Design for AI Products and Services - Project 3: AI and Internet of Things

Predictive Maintenance in Semi-Truck Brakes: Process Book

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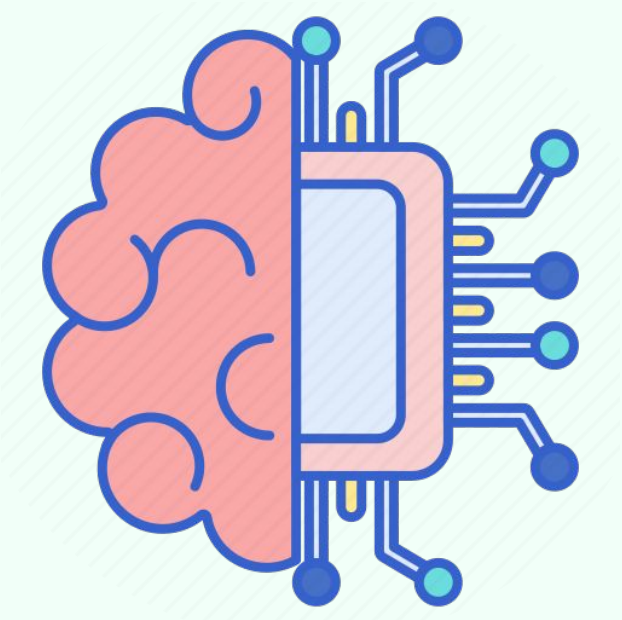
Project Background

Internet of Things (IoT) is a network of interconnected devices embedded with sensors, software, and other technologies that enable them to collect and exchange data. Physical sensors collecting real-world data, coupled with AI capable of processing and making inferences from massive datasets, can be a powerful system that easily adapts to and takes action in response to changes in the world. In this project, we think of ways that AI-IoT systems can be applied in a useful, technically feasible, and profitable way.

About the Project

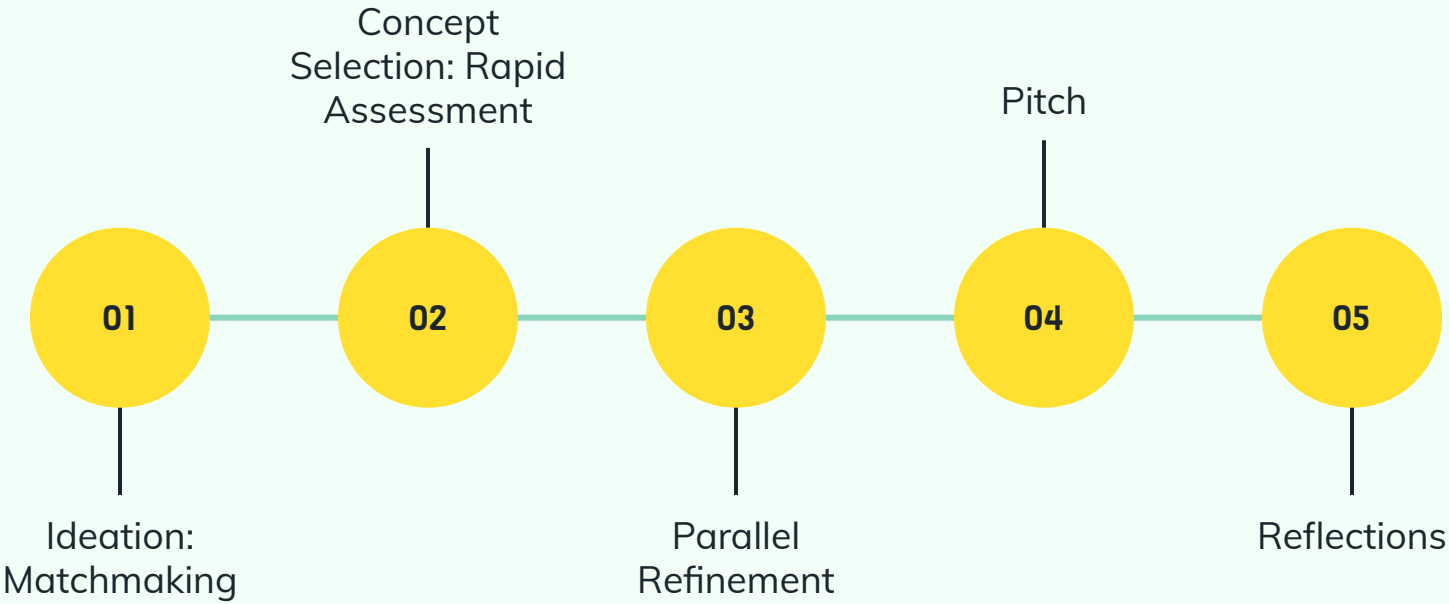
Project Objective: to ideate, select, and refine a service concept combining AI and Internet of Things (IoT).



Methods:

- Learn more about capabilities of AI/IoT
- Ideation: Consider several concepts using the matchmaking process
- Concept Selection: rapid assessment techniques to select a feasible low-risk, high-value concept
- Pitch: After refinement and critique, we turn our concept into a feasible and fleshed-out in-class pitch, where we assess technical feasibility, financial viability, and user acceptance/desirability.

Our Project Process



01

Ideation

Technological Capabilities and the Matchmaking Process

The Matchmaking Process

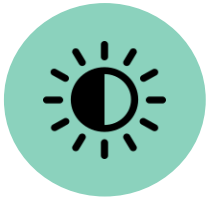
To kickstart the ideation phase, we leveraged skills from our prior projects and used a matchmaking approach to find AI applications suitable for a range of sensors that we learned about during our class. We did this by first examining **five sensors and their technological capabilities and limitations: light, image, RADAR, inertial, and depth sensors**.

We wanted to ensure a diverse and broad pool of concepts to pick from, so we began by tasking each team member to choose one of the sensors we learned about in class, then independently generate a minimum of **10 ideas per team member** for customer application pairs, free from each other's influence.

Then, each idea was **evaluated based on three factors** crucial for the successful integration of AI into a new product or service:

1. Financial Viability
2. Technical Feasibility
3. User Acceptance

Sensor Capabilities and Limitations



Light Sensor

+ Obstacle, motion, & context detection, cheap sensing & computation

– Low detail/depth, no recognition

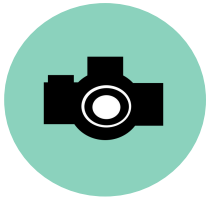


Image Sensor

+ Image classification, object detection & tracking, semantic segmentation, pose & motion estimation

– Expensive sensing and computation

RADAR

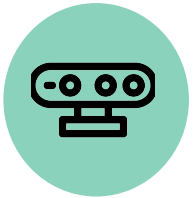
+ Obstacle detection, object recognition, motion detection, activity recognition, strong anti-inference ability

– Expensive sensing

Inertial Sensor

+ Acceleration, rotation, orientation, activity detection, system health, anomaly; cheap

- Accumulate error, only relative position



Depth Sensor

+ Depth perception, gesture recognition, low light operation

– Limited range, Interference, Calibration

	LIGHT SENSORS (Joey)	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
1	Obstacle Detection	Autonomous Vehicles	Drivers of AVs	Sensing obstacles for self driving cars	4	Large user base, premium cars so high profit	2	Detecting obstacle isn't really hard, but deciding what to do with it is difficult	4	Most people are excited with AVs, but there is still some fear about safety	10
2	Obstacle Detection	Building planning	Construction, contractors	Detect when a door should be closed or open to optimize for traffic	4	Large office buildings could have these on all high traffic doors	3	Would have to build a network of all doors	5	People probably would be okay w/ not having to open doors	12
3	Obstacle Detection	Home improvement	Building management	Detect when trash chute is blocked or at a certain level, allow for better collection insights	2	Not sure this is a real problem currently	5	Since contained to a trash chute, don't have to worry about scale	3	Easy to accept, but is there a need?	10
4	Obstacle + Motion Detection	Parking lots	Car owners	Direct people to open slots for best traffic flow	3	Saves lots of time, but would need ppl to pay more for that service	3	Detect when slot is open and then path planning after	4	People would love to know where an open slot is, but maybe not pay	10
5	Motion Detection	Smart doorbell	Home owners	Detect when there is somebody at the door and not when there's random flybys of birds, etc.	5	Large user base, people like to know what's going on at their house	4	Just have to detect when someone is in close proximity	5	Pretty widely accepted already	14

