive real-time data to the system and then to the consumers

- This is important because it **creates brand awareness for the technology and begins to build trust with the people** to secure future consumers that will want to use the technology - **especially the autonomous technology**

- The technology industry is happy with this time because they are able to display their **technology and getting it into the hands of the consumers to test and give feedback about the system**

- The technology agencies have also been given the **contract to control and operate the system** in partnership with the city officials

Data Company

- The data industry is able to primarily **help the consumers by working with the city to put out an app** that allows the tech from the **OLED screens in the hands of the consumers**

- The data industry is a **consultant to the tech company** to help in the development and management of the transportation system

- The data industry has struggled with **the debate of who controls the data and whether the data is in the hands of the private corporation or the public agency**

- By partnering with the tech company and relating a well designed user interface in their app - **the company is marketing their brand**

- The data industry is working with the city officials to **build a system that helps to tailor the experience of the real-time data** in the city with the experience of the consumers - all in the end to try to better the quality of life for the people

- This era of early adopters is t**argeted at gaining the trust and building the relationships with the city and with the consumers** to benefit their business with future technology and implementation

Consumer

- The **consumers are relatively happy** with the state of the city and the changes that are being made within the regulations and the integration of technology into the urban fabric

- People are able to see **new and accurate information about the city and about the transportation system** - traffic, parking, and general city needs - this is a new way for the consumers to **experience and interact with the city**

- The consumers are also happy that during this stage of early adoption, **citizens are able to give feedback** about the system and the technology to the companies that are in charge - the people have **a greater impact on the operation and functionality** of the system to better their own quality of life

- The consumer is able to build more trust in the company's that value their feedback

- The consumer is able to **pay a small fee in order to use the system** - there is also a need for the consumers to have relatively new technology in order to receive and send real-time data to and from the system

- This can be a bad thing for a portion of the population who can't afford to upgrade their personal devices along with having to pay a monthly fee in order to even be included into the system

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Physical Implementation

- working with the vehicle and tech companies to establish a test loop of AI vehicles
- this implementation allows the city to collect feedback and data of the operation of the vehicles and feedback from the citizens
- the vehicle manufacturer is creating a name for itself by releasing the newest tech in their electric vehicles which is gaining a lot of traction
- these electric vehicles are important for the company to gain more customers and positivity because of being environmentally friendly which is important to the city officials and the citizens
- the partnership between vehicle and tech companies has put a test autonomous vehicle on a closed network of roadway
- this helps both companies show the public what the future holds for transportation along with creating a relationship with the city to potentially provide vehicles to their public fleets in the future
- this move will allow the company to make more revenue than they are now since the market is still very young with the tech and the trust of the people is not quite there
- the company has established a network of OLED panel nodes in the city to display real time data from the road ways along with information with the city
- allowing the city to become a "thing" within the Internat of Things
- working with the city and vehicle manufacturers to establish a closed testing portion of the city
- this loop will allow citizens to ride in autonomous vehicles and provide feedbck about the experience along with collecting data from the technology
- using onboard technology and sensors along with connecting their technology to the city's existing road infrastructure (lights)
- the data industry is able to primarily help the consumers by working with the city to put out an app that allows the tech from the OLED screens in the hands of people

Cost

- cost is low for the city because in this year the operation of the system is controlled by the private company
- the city would be spending money to apply renewable energy sources (solar) to public parking lots (covered)
- because of the increase in electric vehicles - the city wants to provide for these people and make them happy
- the vehicle manufacturer is putting a lot of the investor money into the innovation of the autonomous technology
- the company decides to partner with the technology company to create and innovate the technology in the autonomous vehicle further
- the vehicle manufacturer is frustrated because they know they will be able to make a lot more revenue once people buy into trusting the system and technology of the future
- technology company is gaining revenue from people that are buying into the system
- this is also a method of marketing to be able to get more customers for their more ambitious future projects
- the data industries costs reside primarily in the development and management of the system
- being able to upkeep and innovate the digital system of collecting and providing data in order to increase the quality of life for the
- by doing this the brand will be seen as more reliable to the citizens which will in turn provide more users using the company's system
- the only draw back is that the consumer does have to pay a recurring membership to take part in the new system of technology
- the membership is not a significant amount of money in order to try to get the most amount of people to be apart of the system
- along with technology requiring people to have some of the latest generation of technology which a lot of people cannot afford with the prices of these things going up
- updated and current smart devices will allow people's personal devices to gain new real-time data through a new app that was not possible before on older generation technology

Are they Happy?

- City is Happy - providing new technology to increase the quality of life for its people
- the city is also growing at a faster rate as more younger people are wanting to move to the urban centers
- city is making money by partnering with technology companies - royalties revenue from the tech company putting their tech in the public right of way
- city is also benefitting from learning about the new technology of AI vehicles - test loop
- vehicle manufacturer is not super happy with the sate of the market - they know they can do really well with their upcoming technology
- the company is still putting out new vehicles with upgraded technology especially in a new market where sustainability is key
- the company is establishing a brand sense by making and selling electric vehicles to the citizens
- tech company is very happy with how their technology is progressing and being able to put technology out into the city
- technology company is creating brand awareness within the city and building trust with the citizens
- because of the increased brand awareness more vehicle manufacturers are wanting to use the company because they have already established themselves
- this compnay also already has experience with partnering with the city's agencies - EXPERIENCE
- not super happy with the situation
- because of past events with the conversation of data and the privacy - the company has not been able to secure trust with the people
- the data industry is working with the city to build a relationship and to work to build a system that helps to tailor the experience of the city and its data to the people
- this year is a year for putting the brand out their in order to build trusted relationship for the people to have an easier time implementing more serious technology into the urban fabric
- consumer are relatively happy with the changes in the city
- people are able to see new information that is in real-time that provides data about the traffic, parking, and general city needs that people want to know about
- consumers are able to give input about the system (tech and AI) as to their experience with it which is taken into account by the companies to improve the user experience
- the consumer is able to build more trust in a company that actually uses and values their feedback

Negatives

- the implementation of this technology is a fee driven market for the tech company
- this method is not inclusive for the poorer communities within the city - backlash or less support from these people
- the city still sees a wide use of vehicles sitting in parking lots for a lot of time - taking up valuable space that they know could be used for something more efficient in that space
- city wants to try to establish programs to help these people be able to use the system - a new way of interacting with the city
- even though more people are migrating to the urban centers - many of this new population do not want to own a vehicle in the city
- this creates a dip in this comapnies market with a large portion of this new younger generation not wanting to privately own a vehicle
- the vehicle and mutlimodal transportation is still a very young market and is till in trial phases
- the ehtical values of the company are put at risk because something that is put into the public sphere is not actually inclusive
- citizens have to buy into the system for the company to make money and to then pay the city for allowing their technology in the public ROW
- still a bit of controversary about the control of data - private companies tend to sell data to other companies to make money
- partnering with the public might make valuable data public to people - this would lose money for the company
- the data industry's market value is held within the data that they manage and collect from the system and the people
- rather than selling to company's the data industry to sell it to the public in order to increase the maintenance on highly traffic areas as well as to see problems within the system
- the poorer population of city are upset with how the city offcials and big tech have brought this new "public" system to only be used by the people that buy in
- people are upset becuase the new street terminals only display general real-time data - not personalized
- terminals are also only being placed in high end and highly trafficked areas - not necessarily the areas where a lot of the people who can't buy in live

PPP with public authority to place screens within the public right of way for people to interact with the city - more electric vehicles on the roadways

People still trying to wrap their head around privacy control - group of people not liking the private company controlling the data

still looking to secure trust with the broader population - people still have controversy of who holds the data and its control

the city is focused on a user centered public infrastructure - happy citizens = good rating

control of the screen and the data that the screens collect from people

vehicle manufacturers are not super happy because the tech vehicle market is still underdeveloped and revenue is low

More people (younger) are moving to the city for an urban experience and not necessarily wanting to own a vehicle - low wages relative to real-estate cost

Bikes becoming a more viable option for transportation in the city

partnering with vehicle and tech companies to build trust amongst the people

important for vehicle manufacturers to meet the regulations of the city agencies to safely put their vehicles on the road

city agencies getting a portion of money from the private agency

city agencies establish a constant loop (straight) for people to experience the next generation of efficiency in technology and vehicles

important to get approval from citizens on the implementation - in the future - of this technology into the road networks

understanding of the best ways to approach and regulate the integration of this technology (test run)

city officials can use the data to see if implementation into the public transportation system is viable - would help to reduce costs (environmental = good)

negative view towards the public entity in this situation = lower approval rating

people in the city are becoming upset because of the cost to enter the system - when it has been marketed as a PUBLIC INFRASTRUCTURE

trying to gain back support by putting more money into other projects in these areas of the city

city uses tax money in order to establish a program that will help the poorer people be apart of the system

tech company is getting money from the users that BUY into the system

implementation of screens throughout the city

tech company is happy becuase of the widespread use of their technology in the city

making a lot of money to help supplement the new innovation of the technology

establishing a new way for people to interact with the city

screens only really being implemented into the higher end popular neighborhoods - equity issue

tech company is increasing brand awareness as they look to innovate the young tech vehicle market

vehicle manufacturer is wanting to partner with the successful tech agency because of their success with the PPP and the implementation of technology into the consumer's hands

people are liking the way the new interaction with city - parking opening in a space, flow of traffic on the roads

consumers also want to be able to be connected to the system through their personal devices

negative impact for the way people view the public agency by people in the city - losing support

for the tech company this is a test revenue and trust generator to continue to help innovating with the tech of AI within vehicles

partnership between tech compnay and data industry

city officials listen to the people on how to increase the benefit of this new technology - looking at how people interact and like the implementation

building an app to help translate the data from the city to the consumer - the city is now a "thing" in the Internet of Things

utilizing a more robust 5G network to gain access to real-time data - same data that is being tested by vehicle manufacturers for autonomous driving

progrssive power is implementing this technology to build the next generation of infrastructure for the future of movement in the city

helping to combat climate change through new means of renewable energy and more efficient ways of traveling in the city

vehicle manufacturers are putting out more electric vehicles into the market to help increase their brand reputation

More electric vehicles on the roadways - city is giving incentives for people to switch to renewable resources - free solar charging

city starts to implement new renewable energy infrastructure in parking lots to predict for the mass use of electric vehicles

vehicle manufacturers partnering with the city to provide many more charge spaces for the vehicles that they are putting on the road - free charging for buying an electric vehicle

tech company integrates technology into bikes in order to use the bikes with the screen and phones

vehicle manufacturer in need to think of a new option to get the most amount of people in their vehicles - to make MONEY

a more environmental generation want to ride more bikes within the city (also cheaper)

continually adapting to find new sources of money and to build trust by the consumers

city begins to reorganize the city's roadways to accommodate this need for bike space on the streets

tech compnay retrofits existing city tech to accomodate this new lane of bikes in order to collect more data - geoposition + user data

city partners with tech/bike company to understand the success of users on bikes and to see the efficiency that they have over vehicles

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

ERA OF THE ELECTRIC VEHICLE

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

Tesla Autopilot

- The first commercially available driver assistance that can steer the car and even change lanes on the motorway

Accessible Fully Electric Vehicles

- Costs of fully EVs are dropping to allow for accessibility for a lot of people
- Production of different types of vehicles (private and public) allow for a more efficient and cleaner environment

2014

2010s

Driver Assist Technologies

- Lane Departure, Blind Spots, High Beam Assist, Cross Traffic Alerts

- Carmakers have also begun adding smartphone integration, with many producing apps so you can find your car via GPS, and remotely lock the car and check its fuel levels

2020

Type IV

Will 5G Transform Smart Transportation

- Allows people to leverage the full potential of advanced technologies -- virtual reality, artificial intelligence, intelligent transportation systems

2021

Innovation of AI Vehicles

- Collaboration between Vehicle Manufacturers and Technology Innovators

- Testing of autonomous methods of travel -- how this technology can change the way people travel and the efficiency of cities

5G + Internet of Things Integration

- Connection of "things" within the digital world -- data an communication with objects connected to the network

- Advancing developement of connecting people to the network and with the "things" -- connection and communication of people and objects

Increase in Electric Vehicle Production

- As technology in electric vehicles becomes cheaper to manufacture -- vehicles are able to be sold cheaper than before

- City incentives and regulations benefit consumers who drive / use electric vehicles

2022

Type IV

Victoria Transport Policy Institute - Implementation Predictions

- Autonomous vehicles are projected to be safe and reliable
- Full integration of commercially readily vehicles by 2030

2025

2021 +

Type IV

Deliveries will be Increasingly Autonomous

- Innovation in technology allows companies to slowly integrate this technology into their fleet

- More probable for later integration -- big companies do not want to go all in just yet (more success to prove) -- 2023+

2024

AI Vehicle Testing

- Working with the city, the vehicle and technology industries are able to set up safe closed routes with their new vehicles and technology

- This is the start of the company's trying to build trust with the consumers about using their technology daily in the future

Integration of Solar to Buildings

- City officals working with the technology industry to integrate solar panels to roofs throughout the city

- Setting up the city to renewable charge electric vehicles -- SUSTAINABILITY

2026

Wave of Bikes / Scooters

- As younger people with no car continue to move to the city, bikes and scooter have become a new method of transportation throughout the city

- City is integrating new bike lanes into streets to increase the efficiency of this new transport method

2028

Environmental Incentive / Need

Scenario 1

2030

Type III

Octopus Article

Carbon Free Vehicular Transportation

- This proposal is a need for most cities with increasing dense populations

- Most vehicles will be powered by batteries that will continue to be developed -- this will help with a more renewable source of energy rather than the use of fossile fuels

Autonomous Vehicles as Accepted Transportation

- 2030 is the point in predicted commercial developement for use by everyone

- Will take a period of time for consumers to become comfortable with the technology and the new way of traveling around these urban environments

2032

Type I

Reduction of Vehicle Ownership

- This is a projection that due to the innovation of transport technology, there will be no need to own a private vehicle -- this is due to the increase in population and the potential regulation of vehicles on the roadways

2035

Type VI

The Guardian

All new US Vehicles can be electric by 2035

- Rapid advancement in technology and the cost of batteries should allow all new cars sold in the US to be electic by 2035

- The rapid electrification of transport would save about $2.7tn in driver costs by 2050

2040

Type I

Manufacturing of Vehicles

- This prediction indicates that it could be possible that vehicles and vehicle parts would be able to be 3D printed which would make the cost of ownership of a vehicle much more accesible

- Would this be more beneficial? The goal of efficiency could suggest that vehicle ownership would decrease and be controlled through a centralized private or public industry

2042

Type VI

Credit-Suisse

1 in 4 cars on the road will be electric - US

- This change will drastically decrease the carbon emissions that vehicles contribute to global warming

- Europe is looking to implement this statistic at a faster rate than the United States

2045

Type I

75% of Vehicles to be Autonomous

- Highway lanes will be rephased to include dedicated lanes for autonomous vehicles

- Attitudes and acceptance of autonomous vehicles will be near 100% -- This technology will be engrained within everyday life and the need to make more efficient.