	LIGHT SENSORS (Joey)	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
6	Motion Detection	Shipping	Warehouses	Route packages throughout warehouse automatically	5	Big speed up, faster delivery, premium shipping rates	3	Have to manage where every single package is	5	People like faster shipping, warehouses like to operate more efficiently	13
7	Motion Detection	Elevator planning	Building managemen t	Efficiently route elevators	3	Saves lots of time, but is there a direct $ benefit?	4	Relatively small scale problem	4	People hate waiting for elevators	11
8	Context Detection	Energy saving	Building managemen t	Detect when people are in room to manage lights	5	Saves a lot of $ via reduced electricity bill	4	Small scale problem	5	Building management loves this, people using rooms don't really mind.	14
9	Context Detection	Productivity	Someone with tasks or jobs	Record motion and context to develop understanding of "are you focused"	4	People are probably willing to pay for these insights	2	Seems like a pretty challenging problem to solve with just light data	3	People would love to be more productive, but might not want to be monitored while they work	9
10	Motion Detection	Gym	Gym goers	Detect if gym is occupied or not, when is the best time to go?	3	People are probably willing to pay for this info	3	Have to figure out which machines are in use, who is likely to leave soon, who just came, etc.	4	Would save people a lot of time and help optimize gym trips	10

	IMAGE SENSORS (Ashley)	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
11	Image Classification	Health	Health-conscious individuals	Estimate nutrition content through recognizing food ingredients prior to cooking	5	Personalized health is a big market	4	Requires lots but not hard to get data, require medium model performance	4	Desired by people who want to easily track nutrition intake or for health purposes	13
12	Image Classification	Shopping	E-commerce Platforms	Find products in online shopping through uploading photo	4	Large user base, e-commerce platforms will likely pay a lot	5	Doesn't require high model performance, lots of existing data	4	Desired by shoppers who know what they want and it helps them find items faster	13
13	Image Classification	Photo Management	Gen Z	Tag and organize photos based on emotional states so users can easily look back to certain emotions	2	Might not be much demand for this	2	Data is harder to label and might be complex as emotions can be subtle	2	Might have high privacy concerns	6
14	Object Detection	Inventory Management	Retail Stores	Track whether items need restocking	5	Many companies need this for auto mgmt, will likely pay a lot	4	Easy to implement but require high performance	4	Will save companies lots of time and money	13
15	Object Detection	Traffic Planning	Transportation Departments	Monitor volume of vehicles at intersections to optimize traffic flow	5	Government will pay a lot to automate this	4	Require high performance but lots of data, similar tech already exists	5	Better traffic flow will save a lot of time and frustrations	14

	IMAGE SENSORS (Ashley)	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
16	Object Tracking	Sports	Players and Coaches	Track movement of players in sports for performance analysis	3	Professional players might be willing to pay a lot	3	Require high performance, might be complex	3	Real people analysis might still be more effective than machine	9
17	Semantic Segmentation	Accessibility	Visually Impaired Individuals	Help visually impaired individuals identify objects in their surroundings	4	Small market size and expensive, but user willing to pay a lot	2	Will require lots of training data, model requires high performance	2	Might not be highly desirable as individuals likely know daily surroundings well already	8
18	Pose Estimation	Physical Therapy	PT Patients	Guide patients in physical therapy exercises	4	Decent market size and patients probably willing to pay a lot	2	Requires high performance, errors can have serious consequences such as further injuries	2	Patients might still prefer and trust real, human care	8
19	Pose Estimation	Communicatio n	Hearing-impaire d Individuals	Translate sign language	4	Market size is not huge but likely inexpensive to develop, ppl will pay	5	Easy access to required data, similar tech likely already exist	4	Highly desirable for ppl to communicate with hearing-impaired w/o knowing sign language	13
20	Motion Estimation	Art	Artists	Track human motions to interact with art exhibits	2	Medium market size, might not pay a lot	4	Data easily labeled for specific gestures	5	No personal info tied to this	11

	RADAR- Sophie	Domain/Activity	Customer	Application	Financial Viability		Technical Feasibility		Desire/Acceptance		
21	Obstacle detection	Safety	Cities	Helping people navigate curbs	5	Will likely be expensive since you need to map out the entire city	5	Likely pretty hard and if people are relying completely on this for their safety then it will need to perform very well	2	This would likely only be desired by people with issues navigating city sidewalks	12
22	Obstacle detection	Child Development	Doctors	Help children learn to walk	2	Will likely be relatively cheap because the space to map will be small	2	Likely not challenging and it does not need to work perfectly because this would be used in conjunction with parental suppervision	2	Would likely see desire from new parents who are excited to help their child get ahead. There could be privacy concerns because it involces children	6
23	Object recognition	Recreation	Guides	Help hunters track animals	3	Likely not expensive and guides are willing to pay a lot of money	3	Likely feasible and it would not need to work perfectly as it will just be used for recreation	3	Would likely be desired by hunters across the world	9
24	Object recognition	Recreation	Nurseries	Help homeowners detect what is growing in their yard	2	Likely not expensie to produce but homeowners will likely not want to spend much money on this	2	Likely very simple and will not need to perform perfectly since this is for people recreationally gardening	2	This might not be something that is exciting or highly desired since most people just have grass or rocks in their yard	6
25	Object recognition	Natural Resources	Government	Predict the fish population	3	Might be expensive if it covers large areas	3	Likely not too difficult or risky but there will be a lot of data	4	This will be highly desired by conservationists as well as fishermen	10

	RADAR- Sophie	Domain/Activity	Customer	Application	Financial Viability		Technical Feasibility		Desire/Acceptance		
26	Activity recogntion	Safety	Car companies	Help stop distracted drivers	5	Likely more expensive to produce but there is a lot of money in the auto industry	5	This would likely be more difficult but also it would not need to perform perfectly considering there is currently nothing to stop distracted drivers	4	This would likely be highly desired by public safety advocates and the police	14
27	Activity recogntion	Behavior	Dieticians	Suggest food when people appear irritated	3	Likely not expensive but may be more for research and people may not want to actually pay for this	4	This would likely be more difficult and require a lot of data but it would not need to perform perfectly and the worst thing that would happen if it predicted incorrectly would be that it might be annoying	2	This could be used in research or as a novelty product but it might not bring much actual value to the user.	9
28	Motion detection	Health	Trainers	Help customize exercises	3	Likely not expensive and people pay a lot for workout classes so they may be willing to pay a lot for this as well	3	Likely on the more difficult side and if it got it wrong it could potentially cause injury	4	This could be highly desired by people who train others for a living and want to offer this technology as a unique service	10
29	Motion detection	Health	Hospitals	Help create a physical therapy plan	3	Likely not too expensive and the medical cimmunity will likely have money to spend on this	3	Likely on the more difficult side and if it got it wrong it could potentially cause injury	4	This might be desired by hospitals who want to use cutting-edge technology to treat their patients	10
30	Motion detection	Recreation	Cities	Help control amount of dogs in dog park	3	Likely not expensive but the government may not have too much money to spend on this since it is not critical	2	Likely not challenging and very low stakes	2	This would likely be desired by the city or dog-lovers who want to enjoy a more calm environment with their dogs	7
31	Motion detection	Recreation	National Parks	Help track what part of trails are most used	3	This would likely not be expensive and the park service could use this to bring in revenue as a result of attracting more users because of better trails	3	Likely would require a lot of data but also very low stakes and would not harm anyone if incorrect	4	This would be highly desired by people who enjoy being outdoors as well as people who work to maintain the outdoors	10

	INERTIAL - Melody	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
32	Activity Detection	Safety	People with risky conditions or often in risky situations	Safety detection: detects if a person stops moving for too long (lost consciousness/dead), sends alert to family/friends or authorities	3	Not sure if people would pay for this idea	5	Easy to detect lack of motion for x amount of time, can use AI to track normal amount of movement and what looks "abnormal"	4	Could be helpful for those in trouble or the loved ones of those who may be in risky situations, personal safety is a pretty big market	12
33	Acceleration, orientation	Navigation, Accessibility	Visually impaired	Navigation for visually impaired: can tell them where to go, if they are facing the right direction	3	Could be costly because you need to be connected and sync real time data	4	Could be done, but would probably need to be synced to map services (cloud, location), could be costly	4	could be very useful to those with visual impairments, as they need to get around too. location could be a privacy concern	11
34	Activity Detection	Health	People who want to stay active or have health conditions where they need to be more active	Prompts you if you are sedentary for too long (sitting, laying, standing vs walking, running, exercising), shows your activity stats for the day (how long you were active for)	4	Would probably be financially feasible, but market/competitors already exist	5	Could easily be done w existing technology	5	A lot of people care about their health, not too invasive	14
35	Acceleration, rotation, orientation	Safety	Uber/Lyft, or for new drivers, or for people who just want to know how good they are at driving	Driving Performance Rating: rates how good of a driver you are based on how much you speed, sharpness of turns, smooth acceleration/braking, how often you go the wrong way	5	I think services would pay for this add-on, and it would be helpful for customers and for drivers to stand out, and increase safety	5	All data is given by sensor, AI is capable of making those predictions	5	It would be useful to the driver, passenger, and to the reliability of the company	15