2060

Being able to find renewable energy to power electrical plants in order to make this implementation the most effective

2030+ : Countries begin to roll out bans on vehicles with a combustion engine (Non-renewable Energy)

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Web 3.0

User Centric - Decentralized - Private and Secure

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

2020

5G Network Integration

- 5G Networks are the fastest networks created and allow for the advancement of technology to increase as well allow more devices to be reliably connected to the IoT

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

2022

SimonIOT Prediction

Type III

Majority of Lives Turn Digital

- As digital technology become more important in the consumer's daily lives - it is important to continue to establish a reliable connection

- Ability to have more "things" connected everyday

2022

2023

Established 5G + Accurate GPS

- This integration and establishment allows vehicles to be tracked more accurately along with faster and more reliable connection speeds to the 5G network

Public Cloud

- 75% of the world's population will be interacting with online data everyday -- each user would have about 1 data interaction every 18 seconds

- Majority of data will be kept on a public cloud network. This will lower the storage of data on each device and will become easier and faster to access

2025

iTransition

Type VI

Type IV

SimonIOT Prediction

2025

Commercial Autonomous Vehicles Connected to the System

- Vehicles accessible to the public will be connected by 2025 with a reliable connection for people to interact with transportation

Changing Interaction

- As more data becomes available to people -- the way people interact with the city is cahnging

- City as a part of the Internet of Things

2026

2027

Mass Amounts of Data

-With an ever increasing amount of things on the IoT, mass amounts of data are able to be transferred through the updated system

- New system for vehicles is able to read more real-time data faster and more efficiently

Scenario 1

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

2030

SimonIOT Prediction

Type III

Type III

Popular Mechanics

2035

An Increasingly Virtual World

- The Internet will begin to blend and exist within the real world
- Our methods now will be considered archaic and clunky

- Everyday life will begin to move more around the digital environment and how we interact with it in the physical environment

Artificial Internet of Things

- Artificial Intelligence and the IoT combined to achieve more efficient IoT operations, imrpove human-machine interactions and enhance data managment and analytics.

2038

Industry Europe

Type VI

2060

City Agency

Vehicle Manufacturer

Technology Company

Data Company

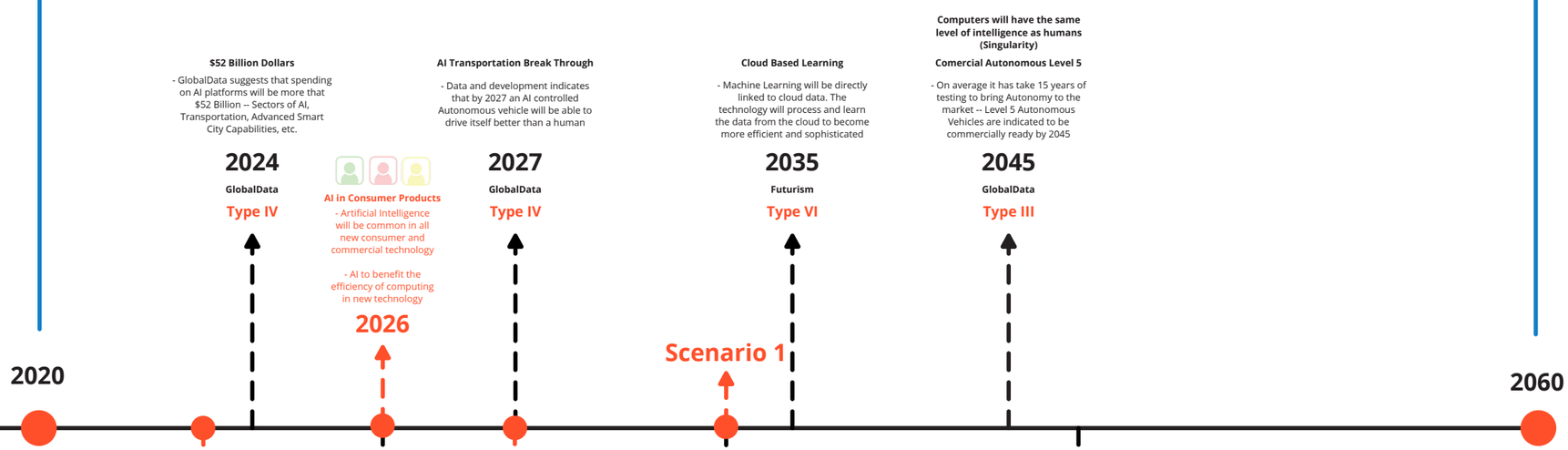
Consumer

Data Governance will come more to the forefront about who controls and manages the public data sphere

IoT Devices will become more and more intelligent and be ever increasing as a part of our daily lives

RAPID INVESTMENT AND DEVELOPMENT OF AI TECHNOLOGY

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS



City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

2030

My Grandparents

My grandparents have been able to experience a lot of technological development during their lifetime. They will be able to see change and use of electric vehicles along with the use of Artificial Intelligence in personal technology. The year 2030 provides minimal change to the urban fabric, but change in the way consumers are able to interact with the city. They will also continue to see innovation in the personal technology that consumers use on a day-to-day basis. This age group is also very reluctant to significant change and handing over control of vehicles.

My Parents

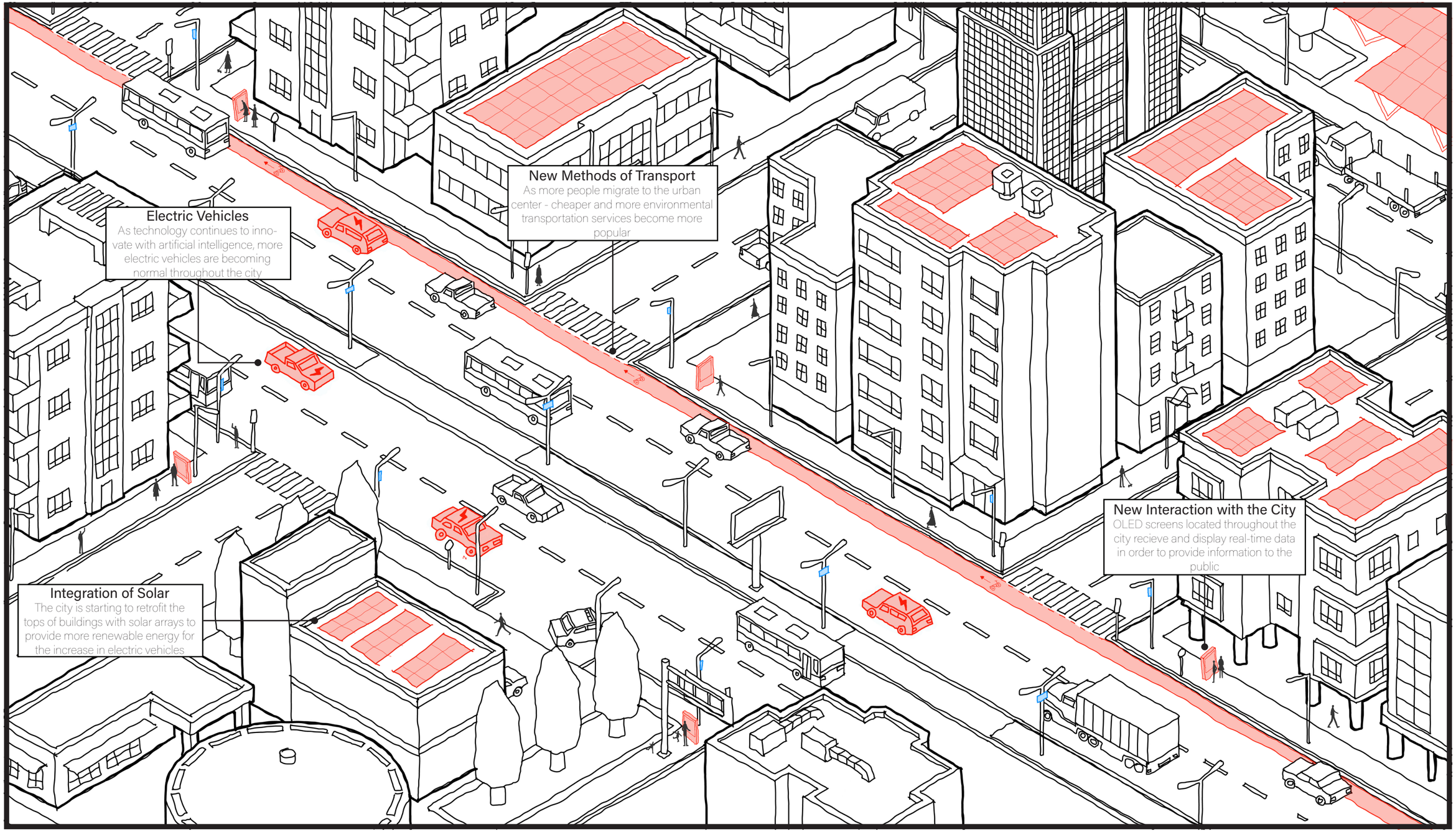
My parents demographic has been able to closely experience and adapt to large amounts of technological change from the year 2000 up until 2030. This generation is also slightly more open to the idea of AI controlled vehicles. This group is the primary one that needs convincing on the part of the private companies. This era of early adoption will help to yield data and results to showcase the success of the their new technology to this portion of the public. This group is also important because they will become the older generation when a lot of this technology starts to become more accesible to consumers.

Myself

My generation is made up of the primary early adopters in this year. 2030 has been able to showcase new forms of transportation and integration of technology that is appealing to this tech-minded generation. This group of people in their 20s in the year 2030, will be the primary market for these companies. This is also the generation that is able to provide these companies a lot of data and feedback about the technology. Growing up in a world of technology that is upgraded every year, this generation is enticed by the new and flashy (yet affordable) technology to make their connection to their digital lives better.

My Kids

My kids generation have not been born yet into this early adoption era of new technology in AI transportation. This generation will also play a significant role in marketing and brand awareness throughout the upcoming years. The companies goal is to get this generation accustomed to their name and the innovation and products that they are apart of. As they grow up with this brand awareness around the company - the private industry hope that they will buy products from them becuase they are known from throughout their lives.


Electric Vehicles
As technology continues to innovate with artificial intelligence, more electric vehicles are becoming normal throughout the city
New Methods of Transport
As more people migrate to the urban center - cheaper and more environmental transportation services become more popular
Integration of Solar
The city is starting to retrofit the tops of buildings with solar arrays to provide more renewable energy for the increase in electric vehicles
New Interaction with the City
OLED screens located throughout the city recieve and display real-time data in order to provide information to the public

5G Network + GPS
An established system that can hold the connection of more "things" and a more accurate GPS connection

Radar, LiDAR, + Cameras
The city officials are retrofitting the existing infrastructure as well as passing regulations to put this future technology into vehicles

chatting to friend
Stacy! I found one of the new screens on the sidewalk. There are people using it right now, but stay on the phone and I will make my way over to it!

poking at the screen
Oooo! The bus is only 3 blocks away! This is so much more efficient than our old station wagon.

RETAIL

It is just so much easier to look at my phone to find a city bike. If it didn't exist I would mindlessly be wandering around the city looking for one.

high pitch excitement voice
Ooooooooo! What do all the icons do at the bottom. I wonder if it will tell me where the nearest cafe is at. I could use a good cup of coffee.

Reflection / Conclusion - Scenario 1

This early adoption stage is important to make more people aware of the future of technology in vehicles and interacting with the city. Companies push to create brand awareness by introducing new technology, in partnership with city officials. This tactic used by the company's officials. This tactic, used by the companies, is valuable to build trust with the citizens of the city.

As Artificial Intelligence is still at an underdeveloped stage, vehicle manufacturers are starting to put out more electric vehicles into the market. The city is looking to plan for the future, by putting in solar panels on buildings to help generate enough energy to power these new electric vehicles. The solar initiative, by the city, helps to reduce the carbon footprint of the city which is a positive impact in the eyes of the citizens. People who want the best and latest technology are buying these vehicles along with the incentives, from the public officials, to switch over to having a vehicle that runs on renewable energy.

As more younger people are moving to the city, they believe in a sustainable future. These people are not necessarily wanting the hassle that comes with owning a vehicle a vehicle in a city, and so bikes are becoming much more popular. This means that the city is going to readjust the roadways to accommodate newly integrated bike lanes for the increase in bikers and scooters. This new wildcard is also added to the system. The technology and data companies can incorporate these methods in order to receive real-time data.

The technology company was also able to benefit from a partnership with the city officials to incorporate new OLED screens in the public right-of-way to allow for a more public connection to the information and data from the system. This connection allows the city to display its information – about traffic and vehicles- with the people in a physical implementation. These new methods of transportation and integration of technology can increase the efficiency of information to the people which increases the quality of life.

To address negatives in the scenario, city-dwellers who have a lower income are not happy with the implementation and isolation from the system. With a fee to use the network and transportation, this portion of the population is excluded from the benefits that the technology brings. This pay-to-play model, inhibits people, who cannot afford the cost, from using the system and being able to see the real-time data. In this regard, the city has begun to establish a new program to help incorporate this group of people into the system to reap the benefits from to increase their quality of life.

Scenario 2 - 2045

Era of Blended Technology

Background Narrative - 2045

As **trust in the technology has greatly increased by the public**, trust has also been built by the public agencies working for the city. With the innovation and proven data of the success of autonomous vehicles in the private delivery sphere, **new technology in public transportation is building more confidence with consumers** on other modes of transportation. During this time, many more people are migrating to the urban environment of the cities, which in turn brings more vehicles to the already over densified roadways. This new generation moving to the city doesn't want to have an added cost of owning a private vehicle and the frustration of trying to drive in a not-so efficient environment. This reduction of vehicles means there is a new need for more efficient public transportation. The **city is establishing relations with private corporations to provide public transportation vehicles that are autonomously controlled** to increase the efficiency of the vehicles on the road.

These new electric autonomous vehicles help to ease people into the idea of an autonomous mode of transportation. Planting the seed in people's mind as to how this new technology can add an increase to their quality of life in the city and the efficiency that the city moves mass amounts of people.

Along with the continual innovation of artificial intelligence in vehicles, there is also a **drastic increase in the implementation renewably powered electric vehicles** onto the road network. This important to the people of the city because they understand the environmental impacts that past vehicles have had on the environment. The government's city initiative to provide an incentive for people to drive electric vehicles is also becoming more prominent as environmental scientists say we are running out of time to fix what we have done. This also

comes with a greater decision to reduce the amount of privately owned vehicles on the road to accommodate other modes of transportation in the city. **One in four vehicles on the roadways, by 2040, will be electric** which has a drastic impact in the reduction of carbon emissions that are put off by the city. Consumers are understanding the impact that this new technology in vehicles is having and drastically building a sense of trust by the younger generation that will in turn build trust with the older generation.