	INERTIAL - Melody	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
36	Acceleration, rotation, orientation	AR/VR (Gaming/Tech)	Gamers/At home use	Inertial sensors used to change view on the screen as you move around, control the game	4	would need to cost a lot of money to account for the accuracy of the technology	4	data must be very synchronized with little delay or it will be very easy to disorient/frustrate the user (requires a lot of precision)	4	gaming is a very large industry and these types of things already exist	12
37	Activity Detection	Security	Home/Building owners	sensors could be placed on doors, windows, etc, and track if there is unusual activity based on normal behaviors and send an alert to your phone	3	a lot of competition in the market	3	Big risk if failure, there are probably better systems to detect intruders than opening/closing of windows/doors	4	Security for homeowners is very important, so I think that there is a big market, but I think there are better ways to do it	10
38	Activity Detection	Animal Health	People who own animals (pets, farms)	Detect activity of animal, if they are active enough, if they are laying down or not moving as much as normal, could be an indication of heatlh issue, especially if you are unable to monitor the animal for part of the day or an extended period of time	4	People pay a lot of money to take care of their pets and animals, especially if they are farm animals, where the animal's wellbeing is a major factor in profit	5	Technology exists and is capable of this type of tracking	4	Not sure if this is a big market, but it could be very useful	13
39	Activity Detection	Productivity	People who have trouble being prompt or are very busy	Keeps you on schedule (e.g. detects if you haven't woken up in time for work, when you're getting ready, if you haven't left yet, etc)	4	Wouldn't require too much server data, seems like a cheap implementation	2	I think it would do its purpose, but it may not be sensitive enough to change in daily activity (people don't always stick to the same routine, false positives could be annoying	3	Again, if fail, could be annoying, and could be a privacy concern for this in-depth of tracking	9

	INERTIAL - Melody	Domain/ Activity	Customer	Application		Financial Viability		Technical Feasibility		Desire / Acceptance	
40	Activity Detection	Shipping	People sending fragile or sensitive things	tracks packages that may be sensitive or fragile, detects if it has been moved too much or oriented in the wrong way that might damage it	4	Again, would need to sync with servers often, but does not require much data	4	Easy to detect motion of package, but would need to sync with servers often	4	If someone does need to ship something fragile, it could be useful, but I'm not sure how large of a market it is	12
41	Activity Detection	Dance/Entertainment	people who want to learn to dance	Dance trainer (kind of like Just Dance): tracks motion of arms and legs and sees if youre doing the right moves at the right time	4	People would just pay for the product: doesn't necessarily require live feedback, but it might, needs a lot of data about several positions of parts of the body which may take computing power	4	Depends on how good the trainer is: definitely could be done, but if it wants to be a very in-depth coach, you would need a lot of sensors all over the body, which may not be very comfortable	4	To a certain extent, it could be a fun way to learn dance (like Just Dance), but otherwise I don't think it would be a better way to monitor yourself while dancing than just looking in a mirror	12

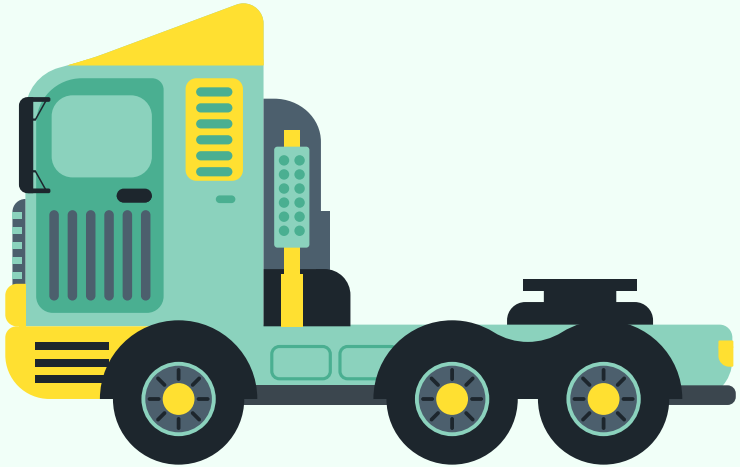
Computer vision & depth sensing-Charu	Specific Capability	Domain and/or Activity	Customer	Application	Financial viability – Financial viability has three aspects. How many users/customers need a specific capability-application pair? How much		Technical feasibility- How hard is the AI challenge? How easy is it to get the required data? How well does the		Desirel/Acceptance-Why would users/customers accept or purchase this innovation? What barriers exist to		Rank
42	3D Reconstruction	Construction	Builders and Architects	Real-time 3D modeling of construction sites to monitor progress, identify issues, and improve project management.	4	High demand among builders and architects. Potential for substantial revenue. Development costs could be moderate.	4	Feasible with available technology and data sources. Requires high accuracy for value.	4	Desirable for real-time project monitoring and efficiency. Some privacy concerns.	12
43	Object Detection and Tracking	Retail	Retailers and Shoppers	Smart shelves in retail stores that detect when products are removed or placed, track inventory, and provide real-time stock updates.	4	Attractive to retailers for inventory management. Revenue potential from shelf rental or product tracking services. Moderate development costs.	4	Feasible with existing computer vision tech. High accuracy required for stock tracking.	4	Desirable for reducing stockouts and enhancing shopping experience. Privacy concerns about in-store tracking.	12
44	SLAM (Simultaneous Localization and Mapping)	Autonomous Vehicles	Transportation Companies	Autonomous vehicles using SLAM for mapping and navigating urban environments safely and efficiently.	4	High demand for autonomous vehicles. Revenue potential from vehicle sales and services. Moderate to high development costs.	3	AI challenge is moderate but requires precise mapping. High-quality LiDAR and camera data needed.	4	Desirable for safer and more efficient transportation. Privacy concerns in autonomous vehicles.	11
45	3D Reconstruction	Healthcare	Hospitals and Clinicians	Custom orthopedic brace creation by scanning and reconstructing a patient's limb in 3D, improving comfort and fit.	3	Demand from patients and clinicians. Revenue from custom brace sales. Moderate development costs.	4	AI challenge is moderate, and data acquisition is feasible. High accuracy required for custom braces.	4	Desirable for better-fitting orthopedic braces. Minimal privacy concerns.	11

46	Object Detection and Tracking	Agricultu re	Farmers and Agribusi ness	Autonomous crop monitoring drones that identify pests, diseases, and irrigation needs for precision farming.	4	High demand in agriculture. Revenue from drone sales and data analytics services. Moderate to high development costs.	4	AI challenge is moderate, and data is available. High accuracy needed for precision farming.	4	Desirable for improving crop yields and sustainability. Privacy concerns in data handling.	12
47	Object Detection and Tracking	Sports	Coaches and Athletes	Sports analytics system that tracks player movements during games, providing insights for performance improvement.	3	Demand from coaches and teams. Revenue from sports analytics services. Moderate development costs.	4	AI challenge is moderate, and data is accessible. High accuracy needed for valuable insights.	3	Desirable for improving team performance. Privacy concerns in player tracking.	10
48	SLAM (Simultan eous Localizati on and Mapping)	Warehou sing	E-commerc e Compani es	Warehouse robots utilizing SLAM for real-time navigation and optimization of order fulfillment processes.	4	High demand among e-commerce companies. Revenue from AGV sales and warehousing services. Moderate to high development costs.	4	AI challenge is moderate, and data is available. High accuracy needed for warehouse navigation.	4	Desirable for efficient order fulfillment. Privacy concerns in warehouse tracking.	12
49	3D Reconstr uction	Archaeol ogy	Archaeol ogists and Historian s	3D scanning and reconstruction of historical sites and artifacts to preserve and study cultural heritage.	2	Limited demand from archaeologists. Revenue potential from heritage preservation and research. Moderate to high development costs.	3	AI challenge is moderate, but data acquisition may be difficult. High accuracy needed for historical accuracy.	3	Desirable for preserving cultural heritage. Privacy concerns in historical site scanning.	8
50	Object Detection and Tracking	Smart Cities	Municipa lities and Citizens	Smart traffic cameras using object tracking to optimize traffic flow and improve road safety.	4	High demand among municipalities. Revenue from traffic management services. Moderate development costs.	4	AI challenge is moderate, and traffic data is available. High accuracy needed for traffic optimization.	4	Desirable for reducing congestion and improving road safety. Some privacy concerns.	12
51	SLAM (Simultan eous Localizati on and Mapping)	Manufac turing	Manufac turers	Autonomous guided vehicles (AGVs) for material handling in manufacturing facilities, using SLAM for navigation.	4	Demand from manufacturers. Revenue from AGV sales and manufacturing services. Moderate to high development costs.	4	AI challenge is moderate, and data is accessible. High accuracy required for efficient AGV navigation.	4	Desirable for automating material handling. Privacy concerns in industrial settings.	12