As these vehicles and technology develop, people are more increasingly **living in a reality that is blended with the digital world**. The Internet of Things and the technology associated with the objects allows people to easily communicate with objects connected to the system. Through **new smartphone, headsets, and glasses, people can live in the physical world along with being able to interact with the digital world simultaneously (Augmented Reality)**. This new form of reality comes from the integration of **Artificial Intelligence and the Internet of Things – AIoT**. This is an important tool within the digital world because now the system can begin to make intelligent decisions about objects that utilizes its network. As more objects are constantly being connected to the IoT, the help of artificial intelligence is drastic to manage and control data and analytics of the system.

From this increase in trust and innovation in the system, a lot of the **urban fabric is being blended with the digital world**. This is important to the consumer as more of people's lives revolve around the digital realm along with how people are now interacting with the system. Existing public **infrastructure is modified to accommodate more people walking** through the city as fewer private vehicles enter the road network in an increasingly denser urban fabric. **Technology is being integrated into the existing streetlights, public right-of-way, and buildings** in order to help increase the methods that people use to interact with the city. Roadways will need to be modified as more autonomous vehicles enter the system – such as specific autonomous zones and lanes to help control the efficiency of traffic between both manually and autonomously driven vehicles sharing the road.

City Agency

- The city officials are **partnering with many private industries** in order to operate the system efficiently in order to **increase the quality of life** for the citizens of the city.

- The city government has **continued to put in place incentives for people to buy renewable electric cars** - reduction of taxes.

- City wants the best for the people - partnership with technology industry to **integrate autonomous technology into public transportation** -- want the most efficient public transportation for its citizens and the technology industry wants to be able to **test and receive feedback** from the public about their experience with the technology.

- The city is also putting **funding towards integrating solar arrays to all buildings in the city** - giving incentives to private building owners - also building in **adaptability to larger parking lots** in the city to accommodate different functions.

- New **road cutaways to accommodate for more efficient boarding and departing** of public transportation - autonomous pickup and drop-off points throughout the city.

- The city is **happy with the outcome of the innovation** and what is going on throughout the city - **more people are also moving to the urban center** of the city which means a larger population = more tax money to put back into the city and the system

- City is facing slight **negative feedback** from the lower income citizens that are being pushed farther away from joining the system - **price increase and older personal technology** not being able to support to new digital world.

Vehicle Manufacturer

- The vehicle manufacturers are **able to sell more electric vehicles that are charged with renewable electricity** around the city - this is because of the increase in the population of the city, the government's incentive program for people who buy electric vehicles, along with an increase in gas and oil prices.

- The vehicle manufacturer has **partnered with the city to build and provide new renewable electric vehicles for public transportation** with the latest technology - along with the **integration of AI** controlled routes.

-The vehicle manufacturer has also **partnered with the technology company to provide assistance for the technology side** of the product to be able to seamlessly connect to the system along with the integration, management and development of the AI technology within the vehicles.

- This company is able to **sell more cars which yields a larger profit** to the company to be able to invest in other developments on the technology and innovation side of the vehicles - along with being able to help the city roadways and infrastructure - trying to provide the best quality of life

- They are happy with the situation that they find themselves in because **people are able to experience and test the technology to provide feedback and data to continue development** - larger brand awareness and trust within the company

- The city is taking up more of the vehicle lanes within the city center to accommodate pedestrians and more bikes and scooters since they have been increasing in popularity with the younger generation.

Technology Company

- The technology company is in a **close partnership with the vehicle manufacture in the development** of the physical technology and the AI innovation of the vehicles

- The company is also continuing their **partnership with the city officials** - establishing a connecting of **OLED nodes throughout the city** and expanding to lower-income portions of the city - a more inclusive system in the eyes of the company

- Putting out a **new form of personal technology** into the hand of the consumers to blend the relationship between the physical and digital worlds - **people's lives are becoming increasingly more in the digital realm**

- Technology Industry is continuing to develop and **establish a reliable system network** - working with the vehicle manufacturer (through their partnership) to **ensure connection to the roadway system and other vehicles on the roadway**.

- The technology company is **increasing its revenue with the more people that buy in and join the system** - this is beneficial for the company with the increase in population in the city and the **more people that don't want to own a personal vehicle** and choose to take public transportation or bikes/scooters

- The technology company is benefiting throughout this year because of the **increased interest** in the innovation of technology with both the city agencies and especially the consumer's interest in vehicle and personal technology.

- The technology company has also partnered with the city agencies to **operate and innovate the system**.

Data Company

- Data company is **working with the tech company and the city to develop the digital interface for the OLED screens** and the support to personal devices - gathering and **presenting real-time data in an understandable way** to the consumers

- Data **buys up bikes and scooters to developed there own method of transportation** throughout the city - since the company has seen the popularity of these vehicles in the last couple years they are buying their way into the market

- The data industry spends **most of their time in the development and control of the overall city system** in collaboration with the city, vehicle manufacturer, and the technology company - this is most of their **cost to maintain this system on the digital side**. As the technology sector is increasingly becoming more at the forefront - the digital sector of the work is handed over to the data industry as things get more complex and more people are becoming connected to the system.

- The data industry is **gaining large amounts of revenue with the more people** that are using the system and are new to moving to the city along with their increased number of partnerships

- As the world and people revolve mostly around the digital world - the **data industry is becoming more happy with the trust that it has built with the consumers** and the state of innovation with the digital and physical technology

- The common **negative** still persists with the **subscription fee to join the system is starting to become more inaccessible** to lower-income neighborhoods

Consumer

- Consumers **continue to pay a monthly fee in order to be apart of the system** and utilize the technology and data

- A majority of people are happy to pay the small fee to use the system - but **low-income families are not happy with added costs on top of the fee** (transportation + buying new personal technology)

- The consumers are **enjoying the new personal interactions** that they are having with the city and the blend of the **digital realm and the physical city**

- The consumer's lives are becoming **increasingly more online and this new personal tech allows for a new experience** and connection between people and the city

- Consumers are very happy with the **increased efficiency and reliability of the new autonomous public transportation system** - they have been giving their feedback and are seeing constant change in the system to try to **better the quality of lives for the people**

- As more people move to the city more public transportation is being used because a lot of this **new younger generation don't want to own a private vehicle**

- Consumers are **trusting the system more and more especially with the new integration of AI technology** in public transportation routes - this trust comes at an important time as more AI technology is getting ready to be released to the consumers and set up throughout the city

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Physical Implementation

- city establishing a partnership with the private corporations in order to implement renewable electric vehicles on the road
- The city also partnered with the tech industry to allow them to test their AI technology on the public transportation
- This is important because the busses have specific routes and the technology can just focus on the safety and not where to go - already programmed
- with this increase in the need for more renewable energy - the city is establishing my solar arrays on top of all buildings in the city
- This energy is also good for supporting the whole city and increasing the efficiency of the buildings in the urban fabric
- More electric vehicles are being implemented onto the roadways because of the governments incentive program to help combat climate change
- The vehicle manufacturer has partnered with the city officials to provide and operate public transportation with AI technology built in
- Working with the technology officials to connect their vehicles to the physical sensors of the city along with incorporating their technology into the vehicles
- Technology and innovation of the physical components in the vehicles
- Working closely with the vehicle manufacturer to innovate technology within the vehicles
- Creating a compatible network for the vehicle system to communicate with the system and connecting to the road sensors / cameras
- Important to familiarize people with the using the technology in a safe way to build trust with the citizens
- Some of the physical components for the technology are built in house for the vehicles and then controlled by the tech industry
- Utilizing a new wave of personal technology with a headset / glasses for people to blend the digital and physical worlds
- These new devices are able to display the traffic information as well as be an extension/ innovation of the smartphone - more people's lives are becoming increasingly existing in the digital world
- OLED screens are continually being updated and implemented throughout the city as more people are taking public transportation with the new technology and not having a private vehicle
- The data industry is still working with both the tech company and the city to continually develop an app to provide real-time data from the system to citizen's personal devices
- Data industry is also working with the vehicle manufacturing company to provide assistance in app and data development for the consumers of their vehicles and for the company to record more data about the vehicles to increase innovation for the future
- Data industry is also partnering with a bike company to be able to provide a bike service to people in order to rent bikes throughout the city to use instead of vehicles

Cost

- The city officials are spending more money in the short term on solar arrays in order to save more money in the future
- cost of operating the system is low because a majority of the system is still in control of the private companies
- By building the renewable infrastructure now - the city will save on operating costs in the future
- the city has also passed regulations that enforce new building to provide solar on top of the building in order for it to generate its own power + more
- This method saves the city from having to put in the solar on their own and at the expense of people's tax dollars
- The vehicle manufacturer is starting to see a lot more revenue from the sale of more electric cars as they begin to replace non-renewable vehicles
- The vehicle manufacturer is also looking at the cost of building the products so that they can sell more vehicles to people and companies (fleet) at a lower cost
- Helps to have more vehicles on the road more than trying to make the most amount of money off of one vehicle (sell more for lower than few for higher)
- Vehicle Manufacturer is reducing costs by starting to make some of the physical technology in house and not outsource to a different party
- The primary cost for the company is with the innovation and expansion of the AI technology in vehicles
- Continuing and building relationships with investors in the company to provide more funding to the development of the future technology
- Operation of cost of the public transportation system that they have partnered with the city for along with providing the city with payment for using their technology on the roadways
- As more people begin to join the system as well as continuing their use of the system - the tech company is gaining more revenue
- Their is a cost that comes to the company with the cost of implementation as well as the partnership with the city
- Trying to provide as many terminals throughout the city to become more efficient - making people's lives easier
- the data industries costs reside primarily in the development and management of the system
- The data industry is gaining revenue from multiple partnerships that they are in - growing rapidly as they provide their services to other companies
- Growing revenue as more people ustilize their specific technology and services - this is beneficial with a rapidly growing population in the city
- The data industry and the technology industry are starting to blend markets and innovation - digital control now in the hands of Data Industry
- The company is spending money to put their technology out there - brand awareness - to keep increasing the comfort level of consumers
- consumers are still paying a monthly fee in order to take part in the system - technology on the street
- Another fee is added on top of the membership in order for people to use the new system of transportation
- People are also paying to get the latestest and greatest personal technology in order to experience the new way of interacting within the city
- Consumers are now having to pay to upgrade some of their personal devices since the digital world is moving so quickly - old technology does not have the capability to run the updated system
- Some of these upgrades in technology are negatively impacting a certain group of people who cannot afford to constantly upgrading

Are they Happy?

- The city is happy because it is utilizing the new technology in its public transportation system to give people the opportunity to experience the new technology of the future
- The city is also growing at a faster rate as more urban centers begin to grow their population more with the younger generation
- City is happy to be partnering with notable companies to provide new technology to its citizens in order to increase their quality of life
- The city is also bringing in more tax dollars from the increase in people that are moving there
- city is also making money from the partnerships that allow private companies to utilize the public right of way for testing and providing their technology to the people
- The vehicle manufacturer is happy with the rate that things are moving for the company and the growth in exposure and partnerships to put their technology on the roads
- Company able to showcase and get their vehicles and technology into the lives of the consumers to be able to start using their new technology
- As more people connect to the system - both the tech industry and the vehicle manufacturers are using the same data to improve the system and the vehicles
- Partnership with the city provides more exposure and wide use of their public transportation vehicle on the system
- This is also beneficial for them to be able to test and update their innovations and vehicles on the roadways
- Vehicle manufacturer is sharing and collaborating with the tech company - not outsourcing- but developing together for the city contract they have (public trans)
- The technology company remains in a happy state as they are being able to put out more personal technology
- They are also continuing their previous relationship with the city as well as establishing a partnership with the vehicle manufacturer
- Because of their past releases and implementation more citizens use their products and services in their personal lives and throughout the city
- This means a lot more revenue for the company because of the increasing amount of people using their product and more of their technology in the city
- They have also been able to establish a new partnership with the city to operate the innovation of the city's system
- The data industry is becoming more happy with the market and the way that their business is moving
- The company is moving in a positive direction with getting consumers more comfortable with using their services and their data contributing to increasing the efficiency of the system
- This year is a lot of partnerships for the data industry and being able to dip their toes in many industries which allows them to generate more revenue for the company
- The partnership with the city is helping to use personal data from consumers to tailor the way people interact with the system and view data that they find important
- the consumers are enjoying the prospect of new interactions in the city - at least the people that can afford the system
- With the integration of new AI technology in partnership with public transportation has increased the efficiency of the public system
- Consumers have a variety of more options of how to get around the city safely and efficiently - bikes and scooters are now a connected method to the system - supply and receive data
- Important becuase more people are moving to the city without a private vehicle
- Consumers are trusting the system more and more especially the new AI technology (on routes) - people will continue to

Negatives

- The city is getting push-back from low-income families about supporting the system because they are continually being pushed away from using the system - cost of entry
- The city is losing funding from the state to help maintain and adapt the roads to the needs of the new system
- Prices of land are increasing throughout the city because more people are moving to the urban center and parking lots are still taking up a lot of space in the city
- New investors along with the partnered companies are starting to put money in to help their businesses - roads bad = bad for business
- Continuing innovation to increase the productivity and adaptability of these parking lots that are more centered in the city
- As more people begin to move to the city - a majority of this younger generation do not want to be financially burdened of owning a vehicle
- This leads the company in a dip in the market (have the city relationship to help level out)
- City is now taking up more lanes of the roadway to readjust the way people move through the city - more bike lanes / non-vehicle lanes
- This means that their is less space for their vehicles on the roadway - want to provide efficient transportation and cannot put too many vehicles on the road
- The technology company has not found its stride in the much more popular non-vehicle market (Bike and Scooter)
- This is more controlled by the data industry and their apps that provide citizens an easy way to use a bike to travel more environmentally and efficiently through the city
- These bike networks have not yet been integrate with the proper technology to make them more efficient as well as being able to be connected to the real-time city system
- The consumers are now not happy with all the new technology that is priced higher as well as the system still being a pay to play system - not fully inclusive
- Subtle disagreement with lower income neighborhoods as the system is not yet fully free to the public - people still need to purchase memberships to use the system
- similar problems persist from the past - but there is promise that the people of the city are changing as well as the younger generation getting on board quicker
- As the system becomes more adaptive to the individual user consumer might start to get worried about what other companies hold their data and use their data to target them
- Lower- income families might not be able to have the funds to gain access to the new technology and the worry is that they will stop being supported
- The physical technology becomes a limit for what the digital world can do since the hardware can only handle so much compared to the rapid innovation that the digital world sees
- The low-income population of city are upset with how the city officials and big tech have brought this new "public" system to only be used by the people that buy in
- Consumer's are having to upgrade their technology in order to support the new digital infrastructure - this can be very costly for the lower income families

Public Agencies continuing partnership with corporations to integrate new AI technology into public transportation

City officials are losing some of their budget to other state funded projects - the city is still committed to making their citizens happy by putting money into other new and innovative projects on the renewable spectrum of energy

Public Private Partnership to innovate the successes seen and tested - further innovation to increase the quality of life for the people

New headset and glasses technology is becoming more popular with the early adopters in the city - using something that changes and improves the user's interaction with the city

The state government has lowered the budget for the maintenance of the roadways in the city

Vehicle manufacturers are not happy becuase they need good roads to give their customers a good experience

The city is getting negative feedback from consumers about the condition of the roadways and the experience within the city

Technology Companies are putting forth money in order to maintain the partnership and to show the public agencies that they are committed to bringing the best quality of life to their consumers

Vehicle manufacturers have put investor money - in their company - forward to help repair and maintain the roadways until the budget can be readjusted

City still putting money into other innovation projects within the city - turning parking lots into more adaptable and usable spaces for the city

Because of all the money being switched to help the city - prices have gone up and people are not happy with how prices to enter the system have increased

Consumers are now paying more for hopefully a better and smoother experience of living and traveling within the city

The city is focused on providing the newest technological experience fo its people

Vehicle Manufacturer is able to generate a lot of revenue and publicity of their high tech vehicles with the larger consumer audience

Creating a Compatible network for the city and the people by utilizing the existing infrastructure in the roadways in order to reduce costs

Headsets are flying off the shelves as people want to use the newest technology

Partnership

The software for the system is adapted to display important information to the consumers through the headsets

Goal of creating a renewable and efficient system to make their city and people more productive and lives better

Consumers are able to provide real-time feedback and suggestions in order to provide data about the experience with the companies / officials

New innovations in the vehicles can be transferred over a cloud update through the system - easier time for the people (good mood)

OLED Screens are being implemented at a faster rate with their previous success - connecting people to the digital system displaying and providing real-time data about the city, roadways, and vehicles

Consumers have the demand for these new products and everyone wants to get their hand on these - changing the way people interact with their digital lives on a day-to-day basis

More renewably electric vehicles are on the road (1 in 4 vehicles)

Incentive based management to encourage people to change their habits to become better for the environment as well as saving people money

Data control is being handled by the 3 private companies who are all looking at different sets of data

The technology industry is now closely integrated their products into the vehicles and people are responding with feedback in order to help continue development

The technology industry has been putting out other technology in partnership with the digital side of the innovation with the data industry

More data is being given to the consumers especially since the integration of an updated GPS system that can more accurately detect vehicles and all the data from the vehicle

The software of the headsets is constantly being innovated on based on feedback from the consumers

The technology industry has developed the headsets to be able to communicate with the digital world more efficiently - becoming a new way of interacting with the city

The data industries digital realm is being manifested within the physical world

Gas prices have become too expensive now that more reliable renewable solar energy is available - increasing the experience of the people

The data industry is responsible for compiling all the important data that is beneficial to the knowledge of the consumers - dispersing into the digital realm to people

The technology company is looking at the data that is important for development and feedback on the technology side of the system

Vehicle manufacturers are looking at the data of individual vehicles as well as how they are able to communicate with one another as well as the system

This data is important for the developement and innovation of the physical technology components of the system

The vehicle manufacturer is happy with this change in attitude for people since they started only making electric vehicles

With more people buying newer electric vehicles - the technology on board is able to connect more people to the system which will increase the efficiency of the system

The more the user interface is developed and refined the better it is for the increase in the quality of life for the people of the city - their direct interaction with the system

Consumers who are able to afford the technology are really enjoying the experience that it offers and their connection with the Internet of Things

Lower-Income families are not able to keep buying all the new technology - negative attitudes building towards the development of the system

City officials are recieving negative feedback from these communities because of the pay to play situation that they are left to

The people are not happy becuase they feel that they are being more and more excluded from being apart of the system and utilizing its functionalities

The technology company is trying to place more public terminals throughout the city and being able to make them more accessible for people within this class

The city has put policies in place to keep public transportation costs stable for these people as more development and innovation happens

With an increase in fees for the majority population - this allows the tech company to still make money, pay the city for rights, and allow access for low-income families free of charge

The consumers are much more tolerant of the inclusivity problem because of these changes being made within the system and being able to be apart of the technology system

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

ERA OF THE ELECTRIC VEHICLE

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

Tesla Autopilot

- The first commercially available driver assistance that can steer the car and even change lanes on the motorway

Accessible Fully Electric Vehicles

- Costs of fully EVs are dropping to allow for accessibility for a lot of people
- Production of different types of vehicles (private and public) allow for a more efficient and cleaner environment

2014

2010s

Driver Assist Technologies

- Lane Departure, Blind Spots, High Beam Assist, Cross Traffic Alerts

- Carmakers have also begun adding smartphone integration, with many producing apps so you can find your car via GPS, and remotely lock the car and check its fuel levels

2020

Innovation of AI Vehicles

- Collaboration between Vehicle Manufacturers and Technology Innovators

- Testing of autonomous methods of travel -- how this technology can change the way people travel and the efficiency of cities

5G + Internet of Things Integration

- Connection of "things" within the digital world -- data an communication with objects connected to the network

- Advancing developement of connecting people to the network and with the "things" -- connection and communication of people and objects

Type IV

Will 5G Transform Smart Transportation

- Allows people to leverage the full potential of advanced technologies -- virtual reality, artificial intelligence, intelligent transportation systems

2021

2021 +

Type IV

Deliveries will be Increasingly Autonomous

- Innovation in technology allows companies to slowly integrate this technology into their fleet

- More probable for later integration -- big companies do not want to go all in just yet (more success to prove) -- 2023+

Increase in Electric Vehicle Production

- As technology in electric vehicles becomes cheaper to manufacture -- vehicles are able to be sold cheaper than before

- City incentives and regulations benefit consumers who drive / use electric vehicles

2022

Type IV

Victoria Transport Policy Institute - Implementation Predictions

- Autonomous vehicles are projected to be safe and reliable
- Full integration of commercially readily vehicles by 2030

2025

Integration of Solar to Buildings

- City officals working with the technology industry to integrate solar panels to roofs throughout the city

- Setting up the city to renewable charge electric vehicles -- SUSTAINABILITY

2026

2024

AI Vehicle Testing

- Working with the city, the vehicle and technology industries are able to set up safe closed routes with their new vehicles and technology

- This is the start of the company's trying to build trust with the consumers about using their technology daily in the future

2028

Wave of Bikes / Scooters

- As younger people with no car continue to move to the city, bikes and scooter have become a new method of transportation throughout the city

- City is integrating new bike lanes into streets to increase the efficiency of this new transport method

2030

Type III

Octopus Article

Carbon Free Vehicular Transportation

- This proposal is a need for most cities with increasing dense populations

- Most vehicles will be powered by batteries that will continue to be developed -- this will help with a more renewable source of energy rather than the use of fossile fuels

Autonomous Vehicles as Accepted Transportation

- 2030 is the point in predicted commercial developement for use by everyone

- Will take a period of time for consumers to become comfortable with the technology and the new way of traveling around these urban environments

Environmental Incentive / Need

Scenario 1

2032

Type I

Reduction of Vehicle Ownership

- This is a projection that due to the innovation of transport technology, there will be no need to own a private vehicle -- this is due to the increase in population and the potential regulation of vehicles on the roadways

2035

Type VI

The Guardian

All new US Vehicles can be electric by 2035

- Rapid advancement in technology and the cost of batteries should allow all new cars sold in the US to be electic by 2035

- The rapid electrification of transport would save about $2.7tn in driver costs by 2050

2040

Type I

Manufacturing of Vehicles

- This prediction indicates that it could be possible that vehicles and vehicle parts would be able to be 3D printed which would make the cost of ownership of a vehicle much more accesible

- Would this be more beneficial? The goal of efficiency could suggest that vehicle ownership would decrease and be controlled through a centralized private or public industry

2042

Type VI

Credit-Suisse

1 in 4 cars on the road will be electric - US

- This change will drastically decrease the carbon emissions that vehicles contribute to global warming

- Europe is looking to implement this statistic at a faster rate than the United States

2045

Type I

75% of Vehicles to be Autonomous

- Highway lanes will be rephased to include dedicated lanes for autonomous vehicles

- Attitudes and acceptance of autonomous vehicles will be near 100% -- This technology will be engrained within everyday life and the need to make more efficient.

2060

Being able to find renewable energy to power electrical plants in order to make this implementation the most effective

2030+ : Countries begin to roll out bans on vehicles with a combustion engine (Non-renewable Energy)

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Web 3.0

User Centric - Decentralized - Private and Secure

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

2020

5G Network Integration

- 5G Networks are the fastest networks created and allow for the advancement of technology to increase as well allow more devices to be reliably connected to the IoT

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

2022

SimonIOT Prediction

Type III

Majority of Lives Turn Digital

- As digital technology become more important in the consumer's daily lives - it is important to continue to establish a reliable connection

- Ability to have more "things" connected everyday

2022

2023

Established 5G + Accurate GPS

- This integration and establishment allows vehicles to be tracked more accurately along with faster and more reliable connection speeds to the 5G network

Public Cloud

- 75% of the world's population will be interacting with online data everyday -- each user would have about 1 data interaction every 18 seconds

- Majority of data will be kept on a public cloud network. This will lower the storage of data on each device and will become easier and faster to access

2025

iTransition

Type VI

Type IV

SimonIOT Prediction

2025

Commercial Autonomous Vehicles Connected to the System

- Vehicles accessible to the public will be connected by 2025 with a reliable connection for people to interact with transportation

Changing Interaction

- As more data becomes available to people -- the way people interact with the city is cahnging

- City as a part of the Internet of Things

2026

2027

Mass Amounts of Data

-With an ever increasing amount of things on the IoT, mass amounts of data are able to be transferred through the updated system

- New system for vehicles is able to read more real-time data faster and more efficiently

Scenario 1

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

2030

SimonIOT Prediction

Type III

Type III

Popular Mechanics

2035

An Increasingly Virtual World

- The Internet will begin to blend and exist within the real world
- Our methods now will be considered archaic and clunky

- Everyday life will begin to move more around the digital environment and how we interact with it in the physical environment

Artificial Internet of Things

- Artificial Intelligence and the IoT combined to achieve more efficient IoT operations, imrpove human-machine interactions and enhance data managment and analytics.

2038

Industry Europe

Type VI

2060

City Agency

Vehicle Manufacturer

Technology Company

Data Company

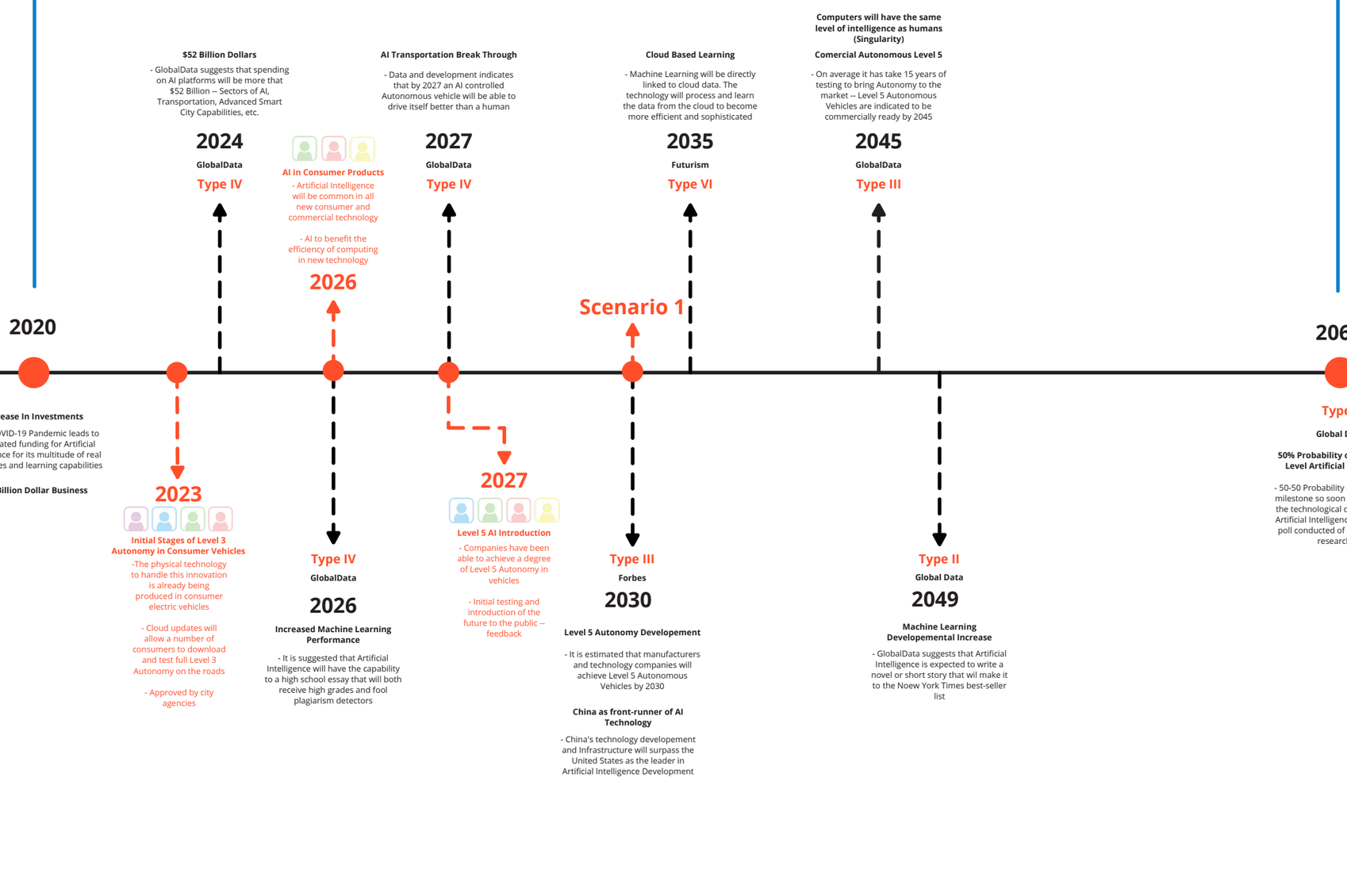
Consumer

Data Governance will come more to the forefront about who controls and manages the public data sphere

IoT Devices will become more and more intelligent and be ever increasing as a part of our daily lives

RAPID INVESTMENT AND DEVELOPMENT OF AI TECHNOLOGY

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS



City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

2045

My Grandparents

My grandparents generation will not be able to see wide use of a lot of the technology picked up by early adopters in years prior. The the companies were primarily looking to market to the younger generations who would ultimately become their primary customers when the technology became readily available for the consumer market. This generation is also not able to see the widespread use of Autonomous innovation in public transportation.