02

Concept Selection

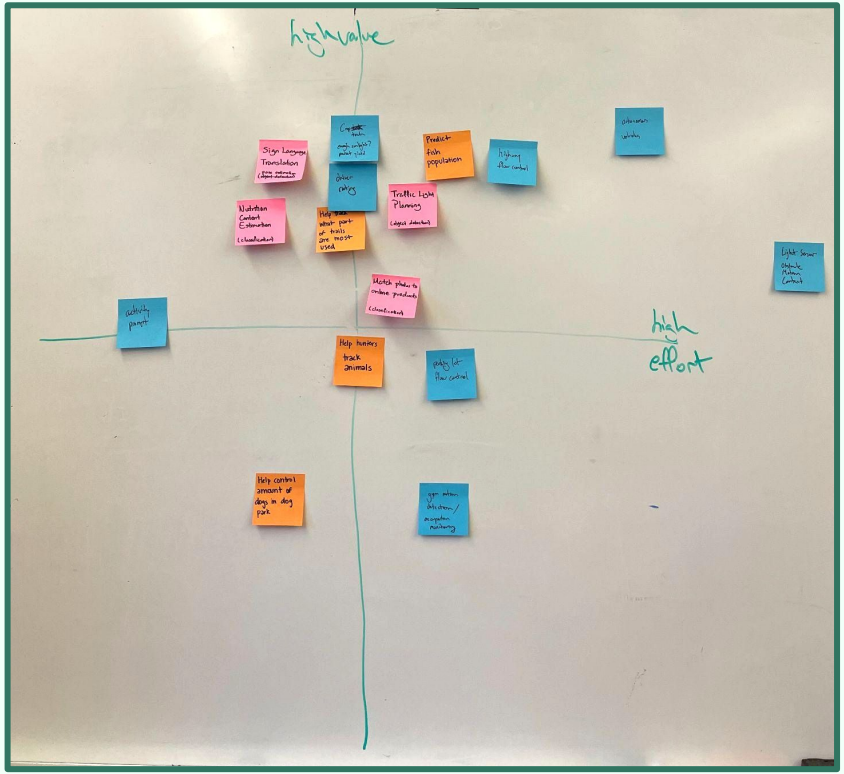
Rapid Assessment and Notes from Critique

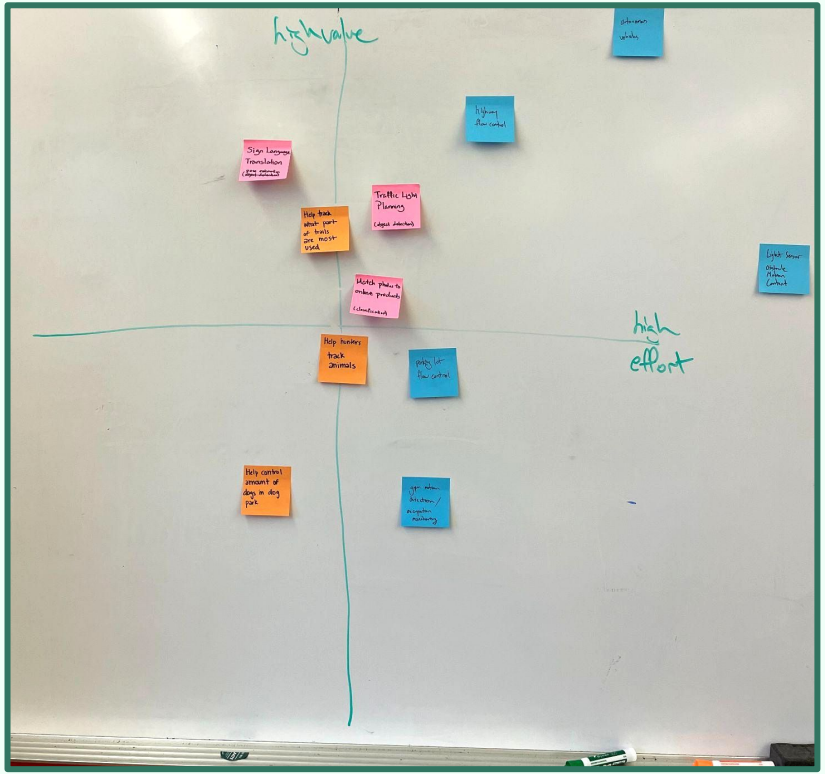


Rapid Assessment

After we had all of our ideas, we used various rapid assessment techniques to assess each one and narrow them down. This helped us ensure we were thinking critically about our ideas weighed against different factors, and helped us rank them against each other in a way we could agree on together.

Impact Effort Matrix





Impact Effort Matrix

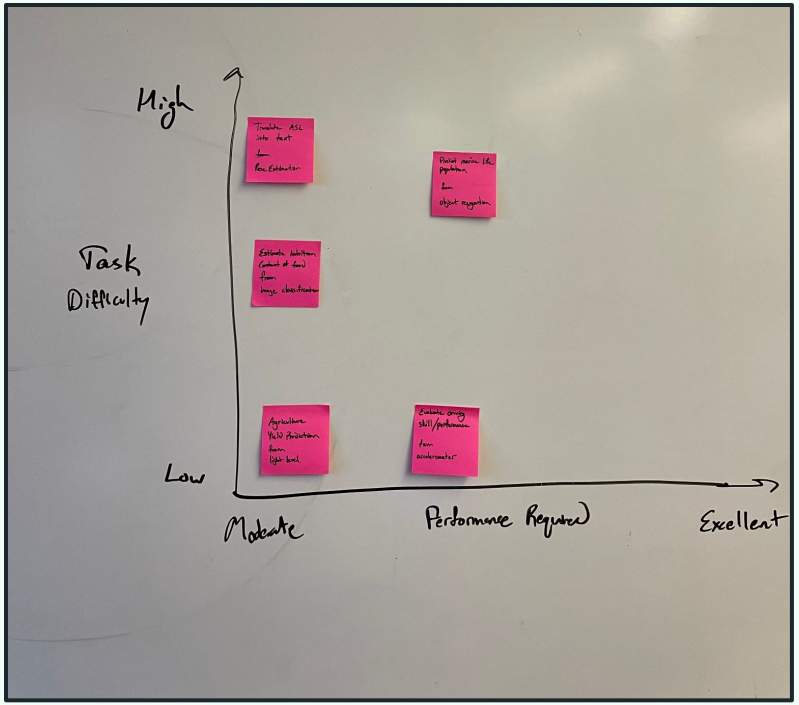
From this exercise, we narrowed down our selection to five ideas which we found to be a good combination of effort and impact:

Capability	Domain/Activity	Customer	Application
Light level detection	Agriculture	Farmers	Detect level of light plants receive, estimate yield
Image Classification	Health	Health-conscious individuals	Estimate nutrition content through recognizing food ingredients prior to cooking
Pose Estimation	Communication	Hearing-impaired Individuals	Translate sign language
Object recognition	Natural Resources	Government	Predict the fish population
Acceleration, rotation, orientation	Safety	Uber/Lyft, or for new drivers, or for people who just want to know how good they are at driving	Driving Performance Rating: rates how good of a driver you are based on how much you speed, sharpness of turns, smooth acceleration/braking, how often you go the wrong way

Rapid Assessment & Concept Selection

In this exercise, we wanted to pick the best idea of the top five from the previous activity. To help us, we plotted the concepts on a graph of task difficulty versus performance required. We found that the agricultural yield prediction and the estimation of driving skill to be the best combination of our two criteria.

Neither of these options require high performance and we evaluated them as not being too difficult. Ultimately, we chose to go forward with the driving skill because the agricultural concept has been developed and didn't seem to offer many avenues for improvement.



Rapid Assessment & Concept Selection Details

Concept	Critique
Translate sign language	• Very technically challenging • Processing lag will inhibit real-time use
Estimate nutrition content	• Would require many types of sensors • Expensive solution
Detect light levels in plants	• Technically feasible • Already exists • Limited ways to reframe
Predict fish population	• Very large scale • Many sensors required • Expensive
Driving performance	• Technically feasible • Need to find a way to reframe