My Parents

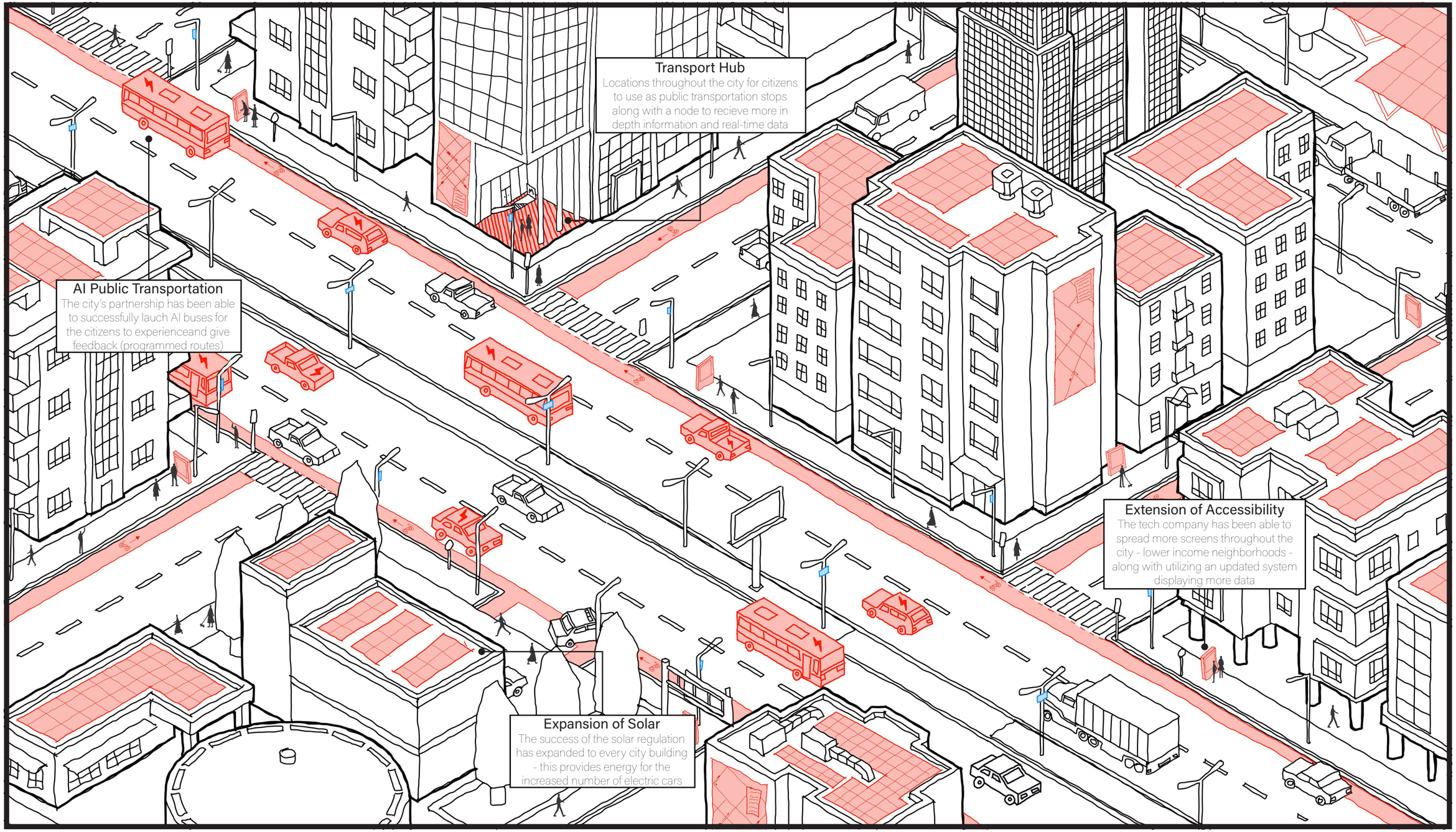
My parents generation are the group that are still hesitant about the change in the urban transportation system. Collaboration and testing allows this generation to feel more comfortable with the idea and use of autonomous transportation on a public scale with transportation allows a lot of different groups of people to test out and experiecne the technology first hand with the benefits that it provides in regards to efficiency. This generation will get used to the integration and partnership will be able to come around to the idea of computers controlling the system - even though they lived in a predominately manual world throughout the majority of their lives.

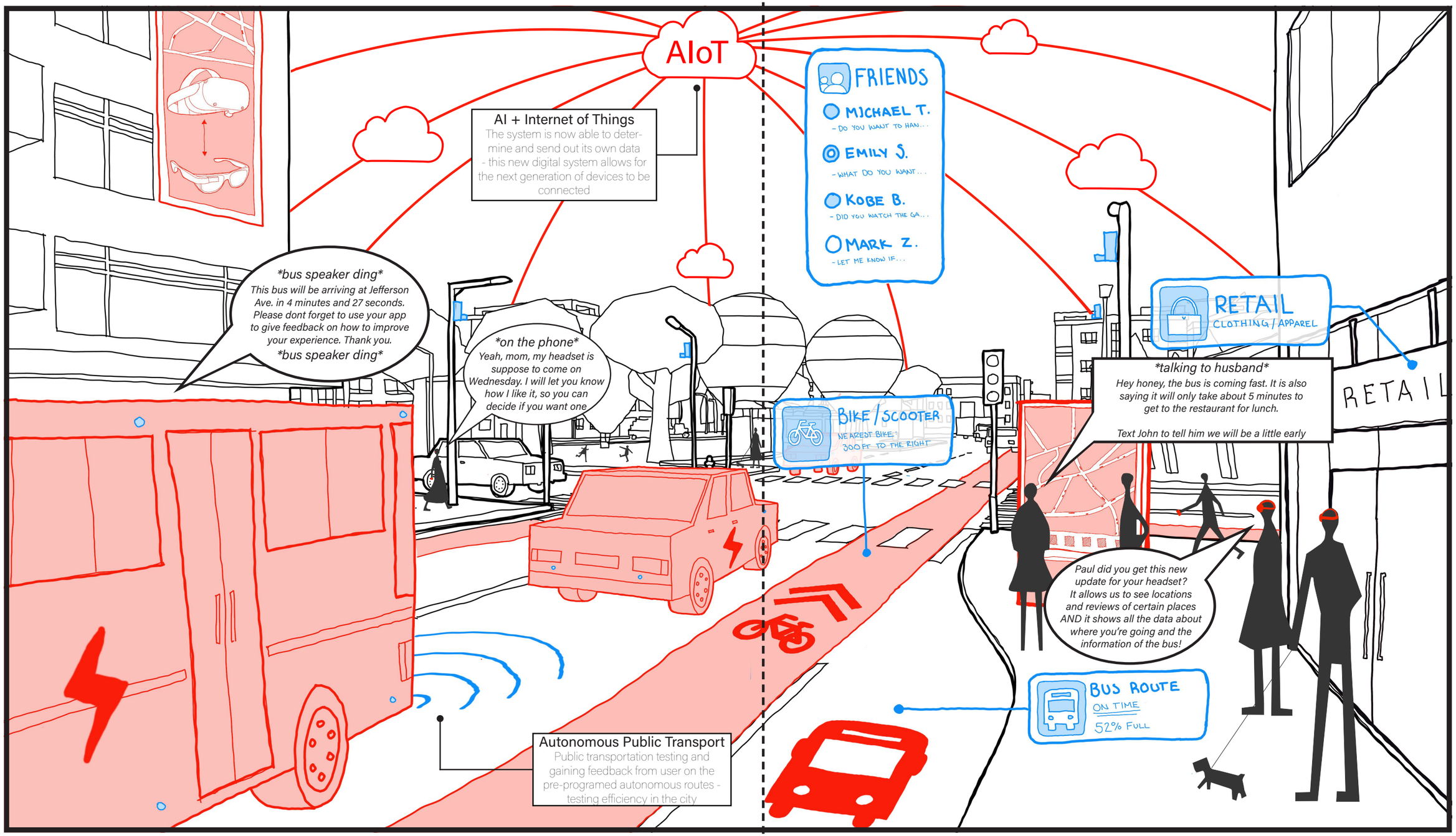
Myself

My generation is has been very open to the adaptation of the existing system and changing the way transportation moves people throughout the city. The integration of the new technology in 2045 allows people to become more efficient in their lives which increases the quality of life for the consumers. This is also a big generation that the company wants to market new headsets and augmented reality towards. A lot of the marketing comes from the consumers themselves in seeing and experiencing how they interact within the city. This group's lives revolve around the digital world and these new personal devices are able to blend reality and the digital realm.

My Kids

My kids generation was born into this new innovation and implementation in the city. They have been able to grow up with AI technology and electric vehicles being the norm in society. This group of consumers will most likely grow up similar to their parents in a way of wanting the newest technology that improves their lives. The companies continue to push their marketing and brand awareness towards this group as they are the most comfortable with all this new technology because they have been able to grow up with it and havent really known anything else.


Transport Hub
Locations throughout the city for citizens to use as public transportation stops along with a node to recieve more in depth information and real-time data
AI Public Transportation
The city's partnership has been able to successfully lauch AI buses for the citizens to experienceand give feedback (programmed routes)
Extension of Accessibility
The tech company has been able to spread more screens throughout the city - lower income neighborhoods - along with utilizing an updated system displaying more data
Expansion of Solar
The success of the solar regulation has expanded to every city building - this provides energy for the increased number of electric cars


AIoT
AI + Internet of Things
The system is now able to determine and send out its own data - this new digital system allows for the next generation of devices to be connected
FRIENDS
MICHAEL T.
- DO YOU WANT TO HAN...
EMILY J.
- WHAT DO YOU WANT...
KOBE B.
- DID YOU WATCH THE GA...
MARK Z.
- LET ME KNOW IF...
bus speaker ding
This bus will be arriving at Jefferson Ave. in 4 minutes and 27 seconds. Please dont forget to use your app to give feedback on how to improve your experience. Thank you.
bus speaker ding
on the phone
Yeah, mom, my headset is suppose to come on Wednesday. I will let you know how I like it, so you can decide if you want one
BIKE / SCOOTER
NEAREST BIKE:
300 FT TO THE RIGHT
RETAIL
CLOTHING / APPAREL
RETAIL
talking to husband
Hey honey, the bus is coming fast. It is also saying it will only take about 5 minutes to get to the restaurant for lunch.
Text John to tell him we will be a little early
Paul did you get this new update for your headset? It allows us to see locations and reviews of certain places AND it shows all the data about where you're going and the information of the bus!
BUS ROUTE
ON TIME
52% FULL
Autonomous Public Transport
Public transportation testing and gaining feedback from user on the pre-programed autonomous routes - testing efficiency in the city

Reflection / Conclusion - Scenario 2

This stage of innovation is about bringing the technology into the hands of the consumers. By partnering with the city officials, private companies are providing renewable electric and autonomous vehicles to be used in the public transportation sector. This is important to build the trust of the consumer, as this is the first large scale integration of this technology into the roadways.

As artificial intelligence is still being tested and developed – for level 5 autonomy – data can be reported about the efficiency and performance of the public system over the old network. Consumers can provide feedback about their experience and the innovation can be adjusted to address the feedback. This relationship with the consumer, allows the company to listen to the feedback about the technology to update the system to continually increase the quality of life based on the feedback they receive.

As the personal technology market continues to progress, the introductions of new personal headsets is a change in the way consumers interact with the city and the digital system. The new user interface allows real-time data and the consumer's digital lives to be blended with the physical urban fabric. As more people's lives increasingly revolve around the digital world it is important to continue to blend their lives to increase their efficiency and their quality of life in the city. These first-generation augmented reality headsets allow for digital features to be overlaid to the physical environment. The partnership between the technology company and data company are working closely to innovate the digital side of the technology and the release of new physical technology.

City officials are budgeting to increase the efficiency and adaptability of the city's parking lots. Through projects with renewable energy and large gathering spaces, the city is able to create new spaces that accommodate for the increasing number of citizens.

Scenario 3 - 2060

Time of Technological Adaptation

Background Narrative - 2060

Through the introduction of **autonomous vehicles within the realm of public transportation**, the city has gotten increasingly positive feedback as for the trust that the technology has established with the people of the city. The **people have been increasingly more efficient** getting around the city as more and more people begin to see the positive impact that the technology has on the lives of the people that use it. This chain reaction has caused most people to **get rid of personal vehicles in order to take a mode of transportation that runs on a system**.

Because of this large new amount of people, the city officials have partnered with private vehicle and technology manufacturers to create a **fleet of ride-share vehicles** on the public roadway. This introduction is a new method of transportation that is **regulated by the public agencies and operated by the private sector**. This new method also allows people to not have to own a personal vehicle but adds the inclusion of being able to go from Point A to Point B very efficiently without having to make stops along the way – like public transportation. This is important and beneficial to the consumers because this allows their efficiency to be increased when traveling along with being able to **call or schedule a ride from their personal devices** which increase the positivity in the quality of life of the public.

With these changes in movement through the city – this increased efficiency has led the **city to develop modified roadways**. With the drastic increase in autonomous vehicle efficiency, the city has designated **main north-south roads to vehicle transportation**. This allows for the **smaller through roads to be transformed into being pedestrian outdoor space** between buildings. The city has been able to readjust the urban fabric to

accommodate more **transportation nodes throughout the city**. These locations occur on the corner of pedestrian populated through spaces and main vehicle roadways.

Another important change in the city is about how people now interact with the city. **Using digital interaction in the physical world**, people can access data, through the **AIoT**. The digital world used to be a part of the physical, but now the **physical world is just a backdrop of reality for the digital world**. The technology of augmented reality has progressed to include more vital information to the consumer. Upgraded slim **glasses allow people to gain a digital overlay to the physical urban fabric**. Older forms of **physical technology are removed from reality and incorporated at specific points in the digital environment**. Most people's lives are all about the digital and the city has expanded to include public stations, to include everyone within this new environment.

The city government has been able to establish a program that uses tax money to provide admission into the system for people in a lower-income class. This increases the quality of life for the people that used to be pushed away from utilizing the system because of the cost of admission.

The environmental concern with people was done away with when the city **regulated a mandate that made all cars on the road be electric**. This body of government took a strong action that has paid off in the eyes of the public since this older population were the ones originally concerned with the climate crisis happening in the past. This mandate by the agencies also allowed people to upgrade private vehicles, if they still owned one, with the latest technology to allow their **vehicles to communicate with the fleets that were dominating the road network**.

The citizen of the city also have means of providing **constant feedback** to the people and system to constantly roll out updates and find problems within the technology to be able to fix through cloud updates. This new way of living has provided the city with faster means of living and the people are not just more efficient on the roads, but also in their daily lives as well.

City Agency

- City officials have **partners with the conglomerate company in order to establish, innovate and operate a new technology system** for transportation and user interaction in the city

- The city strives to **increase the quality of life for all their citizens** and to make the people's lives **more efficient** while living, traveling and interacting with the city.

- Drastic increase in the efficiency of vehicles, has allowed the **city to reorganize the program within the public right of way** -- the city has designated all north south roads as main vehicle arteries with the existing side roads being **converted to pedestrian inhabited public space**

- This change has been able to **increase the interaction amongst people** in the city and increased the quality of life as people have more new space in the city to enjoy.