03

Parallel Refinement

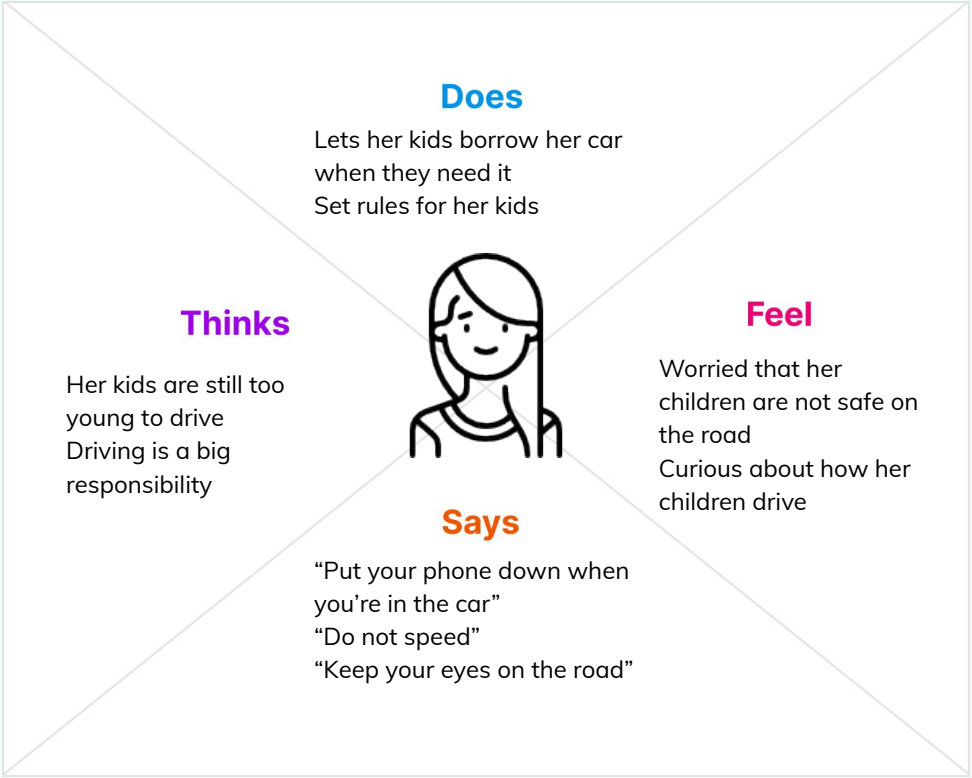
Customer: Parents

- Motor vehicle crashes are the leading cause of death among teens
- 2,116 drivers aged 15 to 20 died in traffic crashes in 2021
  - An increase of 11 percent from 1,899 in 2020
- Fatal crashes for teenage drivers were reduced when they had strong restrictions on:
  - Nighttime driving
  - Teenage passengers
  - Delaying licensing age
- Delaying permit age reduces fatal crashes
- Increasing practice hours reduces insurance losses
- Dialing a phone number while driving increases teen's risk of crashing by six times,
- Texting while driving increases the risk of crashing by 23 times
- Talking or texting on the phone takes teen's focus off the task of driving
  - Significantly reduces their ability to react to a roadway hazard, incident, or inclement weather

User Empathy Map: Parent

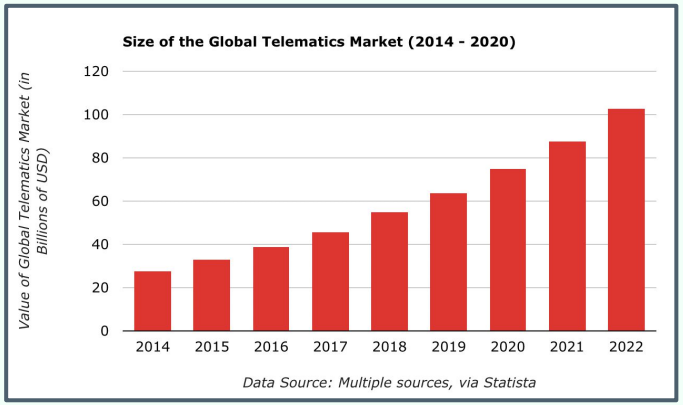
User
Mother

Goal
Keep children safe as they begin to drive



Customer: Insurance

- In 2010 Allstate formed Arity
  - Arity is a company that collects and synthesizes driving data
  - Has access to Allstate's claims data and user data
- Allstate uses data from Arity to calculate insurance premiums
  - Also sells this data to other insurance providers and also uses the data for marketing purposes
  - Risk scoring operation
- Telematics market has surged
  - 2014: worth $28 billion
  - 2022: worth $103 billion
- Telematics data can also be used as an analytical tool for accident reconstruction
  - Help to understand why and how accidents happen
  - Help to understand who is at fault



User Empathy Map: Insurance

User
Insurance company

Goal
Make money

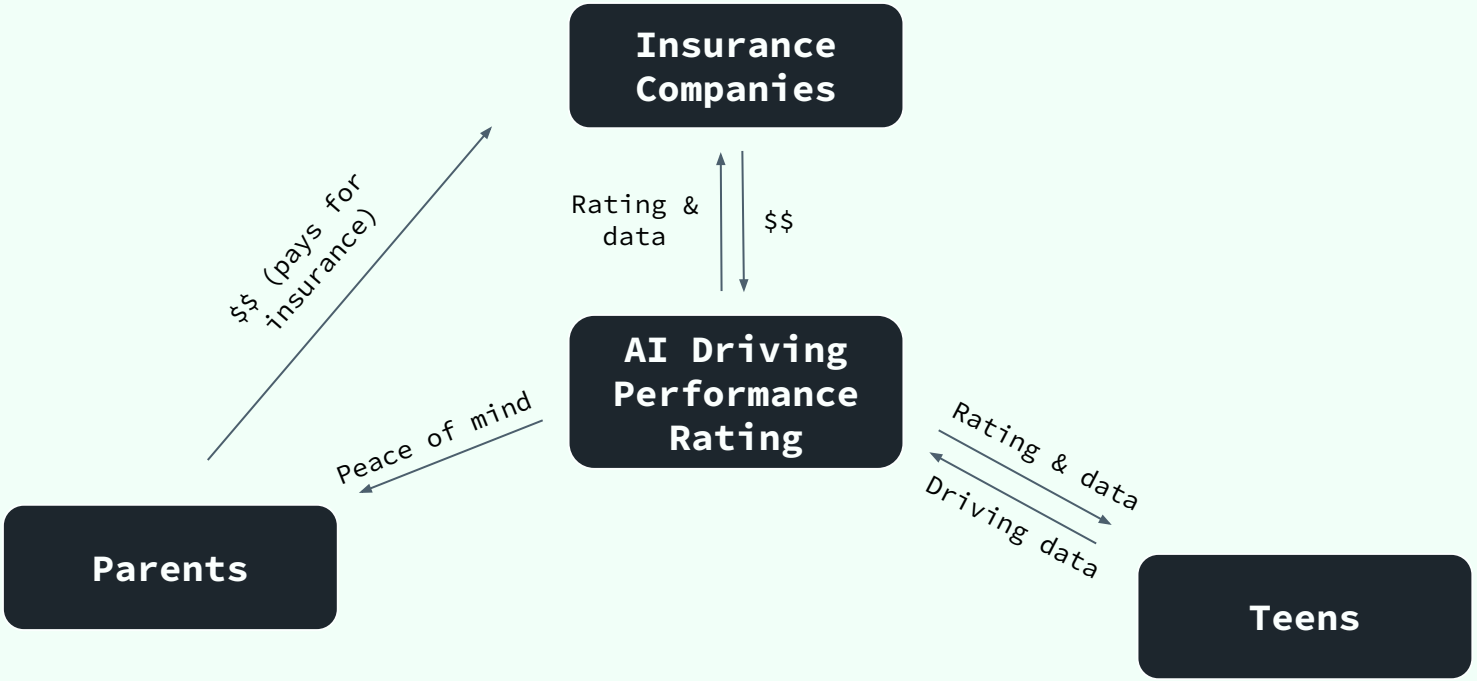
Does
Collect and synthesize driver data
Calculate insurance premiums
Sells data to marketing companies

Thinks
Telematics market is on the rise
All collected data is good data

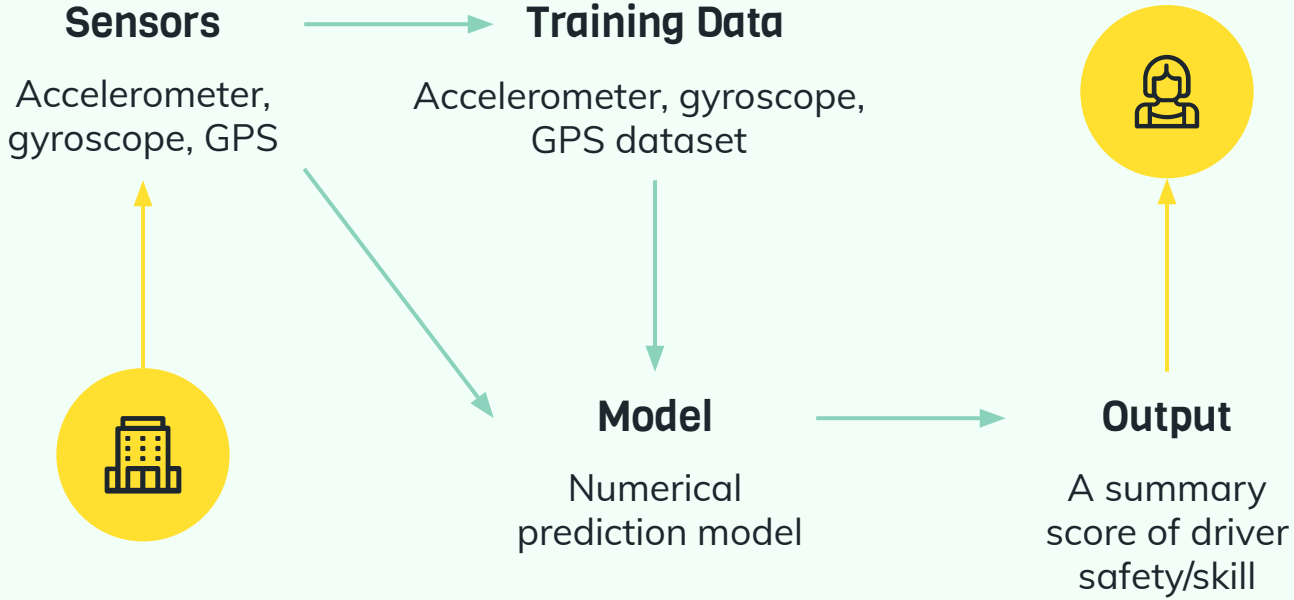
Feel
Good data can be collected from drivers
A lot of people want driver data

Says
“We can help you lower your insurance premiums”
“If you’re a good driver we can save you money”

Value Flow


Insurance Companies
Rating & data
$$
$$ (pays for insurance)
AI Driving Performance Rating
Peace of mind
Rating & data
Driving data
Parents
Teens

Technical


Sensors
Accelerometer, gyroscope, GPS
Training Data
Accelerometer, gyroscope, GPS dataset
Model
Numerical prediction model
Output
A summary score of driver safety/skill

Technical Details

Hardware: There are 2 potential approaches. The first being, we could design a proprietary device with accelerometer, gyroscope, and GPS sensors. The other option is to create an app that collects this data from a smartphone. We believe the second approach would be more economical because it is much cheaper to scale and distribute software. Furthermore the U.S. has good smartphone penetration at 85%.