- The main cost for the city is to **continue the program to help people of lower-income join the city, reorganization of the road networks, and innovation with the renewable energy movement**

- The city's partnership has allowed the private companies to w**ork closely with the agencies to operate, maintain and innovate the system**

- The city is happy because they are able to provide a more efficient system to their citizens along with working with the correct fields of expertise to manage the system

- One of the main drawbacks with the partnership is since the **company provides so much money to the city government - the conglomerate company has a hidden say in policy and regulations** that impact their businesses

Vehicle Manufacturer

- With the new ride-share system and partnership with the city the vehicle manufacturer is **able to get more consumers to use their vehicles as their main transportation in the city** - this is generating a lot of **brand awareness and revenue** for the company

- The vehicle manufacturer is happy with the larger conglomerate because the **new technology is being innovated and worked on in tandem with the production and innovation of the vehicles** - this method provides a more seamless connection to the city and other vehicles

- The vehicle manufacturer is also able to **produce bikes and scooters for the data industry's rental system** that is based throughout the city on consumer's personal devices - a new market in order to **generate more revenue** for the company

- With the vehicle manufacturer and the conglomerate partnership paying to be the operators of the system - **the companies are able to have a larger impact in decision-making of policies and regulations** that impact their businesses

- Vehicle Manufacturer is able to r**educe costs because of the conglomerate partnership that includes the technology industry** - innovating vehicle technology side by side with the vehicles

- Vehicle manufacturer is happy with this era because they are **able to put more vehicles on the roadway - without impacting efficiency** - which creates a broader brand awareness along with **more consumers using the company's technology and vehicles**

Technology Company

- Conglomerate partnership allows **technology to be developed in sync with the development and innovation of the vehicles** that it is going in

- Innovation of **physical vehicle technology continues to improve the efficiency and sustainability** of the vehicles and the system which in turn increases the quality of life for the citizens of the city

- Technology industry is working with the data industry on their **Augmented reality to transfer the data it used to display to become a digital overlay within the city - OLED screens removed**

- The technology company is able to **reduce costs** of implementation and maintenance of the physical system now that the **information is being accessible through the digital world** (cheaper to maintain and faster to innovate on

- Main cost to the company and the conglomerate is the innovation of the vehicle technology along with the standard operation costs of the system and the funding to continually innovate the physical and digital sides of the technology

- The technology company is happy with their business because **more people are constantly moving to the city center which means more consumers to use their system** and to buy into their program to use the system and the transportation - **More consumers = more revenue**

- Production and use of **AR glasses has become the norm** and the technology company is able to reduce the cost of manufacturing to sell the product to the public at a cheaper cost

Data Company

- The conglomerate partnership has allowed the **data industry to work closely with the technology company to understand the capabilities of the physical technology and its relationship with the digital world**. Also helping to transfer some aspects of the physical urban fabric to the digital world

- As more consumers begin to transition to an augmented world - t**he data industry has a large portion of the innovation and implementation between the physical and digital world** - especially with how people interact with the intangible data in the tangible world

- The data industry's revenue is derived from a **monthly fee based system** in order to access the real-time data and the digital interface overlaid within the city - people are also willing to pay their price since their lives are more revolved around the digital world than the physical world

- The data industry shares **similar costs** with their partner - the tech company - in **the operation and maintenance of the system** between the digital world and the physical world

- The partnership as a conglomerate company has **helped people trust the data security and use more as other big name company's partner and back this data company**. This is the age of technology where the data industry can showcase their technology within the digital realm and focusing on how data and consumers display and interact with the physical city

- As more people trust the data security - people still don't want the company to use their personal data - this is in conflict with what the data industry needs to show the public - new tailored experience.

Consumer

- Consumers - as in the past - are **paying a membership fee in order to access and utilize the system and transportation** along with accessing data in an augmented world overlaid in the city

- A majority of **consumers are upgrading their devices to be able to use AR with new glasses** put out by the technology company that is compatible with their existing digital lives and new real-time data

- The consumers are happy because the **personal technology is much more cost friendly and accessible** than what it used to be during the age of early adoption of the technology

- Consumers are much happier during this era of innovation because of their i**ncreased efficiency** when moving throughout the city - vehicles are faster and more efficient getting people throughout the city

- The consumer's **quality of life has increase with the widespread use of artificial intelligence in transportation** along with the accessibility of tailor real-time data for each person - consumers receiving the most up to date and live data of transportation

- One constant frustration that still persists with the consumers if the **problem of accessibility of the system** to people of lower-incomes - even though the city has a program to help, there are not enough funds to help everyone as more people are constantly moving to the city center

Conglomerate Company

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Physical Implementation

City officials have partnered with vehicle and technology conglomerate in or der to establish a new riseshare system throughout the city

With the city reaching its limits of holding citizens - most people have decided to get rid of their personal vehicles in order to be more efficient and sustainable by using public/private transportation services

The vehicle manufacturer has a lot of power in this scneario to help guide and control regulations for the system

The vehicle manufacturer's control on the system pays the city government a lot of money to stay as the primary system operator and partner

With vehicles being autonomously controlled - the vehicles can become more efficient with less complex routes

With this - the city has designated north-south main roads as designated for AI vehicles - the side connecting roads are transformed into pedestrian areas

Vehicle manufacturer is able to provide a lot of vehicles to the new rideshare system

The conglomerate partnership helps to coordinate vehicles, technology and software with each other to give consumers a seamless experience

Their new technology and system is being used in the hands of the majority of the population - more money to constantly keep updating

The vehicle manufacturing division also is implementing their technology with the data side's bike and scooter renting

The vehicle manufacturer is able to branch off into other methods of transportation - gaining more revenue

Conglomerate partnership allows new technology to be developed along with the vehicles to allow for a smooth integration to the system

Innovation of physical vehicle technology continues to improve the quality of life for the consumers, the sustainability of the vehicles and the efficiency in the city

The AR glasses market has taken off and everyone is looking for the next upgrade to the way they interact between the digital and physical worlds

The technology and data industry are the frontrunners in the market and are working with the city officials to help regulate the digital world - lots of say in the process

OLED screens have been taken out of the city and the information has been transferred to being completely digital

This is possible with the help from the development side digitally with the data industry and their skills in the digital consumer market

Data industry to transition removed physical technology into the digital world

The conglomerate partnership has allowed the data industry to work closely with the tech company to develop and transfer physical technology into the digital world

Data industry is able to help the conglomerate partnership with their bike/scotter service in the city for the people

As more consumers begin to transition to an augmented world - the data industry has a large portion of innovation and implementation between the physical world and digital world

Cost

The main cost for the city officials is the cost of reorganizing the public right of way to become pedestrian focused areas

City agencies are also continually working to update the technology of the solar energy within the city to keep making the system more efficient for the vehicles and now for the rest of the city's power usage

The cost of operating the system is left to the cities main partnership with the Vehicle, tech and data conglomerate company - they are in control of the whole system and the vehicles

The city is also drastically reducing its energy costs - with these new solar array technology - the city is currently able to make more energy than what it consumes

System Company is paying the city government a lot of money to be able to maintain the roadways along with maintaining the beneficial partnership that they have established

City government listens closely to the company to help benefit their business which benefits the citizen's lives and the revenue that the city makes

The vehicle manufacturer and conglomerate is seeing a large amount of revenue coming in from the system

The company is also paying the city more money which allows them to have a larger say in regulations that impact their business

The compnay is splitting the revenue between profit, paying the city in the partnership, and putting money back into the innovation of the vehicles + tech

This method allows for the company to have a seamless system with their vehicles and the physical real-time data system

With the conglomerate partnership - the vehicle manufacturer is able to reduce costs by partnering to have technology be developed side by side with their vehicles

By removing the physical technology - OLED screens - from the city, the company is able to reduce maintenance and implementation costs

The tech company is also spending money to help sway the city agencies with regulations that more benefit their business and control

Technology company's main cost is the development of the technology for the vehicles along with innovation of their system on city scale and in the digital world

The innovation in the digital world is at the cost of the user feedback that the company receives

The tech company has also been able to help the solar market with development and innovation along with implementation by the city

The data industry shares costs with the technology industry to help with the operation of the system and communication between the digital world and the physical technology

The data industry has its main costs in the innovation and maintenance of the digital infrastructure of the system

The data industry charges a fee to consumers to be able to access the real-time data and the system to experience the physical city with a digital overlay

The data industry also helps with the cost of regulation of the digital realm in collaboration with the tech industry and the city officials

The data industry has a large amount of revenue with the help of the conglomerate partnership - a majority of consumers are able to use and access the system - more people moving to the city too

consumers - as in the past - are paying a membership fee in order to access the transportation system along with the augmented world

Consumers are also upgrading their devices to be able to use glasses to have an augmented overlay on the physical environment

This physical personal technology is much more accessible than it used to be since it is now out of the early adoption period and manufacturers are able to build and sell the products cheaper

The city government in partnership with the conglomerate company are able to provide a program for consumers who cannot afford the technology to be able to get new tech and join the system

Are they Happy?

The agencies are happy with the state of their city - the people that they represent are becoming more efficient with all the new technology along with new interactions in the city

The city is also happy with the main partnership with the system operation company because they are able to generate a large amount of revenue

With the reorganization of the city's roadways - citizens have given very positive feedback anew way to enjoy parts of the city that were not usable before

This revenue is beneficial because the more money the city makes along with tac dollars they are able to help the citizens with lower-incomes be apart of the system

The vehicle manufacturer is very happy with the progress in this era

The company is able to showcase their technology at the highest level and the people trust the company and the technology that they provide

Their vehicles and technology are being widely used by a majority of consumers and the city - this is generating a lot of revenue for the company/partnership/city

The vehicle manufacturer is also happy with their conglomerate partnership because they are able to provide a innovative experience to the consumers

With the progress of efficiency in the system - the vehicle manufacturer is able to put more cars on the road because of the communication and flow between vehicles

Vehicle manufacturer is able to now develope technology hand in hand with the development of their vehicles - the tech company seamlessly connects the vehicles to each other and the system

As more consumers use the vehicles and the technology - the conglomerate company is able to improve the system with the data they get along with an increase in revenue

The technology company is very happy with this year because the consumers are able to trust the company and the partnership they have

It is also beneficial for the tech company by removing the physical screens throughout the city because they are able to provide the same information to the consumers escept just in the digital world throughout the city

Able to provide the same services around the city without the added implementation and maintenance costs associated

The company is also able to reduce the cost of manufacturing the glasses so that they are able to sell them cheaper to the public - more people connected to the system

The conglomerate partnerships benefits span all the companies associated in the deal - when one is doing well then the others are also doing well

The data industry is very happy - the partnership with the conglomerate business has helped people trust the data security and use more as other big name company's partner with the data industry

As the city fills up more and expands the data industry is able to see a larger market of consumers to get to use their system and also provide more data for the system

This is the time where the data industry is able to showcase their tech to the masses and seeing results of being able to benefit the quality of life for the consumers that use it

The consumers are increasingly happier during this era of technology from the last because of the increased efficiency of vehicles within the city

Consumers are happy because the vehicles are now able to pickup and drop off people with no stops in between - similar to private rideshare programs of the past that were an added cost

Consumers are happy with the partnership of the three companies because of the seamless transition of personal devices and system because they are all developed side by side to be compatible with each other

The quality of life has increased amongst consumers with the widespread use of Artifical intelligence in transportation - the transportation and real-time data that consumers receive is the most up to date live tracking of vehicles

The vehicles and traveling become a lot more accurate and reliable to the consumer

Negatives

One of the big negatives with the way things are going is that the partnership with the system operator is that the company has a large amount of say in regulations and input in the city government

With how much the company benefits the city and the officials - the company has blended to start having say in certain regulations that impact them and their business

The city is being held up by the corporation and the state is able to see that and has been cutting more money to put elsewhere

This is because they know that the company will supply the necessary funds to benefit their partnership and things that impact their business

In order to continually put more vehicles on the roadway - the technology and AI needs to be able to read vehicles faster in order to have a steady chain of vehicles on the roadway

With this new system the bus routes have been done away with since 2045 - it has then been replaced by more rideshare vehicles wich don't have multiple stops before a passengers destination

One worry with the tech company and the conglomerate is that since everything runs through the IoT and digitally

Becuase of this digital infrastructure - what happens if the system goes down for a little? What happens?

Tech company is putting money towards trying to figure out a safety precaussion if this does happen

With cheaper headset and more revenue coming in - the company is able to help the city officials add lower-income consumers to the system through an established program

Users want the technology to be user friendly with the information that they want to see - but at the same time the users would rather their data is not used

This is in conflict with the data industry trying to make the system as efficient as possible, but the data industry needs to use the user's data in order to tailor the experience

The tailored user experience is a major part of the interaction that improves each consumer's individual quality of life

One of the frustrations that still persists is with the lower income population because the city's program does not have enough funds for everyone

This is especially critical since the population continues to increase with many more people moving to the city each year

This mass migration is also impacting and growing the low-income population and the city does not have enough funding from the state and the conglomerate to help everyone

City has partnered with all 3 companies as the system operators for the privately controlled system

Reorganization of the city's road networks - city agencies with funding from the conglomerate company

Conglomerate Company in charge of development and operation of this new system - collaboration with the city's agencies

City agencies are focused on the efficiency of the citizens throughout the city - vehicles are so efficient it benefits to simplifying their routes/access

With the increased number of vehicles on the road network the nature of efficiency of the vehicles can be enhanced through physical change

Data from the vehicles - shows that unique stops that follow the same path are more efficient that and set amount of unique routes throughout a city

City is reformatting the way the city flows - new through streets are turned to public pedestrian areas

Vehicles are able to understand the movement of other vehicles, but the consumer loses parts of the city to a constant flow of vehicles

Consumers are able to take up more pedestrian space throughout the city - transportation through the city is taken up by more efficient vehicle technology

New street purposes allow for a more active exterior public presence along with a safer environment for people enjoy and interact with the city in a new way

The city has also been able to plant more trees in these new public spaces for the people to enjoy as well as add to the sustainability they are already involved in

This new urban move is increasing the interaction people have with the city and with each other in locations throughout the city

City has been able to establish a privately controlled rideshare system - operated by the private companies

Technology Company has been able to create a system where vehicles know their precise location in relation to each other

Tech company has been able to innovate the AI technology to work very efficiently in the city - where vehicles are almost chained together - pull off points

Vehicle Manufacturer is able to put a lot more vehicles on the road because of the increase in innovation in AI technology

City partner is happy becuase of the increase in movement of people throughout the city - the increase in quality of life for people

A lot of new citizens moving to the city and who already live in the city are ditching their private vehicles to take this new and efficient system

More of the company's vehicles are being used by a majority of the population with this new rideshare transportation network

Vehicle manufacturer is not sure how many more vehicles they can put on the road before affecting efficiency - starting to adapt markets

Beginning to manufacture electric bikes and scooters for the consumers to be able to take a different method of transportation throughout the city

Data Industry serving as a consultant for the bike and scooter market throughout the city - already have a foot in the market and development of the technology

Companies have all partnered together to be a conglomerate company in charge of system opertation