Dataset: We found there to be many existing datasets with labels for driver rating. Inputs varied from dataset to dataset, but most used accelerometer and gyroscope data. This allowed us to conclude that it would be feasible to collect and build this dataset ourselves.

Model: Since all of the datasets we found were labeled, and given the nature of our service, we decided to use a supervised learning model. We considered both a classifier and a numerical prediction model. Ultimately we decided that the numerical prediction model would provide the best feedback for both the driver and the school. Both parties might want to know granularity in score and when improvement is happening, rather than just a binary “good/bad.”

Other: Latency and scalability are not much of an issue as we only need to provide a summary score in long intervals (end of drive, weekly, monthly, etc.). Scores of all drivers in a fleet could be viewed on a dashboard, which would be relatively easy to implement.

04

Initial Pitch

The Problem

- School bus-related crashes killed 108 people nationwide in 2021
- About 17,000 children visit emergency rooms annually due to school bus-related accidents.
- Of the people injured in school bus-related crashes from 2012 to 2021:
  - 30% were school bus passengers
  - 53% were occupants of other vehicles
  - 9% were school bus drivers

Our Solution

A driving performance rating for school bus drivers

Rating will be based on:

- Speed
- Sharpness of turns
- Smoothness of acceleration and braking
- Instances of going the wrong way

PIVOT

Reframing our concept

Why we pivoted...

In the Zoom class session where we pitched our initial ideas we found there was one fatal flaw with focusing on school districts and school bus drivers as our target audience: the demand for school bus drivers far outweighs the supply. Schools don't have the luxury of picking between *good* and *bad* bus drivers.

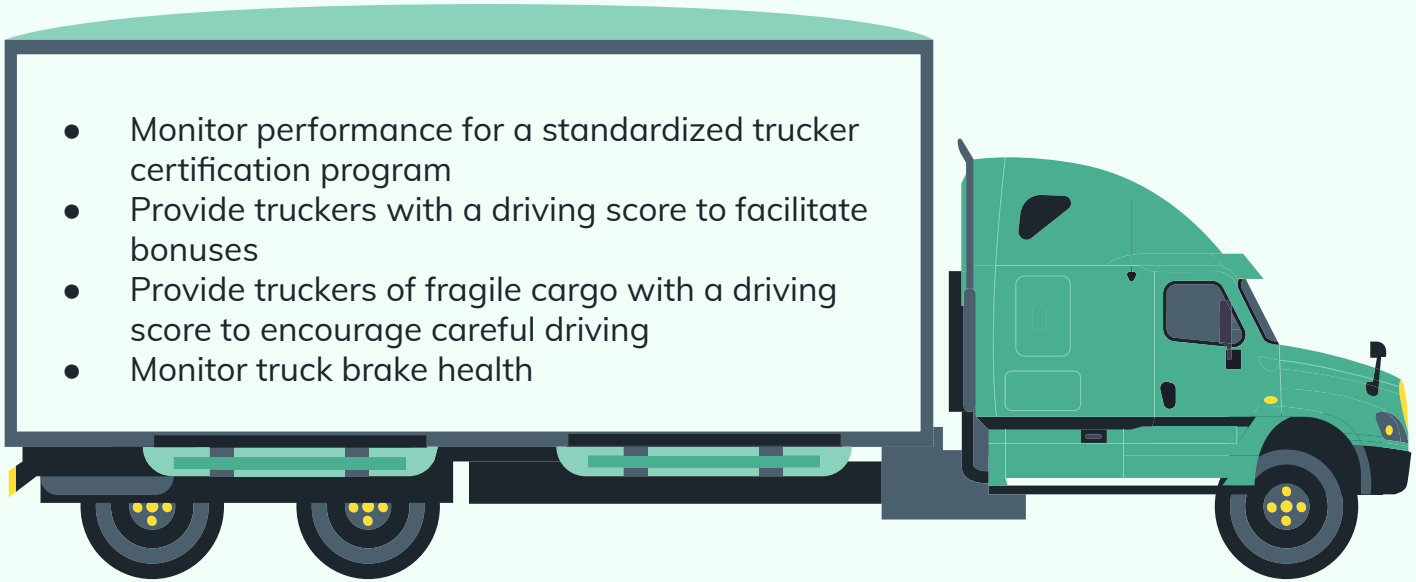
The financial justification for this target audience is weak because even if schools have the money to pay for this monitoring service, bus drivers hold the *power* in this situations and could refuse to be monitored.

Making the Pivot

Doubtful that school districts will be willing to risk losing the already small number of bus drivers they have we went back to the drawing board. Perhaps there was a different audience we could target using the same technology, but with more financial promise.

We considered a variety of customers including warehouse workers, and last-mile package shipping companies. However, we ultimately focused on semi-truck drivers. Semi-truck drivers are used to being heavily surveilled, so the additional sensors shouldn't concern them too much. Furthermore, the trucking industry generates nearly a trillion dollars annually so there is no shortage of money.

Use Cases



- Monitor performance for a standardized trucker certification program
- Provide truckers with a driving score to facilitate bonuses
- Provide truckers of fragile cargo with a driving score to encourage careful driving
- Monitor truck brake health

Reframing With Our Customer

With our focus now set on semi-truck drivers, we needed to find a way to deliver value to them, or adjacent players in the space.

At first we considered trying to score the drivers on their performance (similar to the school bus concept). However, we realized that there wasn't a clear use for this score besides in situations where we could provide additional or faster certification. This would require navigating the policies of the Department of Motor Vehicles. We continued ideating until we came up with our perfect concept.

05

Post-Pivot Concept

New Concept:

Monitor Health of Truck Brakes

We decided we needed to broaden the scope of technology we were considering. Recalling one of the class readings, we focused on applying the methodology of predictive maintenance. Through research we found that trucks frequently break down and one of the most dangerous mechanical failures a truck could suffer is failed brakes. Diving deep into brakes uncovered some interesting facts.

We also realized that as brakes wear, they release brake dust into the air. We could measure that brake dust using affordable air quality sensors. Thus, we could provide insight on the health of brakes for the semi-truck drivers to prevent failures, as well as selling brake wear data to existing route-planning companies. Those companies could use that data to generate more optimal routes that do not wear brakes as heavily, saving some maintenance costs for trucking fleets.

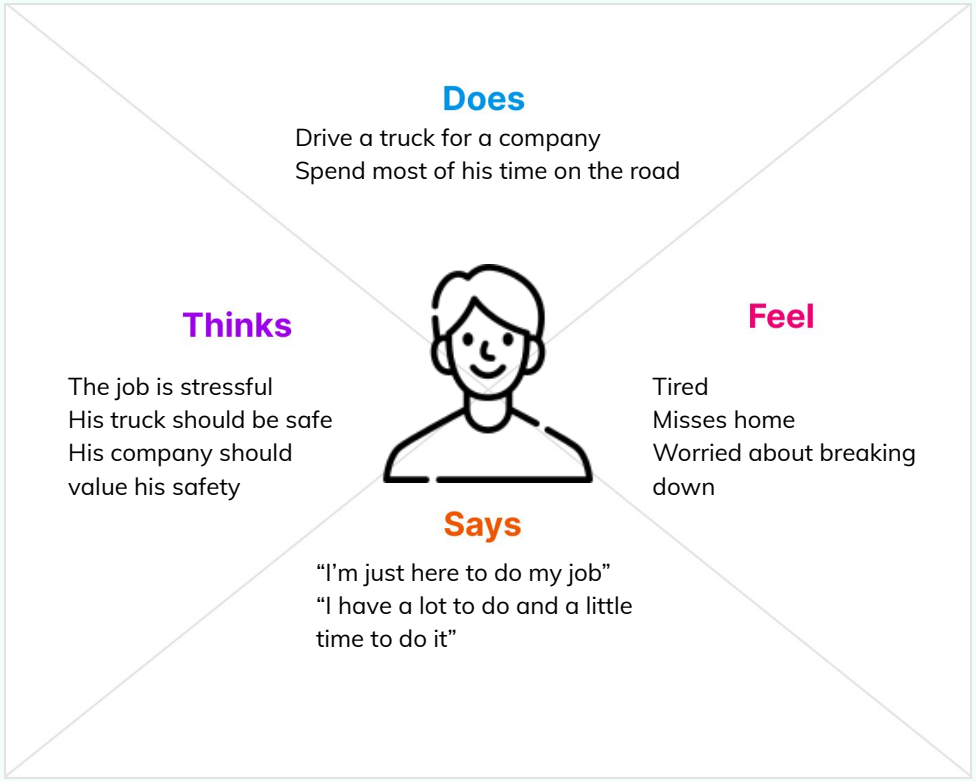
Truck Health Statistics

- On average, semi trucks break down every 10,000 miles
  - Brake problems are the cause behind 29% of semi truck accidents
  - A semi truck's drum and disc brakes can wear down over time if they are not maintained
    - As a result of the heat, pressure and friction they are continually exposed to
- Average truck accident with just one injury costs $150k: source
  - Hidden costs and loss in revenue average $1M+
- Optimistically brake pads last 45k miles
- A truck covers an average of 125k miles per year
- Inspections are required only once a year
- Every day a truck is out of service is ~$2k lost (not counting part and labor repair costs)

Empathy Map

User
Truck Driver

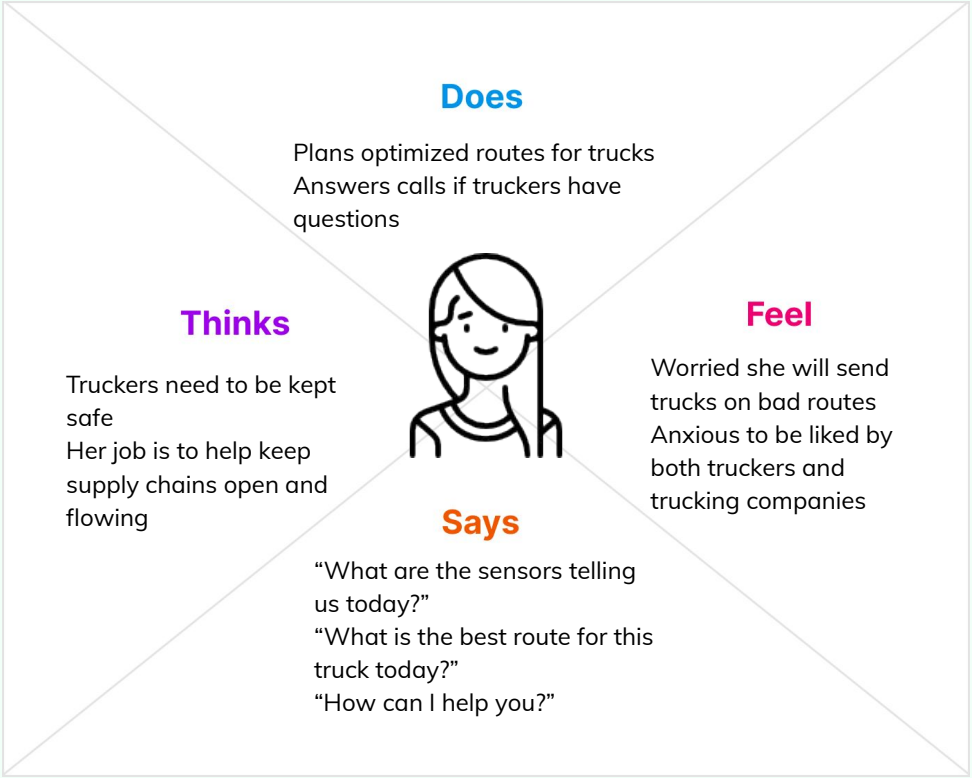
Goal
Safely move goods from point A to point B as quickly as possible



Empathy Map

User
Route Planning Company

Goal
Help trucks get from point A to point B as quickly and safely as possible



Customer Journey Map

SCENARIO & EXPECTATIONS

SCENARIO
Sam just picked up cargo at the Port of Seattle and is on his way to the Sears warehouse to drop it off.

EXPECTATIONS:
- Quickly deliver cargo to warehouse
- Drive safely without any accidents

PHASE OF JOURNEY	LEAVES THE PORT WITH HIS TRUCK AND CARGO	FOLLOWS ROUTE CHOSEN BY ROUTE PLANNING COMPANY	GETS ON HIGHWAY	SENSOR GOES OFF ON HIS DASHBOARD	DELIVERS HIS CARGO TO THE WAREHOUSE	TAKES HIS TRUCK TO THE SHOP
ACTIONS WHAT DOES THE CUSTOMER DO?	1. Watches road ahead 2. Communicates with his boss 3. Communicates with other truck drivers	1. Glances at display to see which road to take	1. Merges with traffic 2. Gets up to speed	1. Recognizes the light that is telling him to get his brakes maintained as soon as he can 2. Radios in to his supervisor to let him know that he's going to deliver his cargo and then go to the shop to get his brakes checked	1. Watches as the warehouse workers unload his truck 2. Looks up where the nearest maintenance shop is	1. Tells the maintainers that the light came on 2. Maintainers check the brakes 3. Maintainers fix the brakes
CUSTOMER THOUGHT WHAT IS THE CUSTOMER THINKING?	I hope this drive goes smoothly When was the last time this truck was in maintenance? Does the warehouse know I'll be there soon?	I wonder why they chose this route for me? Is this the fastest route or is it the safest route?	I'm excited to be on the road finally I hope this doesn't damage my truck	Wow, I am glad that my truck gave me a warning Thankfully I won't need to stand on the side of the road like if my truck unexpectedly broke down	I'm glad I get to take a little break! Where is the nearest maintenance shop?	I wonder how long this will take? I can't wait to actually be home for dinner tonight!
CUSTOMER FEELING WHAT IS THE CUSTOMER FEELING?	WONDERING	WONDERING	HAPPY	THANKFUL	WONDERING	HAPPY

Market Size

2M

TAM

All Operational Semi-trucks in USA

600K

SAM

Operational Semi-trucks in CA & TX

*states with most licensed semi-trucks

30K

SOM

5% Estimated Adoption Rate

Industry Loss Estimation

1. **Brake-Related Accidents:**
   - 29% of semi-truck accidents are attributed to brake failures:
     - ~ 44,000 accidents in 2015 due to parts failures, and 22% or 10,000 attributed to brake problems
   - Cost of accidents:
     - Average cost of $150,000 per truck accident involving just one injury, the total costs associated with brake-related accidents could be:
     - 10,000 * $150,000 = $1.5 billion
     - $1.5 billion * 30% (CA & TX) = **$450,000,000 per year on brake-related accidents**
2. **Break Downs**
   - Semi-trucks break down every 10,000 miles on average and cover ~ 125,000 miles per year
   - ~ 12.5 breakdowns per year (125,000 miles / 10,000 miles per breakdown)
   - Every day a truck is out of service is an estimated $2,000 loss
   - Total loss due to breakdowns: 12.5 breakdowns * 1 day * $2,000 = $25,000 per year per truck.
   - 25,000 * 30,000 trucks = **$750,000,000 per year on break downs**
3. **Annual Inspections**
   - Daily inspections and brake services is ~ $10,000 per year, assuming services and inspections are spread out over the miles
   - 10,000 * 30,000 trucks = **$300,000,000 per year on annual inspections**

$1.5 Billion Total Loss Annually

**estimate based on 30k trucks*

Revenue & Cost

Year 1 Cost = $4.6 Million

Air Quality Monitor Cost			
Component	**Units**	**Units Made**	**Cost**
Particle Sensor	2	60,000	$5.00
Transmitter	2	60,000	$4.00
Mounting	2	60,000	$0.50
Power Supply	2	60,000	$1.00
GPS	1	30,000	$4.00
TOTAL (for 30k trucks)			**$750,000**

Category	Type	Cost Type	Cost	For 30k trucks
Installation	Installation	One-Time	$30	$900,000
Operations	Maintenance	Ongoing	$40	$1,200,000
	Calibration	Ongoing	$40	$1,200,000
AI Model	Development	One-Time	$500,000	$500,000
	Data Processing	Ongoing	$50,000	$50,000
	Maintenance	Ongoing	$50,000	$50,000
TOTAL (for 30k trucks)				**$3,900,000**

Year 2 Cost = $4.1 Million

Air Quality Monitor Cost			
Component	**Units**	**Units Made**	**Cost**
Particle Sensor	2	24,000	$5.00
Transmitter	2	24,000	$4.00
Mounting	2	24,000	$0.50
Power Supply	2	24,000	$1.00
GPS	1	12,000	$4.00
TOTAL (for 30k trucks)			**$300,000**