More vehicles and operation costs reside within the company - larger stake in the movement and efficiency of the city

New technology in the vehicles have allowed then to be the most efficient they have been with being able to communicate with the physical world and other vehicles

Technology is created and innovated side by side with the vehicles with the partnership

With the success and feedback of the early adopters of the Augmented reality - the company has decide to innovate the technology along with making it more accessible to the public

Data Industry is gaining more business as a lot of the physical technology is no longer needed and is transioning to being digital

Data industry is working with the tech company closely to establish a digital overlay that displays vital information to the consumers - real time data

Goal of creating a user friendly experience that connects people in a new way along with giving them more tailored information of the city

Consumers are giving feedback and are happy with this new method of interaction in the city - lots of the physical aspects of the city and information are transferred to the digital world - consumer's lives are almost all digital

Worry about the potential for the digital system to go down - losing information and connection to the system

Lower-income citizens are still not able to upgrade their personal technology in order to enjoy the benefits that the current technology has on their quality of life

Citizens are not happy because the city government has partnered with this companies and is promoting this new technology even though a demographic of people cannot afford it

City officials are recieving negative feedback about the continued support they have for this technology - people who have not been able to experience the benefits of it

In reaction to this, the city has established a program to help give these people the technology they need to connect and utilize the system

City officials want to be able to help the people of their city - state is not able to fund the program with state tax money

Conglomerate partnership is helping the city fund this program in order to get more people using technology and experiencing the benefits that it provides to quality of life

City officials are gaining a lot of attention from there implementation and management of such a system - becoming a precedent for other cities

Net Positive Solar Implementation throughout the city - powering the system, vehicles, and personal devices

City has adopted a partner for its solar energy program - tech industry

Conglomerate company is able to recieve a lot more data through this new system to be able to update through the cloud along with innovate the technology to improve the quality of life for the consumers

Technology company is able to branch out their expertise to help the city in an area that they are able to make more revenue along with brand marketing as being at the forefront of sustainable/renewable technology

Technology industry has been working to innovate the production output of solar arrays throughout the city in order to generate enough energy to run the system and all of its components

Production of energy outweighs the use of energy by the city and the citizens who live there - a net positive impact

City is able to store a large amount of extra power in the case of a loss to the digital world or connection issue to the system

Backup power is able to be run in an event of sorts to help keep the city functioning as normal until the systems are able to be fixed

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

ERA OF THE ELECTRIC VEHICLE

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

Tesla Autopilot

- The first commercially available driver assistance that can steer the car and even change lanes on the motorway

Accessible Fully Electric Vehicles

- Costs of fully EVs are dropping to allow for accessibility for a lot of people
- Production of different types of vehicles (private and public) allow for a more efficient and cleaner environment

2014

2010s

Driver Assist Technologies

- Lane Departure, Blind Spots, High Beam Assist, Cross Traffic Alerts

- Carmakers have also begun adding smartphone integration, with many producing apps so you can find your car via GPS, and remotely lock the car and check its fuel levels

2020

Innovation of AI Vehicles

- Collaboration between Vehicle Manufacturers and Technology Innovators

- Testing of autonomous methods of travel -- how this technology can change the way people travel and the efficiency of cities

5G + Internet of Things Integration

- Connection of "things" within the digital world -- data an communication with objects connected to the network

- Advancing developement of connecting people to the network and with the "things" -- connection and communication of people and objects

Type IV

Will 5G Transform Smart Transportation

- Allows people to leverage the full potential of advanced technologies -- virtual reality, artificial intelligence, intelligent transportation systems

2021

2021 +

Type IV

Deliveries will be Increasingly Autonomous

- Innovation in technology allows companies to slowly integrate this technology into their fleet

- More probable for later integration -- big companies do not want to go all in just yet (more success to prove) -- 2023+

Increase in Electric Vehicle Production

- As technology in electric vehicles becomes cheaper to manufacture -- vehicles are able to be sold cheaper than before

- City incentives and regulations benefit consumers who drive / use electric vehicles

2022

Type IV

Victoria Transport Policy Institute - Implementation Predictions

- Autonomous vehicles are projected to be safe and reliable
- Full integration of commercially readily vehicles by 2030

2025

2024

AI Vehicle Testing

- Working with the city, the vehicle and technology industries are able to set up safe closed routes with their new vehicles and technology

- This is the start of the company's trying to build trust with the consumers about using their technology daily in the future

Integration of Solar to Buildings

- City officals working with the technology industry to integrate solar panels to roofs throughout the city

- Setting up the city to renewable charge electric vehicles -- SUSTAINABILITY

2026

Environmental Incentive / Need

2028

Wave of Bikes / Scooters

- As younger people with no car continue to move to the city, bikes and scooter have become a new method of transportation throughout the city

- City is integrating new bike lanes into streets to increase the efficiency of this new transport method

Scenario 1

Type I

Reduction of Vehicle Ownership

- This is a projection that due to the innovation of transport technology, there will be no need to own a private vehicle -- this is due to the increase in population and the potential regulation of vehicles on the roadways

2032

2030

Type III

Octopus Article

Carbon Free Vehicular Transportation

- This proposal is a need for most cities with increasing dense populations

- Most vehicles will be powered by batteries that will continue to be developed -- this will help with a more renewable source of energy rather than the use of fossile fuels

Autonomous Vehicles as Accepted Transportation

- 2030 is the point in predicted commercial developement for use by everyone

- Will take a period of time for consumers to become comfortable with the technology and the new way of traveling around these urban environments

Mass Migration to the City

- The new younger generation are intersted in moving to urban centers - not wanting to own a vehicle

Type I

Manufacturing of Vehicles

- This prediction indicates that it could be possible that vehicles and vehicle parts would be able to be 3D printed which would make the cost of ownership of a vehicle much more accesible

- Would this be more beneficial? The goal of efficiency could suggest that vehicle ownership would decrease and be controlled through a centralized private or public industry

Increase in Renewably Electric Vehicles

- As the city begins to set regulations for new solar panels on buildings -- incentives to drive renewably are increased

- Updated tech in these new vehicles

2036

2040

2040

New Interaction with Transportation

-With the rollout of new technology -- consumers are able to receive new forms of real-time data along with new experiences with vehicles / information

2035

Type VI

The Guardian

All new US Vehicles can be electric by 2035

- Rapid advancement in technology and the cost of batteries should allow all new cars sold in the US to be electic by 2035

- The rapid electrification of transport would save about $2.7tn in driver costs by 2050

Autonomous Bus Testing

- Partnership with the city to give people the experience and efficiency of an autonomous transit system

2044

2042

Type VI

Credit-Suisse

1 in 4 cars on the road will be electric - US

- This change will drastically decrease the carbon emissions that vehicles contribute to global warming

- Europe is looking to implement this statistic at a faster rate than the United States

Type I

75% of Vehicles to be Autonomous

- Highway lanes will be rephased to include dedicated lanes for autonomous vehicles

- Attitudes and acceptance of autonomous vehicles will be near 100% -- This technology will be engrained within everyday life and the need to make more efficient.

2045

Scenario 2

2051

New Rideshare System

- Established public rideshare system to increase efficiency over public transportation

- User app to see real-time data and system operations -- autonomously controlled system

Companies form a Conglomerate

- Companies partner together to help with innovation side by side their products

- Creating more efficiency and compatibility amongst the products and the system

2052

2055

Electric Regulation

- Data suggests the benefit to the efficiency of the electric vehicles and transportation

- Regulation put in place to have all cars on the road be electric

Change in Flow of Roads

- Vehicle roads to create a looped route that increases efficiency and reduces AI decision making -- more efficient

-Pedestrian parks replacing smaller side roads in the city

2058

2060

Scenario 3

Being able to find renewable energy to power electrical plants in order to make this implementation the most effective

2030+ : Countries begin to roll out bans on vehicles with a combustion engine (Non-renewable Energy)

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Web 3.0

User Centric - Decentralized - Private and Secure

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

2020

5G Network Integration

- 5G Networks are the fastest networks created and allow for the advancement of technology to increase as well allow more devices to be reliably connected to the IoT

2022

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

SimonIOT Prediction

Type III

Majority of Lives Turn Digital

- As digital technology become more important in the consumer's daily lives - it is important to continue to establish a reliable connection

- Ability to have more "things" connected everyday

2022

2023

Established 5G + Accurate GPS

- This integration and establishment allows vehicles to be tracked more accurately along with faster and more reliable connection speeds to the 5G network

Public Cloud

- 75% of the world's population will be interacting with online data everyday -- each user would have about 1 data interaction every 18 seconds

- Majority of data will be kept on a public cloud network. This will lower the storage of data on each device and will become easier and faster to access

2025

iTransition

Type VI

Changing Interaction

- As more data becomes available to people -- the way people interact with the city is cahnging

- City as a part of the Internet of Things

2026

Scenario 1

2027

Mass Amounts of Data

-With an ever increasing amount of things on the IoT, mass amounts of data are able to be transferred through the updated system

- New system for vehicles is able to read more real-time data faster and more efficiently

Type IV

SimonIOT Prediction

2025

Commercial Autonomous Vehicles Connected to the System

- Vehicles accessible to the public will be connected by 2025 with a reliable connection for people to interact with transportation

2030

75 Billion IoT Devices Connected

- This estimation is based on the number of devices that could probably be in a person's household who utilizes and is connect on the Internet already

SimonIOT Prediction

Type III

Blending the Worlds

- As the consumers' lives revolve more around the digital world -- the tech and data industries are working to blend the two seamlessly

2035

Type III

Popular Mechanics

2035

An Increasingly Virtual World

- The Internet will begin to blend and exist within the real world
- Our methods now will be considered archaic and clunky

- Everyday life will begin to move more around the digital environment and how we interact with it in the physical environment

2038

Introduction of AIoT

- Development has lead to the inegration of AI and the Internet of Things

- Being able to determine data that users want to see

Artificial Internet of Things

- Artificial Intelligence and the IoT combined to achieve more efficient IoT operations, imrpove human-machine interactions and enhance data managment and analytics.

2038

Industry Europe

Type VI

Scenario 2

2045

Gen 1 Augmented Reality

- This new technology is picked up by early adopter to be able to use the technology that will soon be used by the masses

- Blend of the digital world and the physical world

2040

2052

Companies form a Conglomerate

- Companies partner together to help with innovation side by side their products

- Creating more efficiency and compatibility amongst the products and the system

Innovation in AIoT

- AI controlled IoT network is able to make decisions with vehicles along with giving specific data to each consumer -- a more tailored experience

2050

2058

Tailored User Experience

- The technology and AIoT learns about each consumer in order to provide the most necessary information that person is interested in

- increase in the quality of the user's life

Gen. 6 of AR Headsets

- Cheaper Augmented Reality headsets are being sold to the public

- Allowing more people to access this new interaction with the city

2056

Scenario 3

2060

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

Data Governance will come more to the forefront about who controls and manages the public data sphere

IoT Devices will become more and more intelligent and be ever increasing as a part of our daily lives

RAPID INVESTMENT AND DEVELOPMENT OF AI TECHNOLOGY

WILDCARDS -- ASSESING PROBABLITY OF SUCCESS

2020

2060

Increase In Investments

- The COVID-19 Pandemic leads to accelerated funding for Artificial Intelligence for its multitude of real world uses and learning capabilities

$26 Billion Dollar Business

$52 Billion Dollars

- GlobalData suggests that spending on AI platforms will be more that $52 Billion -- Sectors of AI, Transportation, Advanced Smart City Capabilities, etc.

2024

GlobalData

Type IV

2023

Initial Stages of Level 3 Autonomy in Consumer Vehicles

-The physical technology to handle this innovation is already being produced in consumer electric vehicles

- Cloud updates will allow a number of consumers to download and test full Level 3 Autonomy on the roads

- Approved by city agencies

- Artificial Intelligence will be common in all new consumer and commercial technology

- AI to benefit the efficiency of computing in new technology

2026

Type IV

GlobalData

2026

Increased Machine Learning Performance

- It is suggested that Artificial Intelligence will have the capability to a high school essay that will both receive high grades and fool plagiarism detectors

AI Transportation Break Through

- Data and development indicates that by 2027 an AI controlled Autonomous vehicle will be able to drive itself better than a human

2027

GlobalData

Type IV

2027

Level 5 AI Introduction

- Companies have been able to achieve a degree of Level 5 Autonomy in vehicles

- Initial testing and introduction of the future to the public -- feedback

Cloud Based Learning

- Machine Learning will be directly linked to cloud data. The technology will process and learn the data from the cloud to become more efficient and sophisticated

2035

Futurism

Type VI

Scenario 1

Type III

Forbes

2030

Level 5 Autonomy Developement

- It is estimated that manufacturers and technology companies will achieve Level 5 Autonomous Vehicles by 2030

China as front-runner of AI Technology

- China's technology developement and Infrastructure will surpass the United States as the leader in Artificial Intelligence Development

2035

AI in All New Products

- Many industries have been developing the use of AI in many daily items in order to increase the efficiency and quality of life for the consumers

AI Enhancing AR

- Integration and development of an AI controlled system in Augmented Reality to be able to blend real-time data with what the user sees in the physical environment

2040

Computers will have the same level of intelligence as humans (Singularity)

Comercial Autonomous Level 5

- On average it has take 15 years of testing to bring Autonomy to the market -- Level 5 Autonomous Vehicles are indicated to be commercially ready by 2045

2045

GlobalData

Type III

Scenario 2

Type II

Global Data

2049

Machine Learning Developemental Increase

- GlobalData suggests that Artificial Intelligence is expected to write a novel or short story that wil make it to the Noew York Times best-seller list

AI in Personal Devices - AIoT

- AI is found in every new piece of personal technology that connects with the AIoT

- Allows information to be tailored on a per person basis

2050

2055

AI Vehicle System

- Partnership between companies and the city to get approval - based on data - to establish and operate a fully autonomous rideshare system

- Taking over the public transportation system - buses

Companies form a Conglomerate

- Companies partner together to help with innovation side by side their products

- Creating more efficiency and compatibility amongst the products and the system

2052

Type I

Global Data

50% Probability of Full Human Level Artificial Intelligence

- 50-50 Probability of reaching this milestone so soon in the future of the technological development of Artificial Intelligence -- Based on a poll conducted of AI experts and researchers

Scenario 3

City Agency

Vehicle Manufacturer

Technology Company

Data Company

Consumer

2060

My Parents

My parents generation will be able to experience this new wave and integration of technology before it is tweaked by the year 2060. This groups of people will also be one of few that will have been able to see many different forms of technology as it has changed over time - from before the cell phone - to a full augmented world that blends digital and physical. This generation is also the group that has had to go through the most adoption and adaptation during their lives because of all the rapid innovation of technology.

Myself

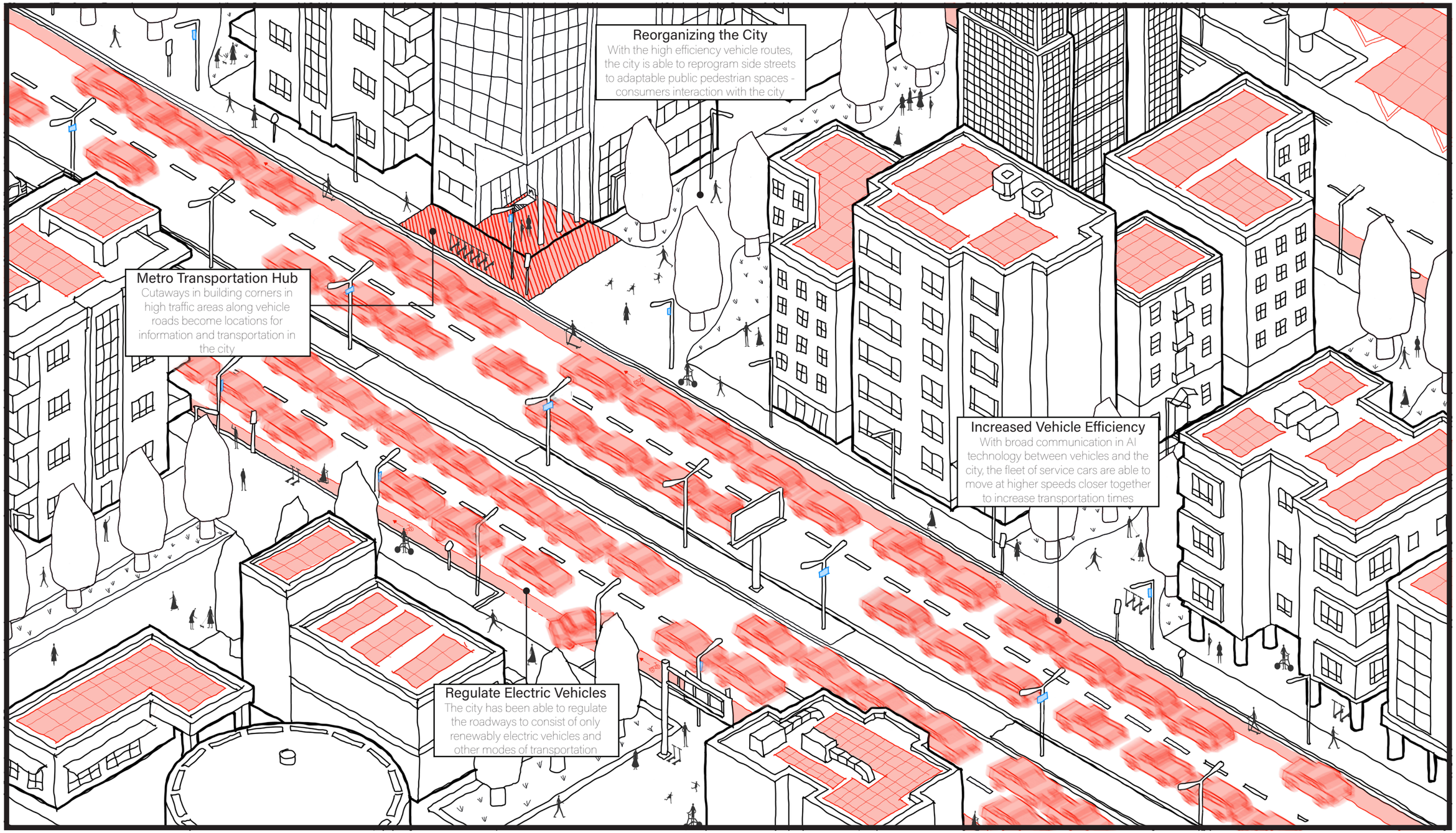
My generation was born into the start of this technological boom staring from the first smartphones. My generation has been the most adapt to change along with being the most active when it comes to fighting for sustatainability in vehicles and in cities. This group of individuals will be able to see their efforts pay off as they continue to take over and advance the technology further and to become more efficient and sustainable for the people and the environment. The new organization of roadways has been able to positivly benefit the interaction that people have within the physical world while still being connected to the digital.

My Kids

My kids generation will be at the age, in 2060, to realy understand the technology that is being relased and being able to hear stories about how it has changed throughout time to benefit the lives of the consumers. This group of people will be the ones to guide the next era of technological innovation in technology and transportation. They have been able to grow up with AI controlled systems and new personal technology and continually look for what is next to release. This generation's interaction with data and the city has been able to transcribe itself across the physical environment and the digital connection that ties people together.

My Grandkids

My grandkids generation will be born in an era of the next generation and boom of technological developement. They will have never been able to experience the technology of the past and the personal technology that feels unrealistic and ancient to them. They will be able to grow up in a world that is safer, more sustainable, and significantly more efficient that what was before. This generation is also taking a page from previous generations about the curiosity in innovation in the digital world and how people are able to interact between the two and to not lose touch with the physical city.


Reorganizing the City
With the high efficiency vehicle routes, the city is able to reprogram side streets to adaptable public pedestrian spaces - consumers interaction with the city
Metro Transportation Hub
Cutaways in building corners in high traffic areas along vehicle roads become locations for information and transportation in the city
Increased Vehicle Efficiency
With broad communication in AI technology between vehicles and the city, the fleet of service cars are able to move at higher speeds closer together to increase transportation times
Regulate Electric Vehicles
The city has been able to regulate the roadways to consist of only renewably electric vehicles and other modes of transportation

FRIENDS
MICHAEL T.
- DO YOU WANT TO HAN...
EMILY S.
- WHAT DO YOU WANT...
KOBE B.
- DID YOU WATCH THE GA...
MARK Z.
- LET ME KNOW IF...

RIGHT : 450 FT
TO: JEFFERSON PARK

TRANSPORT HUB - MORE INFO...

Augmented Data
The system has allowed more real-time data to be displayed to consumers within the physical city. Data is tailored to the consumer's wants based on AI in the system

AIoT

RETAIL
CLOTHING / APPAREL

RETAIL

ZOOM IN

talking to AI
Stacy, can you pull up my schedule for me. I need to see what time my next meeting is at, I cannot miss it

BIKE / SCOOTER
NEAREST BIKE:
300 FT TO THE RIGHT

on video call
Hey honey, I see you over at the metro hub. I am on my way over now, I forgot my keys upstairs and had to go grab them.

headset chime
The restaurant you chose will be on the right side of the street in 1.3 miles. I will notify when you get within 500 feet.
headset chime

talking to personal AI
Jarvis, Can you take me the fastest way to get to work today. I am taking my bike today, so no need for a car to pick me up.

Autonomous Fleet Vehicles
The system of vehicles is operated by the conglomerate with high efficiency transportation that allows them to travel very quickly and close to each other

FLEET PICKUP
SEDAN:
1 MINUTE 24 SECONDS AWAY

Reflection / Conclusion - Scenario 3

This era of innovation is about the drastic increase in efficiency throughout the city along with a mass connection of the digital world and the physical world. Innovation in autonomous vehicle technology has allowed the vehicles on the roadway to become far more efficient in getting people around the city quicker. This technology also translates over the user interface of the continuing to blend the digital realm and the physical environment through the next generations of artificial intelligence.

As the system become increasingly more complex, the companies involved in its operation and innovation partner together. Each of the main companies have been partnering with each other and the city – the companies look to innovate, integrate, and operate the technology in tandem and utilizing each of their specialized skill sets. This new conglomerate company is well known throughout the city and allows technology to be innovate side-by-side to create a series of seamless interactions between technology, the digital world, and the physical environment. This new sense of reliability in the technology increases the positive experience and trust that people are having with the technology in their daily lives.

As consumers' lives continue to revolve around the digital sphere, the synchronicity between the two world needs to be at the forefront of how people interact with the city and with the transportation system. Real-time data and live GPS tracking allow vehicles to be a click away for the consumers which in turn increases the quality of life for these people living in the city.

Data has been able to show the success in the implementation of a fleet of artificially intelligent vehicle on the roadways. This is important because it shows that the vehicles can move more rapidly over a more simplified route – rather than having to make unique complex decisions. As most personal vehicles no longer exist on the roads, the fleet is able to take control of both the private and public sector of transportation to blend the two. The city has taken this data and fleet system as a point to reorganize the flow of roads in the city. North-South roads become a route for vehicles to move in a chain, while East-West side streets can be converted into adaptable public spaces or parks for the citizens to enjoy. These new spaces in the city allows for a new interaction for the consumers to experience.

Reflection / Conclusion - Scenario 3

The process of scenario planning was one of experimental iteration with the interactions of multiple players within the game. While creating the games for the scenarios, the motivations and interactions of players are determined by the previous background research or the previous scenario. The beginning narrative for each scenario year highlights the main aspects of what is happening in the specific game. The narrative helps to guide the actions and reactions taken by players, acting as a base parameter to help guide the probable outcome of the interactions.

The scenario planning is created by a matrix of actions taken by players based on specific categories: physical implementation, cost, are they happy?, and negatives. This is important to focus the options that help players interact with each other when their actions are put into the scenario tree. The scenario tree is able to depict specific intuitive reactions from certain actions taken by players to then continue to move down the tree. Based on knowledge and motivations of each player scenario, the game tree begins to build itself along with creating a possible future to be depicted visually in the perspective and isometric drawings.

The scenario planning and game theory helped to explore a variety of options and interactions that in turn yielded different potential future outcomes. The scenarios, built on intuition and knowledge of the player along with a creative aspect, allowed the futures to be flexible and adaptable to understand what actions needed to be taken in order to return a specific visual of the city.

The process of game theory and scenario planning explorative experiment in creating interactions among players. The interactions were able to be tested with one another to see the impact that they had on the quality of life of the consumers and the physical adaptation of the city.

Conclusion

Answering questions about innovation of technology, method, and the value of the project

Conclusion

How can game theory and scenario planning help to produce a replicable process to create different possibilities of future realities?

The complete sum of the project is to produce a graphic novel that highlights the process of scenario planning and game theory to be replicable to others based on the initial character research. The visual representation of the scenario and its components along with more basic diagrams explaining the process allows readers to understand the process in order to replicate with the given characters or even characters of their own.

The setup of the method allows the reader to set up their own game with specific players and deciding the actions of the players based on the specific motivations for each decided on by the reader. The setup and understanding of this storytelling and research-based game format allows for a qualitative form of possibilities. These possibilities are not about the certainty of the outcome, but rather about the process of manipulating and interacting players with each other bounded by parameters set by the story.

The future possibilities outlined in the project are just one of a theoretical infinite number of possibilities. The process and method of scenario planning and future studies based on complexity, intuition, and the quality of creativity are able to yield a variety of different outcomes, actions, and reactions within the games. The replicability of the project allows it to continue past this initial stage of research and allows others to contribute their own games and scenarios to enlarge the sum of possibilities.

The question helped to guide the projects method in a more exploratory way. Being able to experiment with a new method has allowed the project to develop into a creative process of iteration. The story of the innovation and technology of smart city transportation was a backdrop in guiding this exploration of how to create possible outcomes. The research of the first portion of the project and the question of the story of innovation helps to guide the reader through a process of iterations of potential probabilities of future realities. The visualizations of the city were a product to give light to the second question of the project focusing on the innovation of a smart city transportation system. On the other hand, the answer to the question of method was in the process of understanding, creating, and iterating with the actions and reactions of players in the scenarios.

Conclusion

How does the innovation of a smart city transportation system impact the design adaptation and implementation in the urban fabric and the quality of life of the user's experience?

From the initial research of characters and background on how the systems operate, it is apparent that many companies and cities are involved in pushing the technology and its capabilities further. The project follows a path of rapid innovation that has been seen in recent history, mainly between the years 2000 and 2020. This rapid growth in research, innovation and data provides information to the success that testing shows with new autonomous transportation, the efficiency on consumer's lives, and the positive experience that consumers have with the technology.

With a majority of consumer's lives revolving around the digital world, the innovation of the technology is more of a question of when it will start to be more integrated into the urban fabric of the city. The scenarios and games that the project looks at sets the reader into potential realities of the years 2030, 2045, and 2060. This chronological study shows stages of innovation in the technology throughout its development. The games show actions and reactions by players to show payoffs and outcomes made by those interactions. These outcomes are then visualized in a potential perspective and isometric what the city could look like in the specific year.

From the second phase of scenario planning and utilizing the method of game theory, it is apparent, from the selected actions I have taken, that these potential futures show a world

of blending the digital technology and the physical world. Efficiency, sustainability, and user interaction are the backbone to the motivations of the private companies – Vehicle Manufacturer, Technology Company, and Data Industry – and to the benefit of the city making positive changes to the lives of the people that they represent.

As seen in the 2060 scenario, as society reaches a point of efficiency in transportation, with the help from Artificial Intelligence, the city can open up new space for pedestrians, once reserved as roads for vehicles. These new interactions and spaces in the city allow people more chances to interact with each other and to experience the city in new ways.

Throughout all scenarios, the research presents slower change of the physical urban fabric which lends itself to a more accurate scenario while the digital world is able to innovate and expand very rapidly. These actions with the city and the innovation, derived from extensive research, allow the scenario to lend itself to being more probable in a closer future. The construction of these stories began as being more realistic with closer scenario years because of more research that backs up specific components of each scenario. While later years for scenarios are more uncertain in their probability because of less research and knowledge of how the city will turn out. This becomes the nature of the scenarios. Storytelling based on research and data becomes much more involved in further perceived futures, rather than more data and plausibility controlled immediate futures.

As stated, prior, the research done for this project is based on the motivations I have for the future of the city and the actions I have chosen to take for each player can ultimately be changed by any reader to yield a new outcome. This is going back to the primary objective

of creating a replicable body of research where readers can conduct their own games with different actions to those presented here to expand on the potential futures and scenarios.

Value of the Project

This project looks to the implementation of a Smart City Transportation System into current existing cities. Research, studies, and data are able to show the broader populous the benefits that these innovative technologies have on the efficiency, sustainability, and quality of life for the people that use them.

The integration and adaptation of an Intelligent Transportation System shows strong benefits to the people and the urban fabric of the city. This project and exploration of character development and game theory shows just a few potential future situations that can represent the life of people in the urban city centers. The scenarios, are meant to show the potential outcome based on a set of actions taken by players, not the certain future.

The goal of this project was to provide readers with a source of knowledge about this technology and the players to be able to conduct their own sets of scenarios to widen the scope of potential outcomes for the future of the city. The replicability of the project allows the work to continue on to other readers to play their own games or create whole new characters for the games.

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Drawings

All drawings in project associated with characters, anatomy and scenario planning are created by the author of this project.

Technological innovation is occuring at a rapid pace in the world of personal devices. This trend of change has not been able to occur as fast in the urban fabric. The consumers are curious about the next generation of technology and integration of artificially intelligent technology in transportation and the urban fabric. This project aims to study the motivations and values of a set of characters involved in the integration and innovation of Smart City Technology. These characters create potential future scenarios of the city from there actions and reactions to specific decisions.

An observation on interactions and their potential results . . .

Smart cities are places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems

– Anthony Townsend