Category	Type	Cost Type	Cost	For 42k trucks
Installation	Installation	One-Time	$30	$360,000
Operations	Maintenance	Ongoing	$40	$1,680,000
	Calibration	Ongoing	$40	$1,680,000
AI Model	Data Processing	Ongoing	$50,000	$50,000
	Maintenance	Ongoing	$50,000	$50,000
TOTAL (for 30k trucks)				**$3,820,000**

Year 3 Cost = $5.9 Million

Air Quality Monitor Cost			
Component	**Units**	**Units Made**	**Cost**
Particle Sensor	2	36,000	$5.00
Transmitter	2	36,000	$4.00
Mounting	2	36,000	$0.50
Power Supply	2	36,000	$1.00
GPS	1	18,000	$4.00
TOTAL (for 30k trucks)			**$450,000**

Category	Type	Cost Type	Cost	For 60k trucks
Installation	Installation	One-Time	$30	$540,000
Operations	Maintenance	Ongoing	$40	$2,400,000
	Calibration	Ongoing	$40	$2,400,000
AI Model	Data Processing	Ongoing	$50,000	$50,000
	Maintenance	Ongoing	$50,000	$50,000
TOTAL (for 30k trucks)				**$5,440,000**

Year 1 Revenue = $4.8 Million

Category	Units Sold	Price
Air Quality Monitor	30,000	$40
Monthly Subscription	30,000	$10
TOTAL		**$4,800,000**

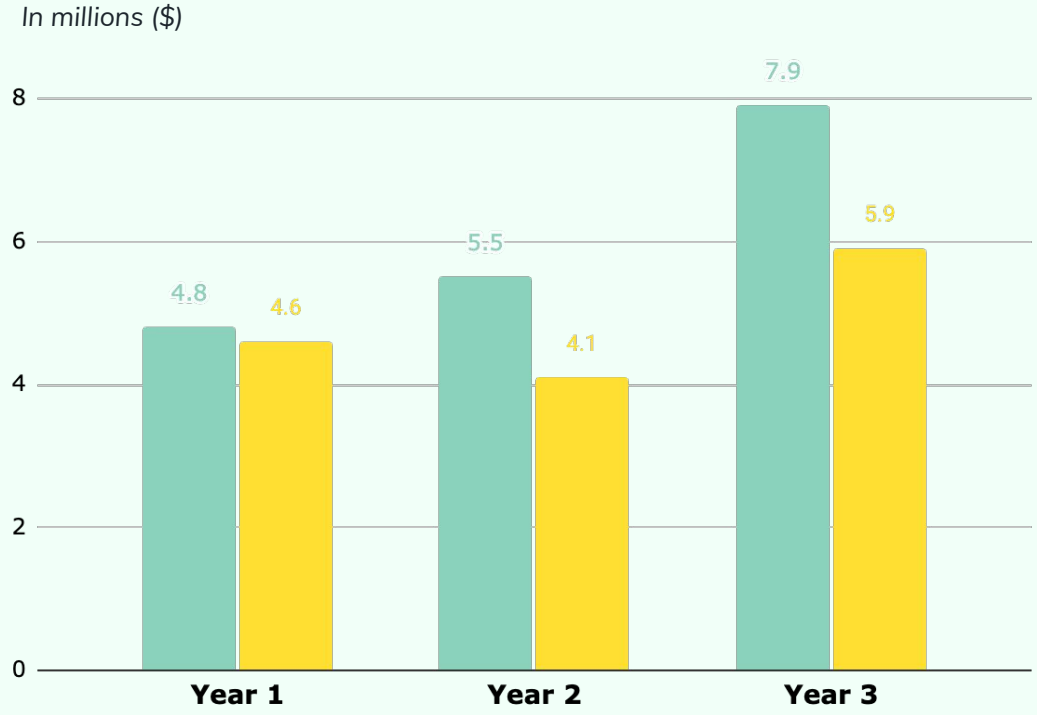
Year 2 Revenue = $5.5 Million

Category	Units Sold	Price
Air Quality Monitor	12,000	$40
Monthly Subscription	42,000	$10
TOTAL		**$5,520,000**

Year 3 Revenue = $7.9 Million

Category	Units Sold	Price
Air Quality Monitor	18,000	$40
Monthly Subscription	60,000	$10
TOTAL		**$7,920,000**

Projected Profit



Revenue

Cost

Year 1 Profit = 0.2M

Year 2 Profit = 1.4M

Year 3 Profit = 2M

Technical

Sensors

Air quality and GPS

Training Data

Air quality, specifically brake dust dataset

Model

Classifier model

Output

A notification to the driver that they should inspect brakes ASAP
+
Data to sell to route-planning companies

Technical Details

Hardware: To measure the brake dust in the air, we can put an air quality sensor local to the wheel area. Brake dust particles are typically 3–4 μm in size, which can be easily measured with affordable (<$5) air quality sensors. We also considered that the ambient air may contain other dust and environmental particles. Thus, we will be deploying a second sensor away from the wheel area to measure the ambient quality. We can combine these 2 readings to get an accurate reading of exactly the brake dust of the truck. Furthermore, since we want to sell data relevant to route-planning companies, we'll also be using a GPS sensor.

Dataset: We found there to be many existing datasets for air quality. Although none are for brake dust specifically, given the relatively large size of the brake dust particle, we believe that this shows we could feasibly create a relevant dataset for this problem. We would want to make sure this dataset is labeled so that we can give good insights to when brake issues are likely to occur.

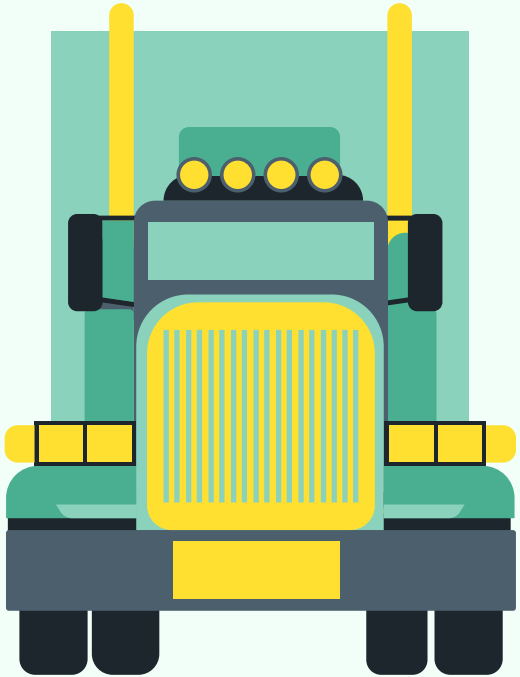
Model: We decided to use a supervised learning model since we are using labeled data. We considered both a classifier and a numerical prediction model. Ultimately we decided that the classifier would be best for a simple alert to the driver that they should service their brakes as soon as possible.

Other: Latency and scalability are not much of an issue because short term insights only need to be provided to the driver. We only need to provide summary and long term data in longer intervals (end of drive, weekly, monthly, etc.) to the route planning companies.

06

Pitch

Creating the Pitch, Final Pitch, Final Concept



Pitch Strategy

Our strategy for the pitch was to start off with our problem, present our solution, and then present the audience with a demonstration of how our product works. Once we felt that the audience was able to visualize our concept, we proved to them that our concept would be highly accepted and desired. Next, we demonstrated the technical feasibility, and the financial viability of our concept. Lastly, we ended our pitch by addressing the risks and reinforcing the high value of our product.

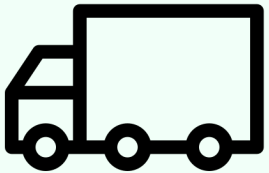
In-Class Pitch Deck:

Preventative Maintenance of Semi-Truck Brakes

Joey Wang, Sophie Davis, Ashley Zhu, Melody Chu, Charu Dixit

Final Pitch Deck

Problem: Semi-Truck Breakdowns



- breakdowns every 10,000 miles

American Trucking Associations

- $3.3B lost to vehicle downtime/yr

FleetNews

- 29% of accidents from brake issues

Federal Motor Carrier Safety Administration (FMCSA)

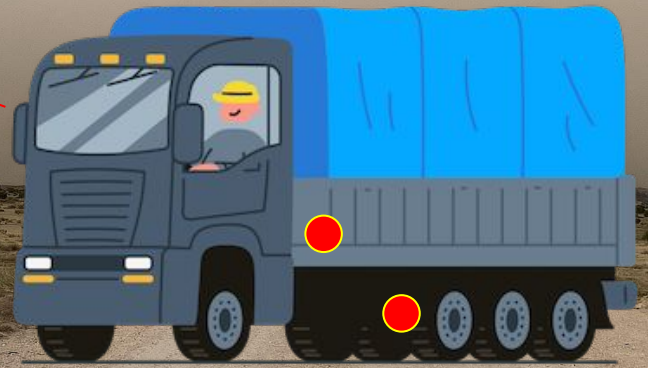
Solution: Preventative Maintenance

Brake issues are often preventable with routine inspection and monitoring

Vehicles with PM have 20% fewer maintenance-related downtime days

Our Product:

- Air Quality Monitor to Track Health of Brakes
  - Brake pads wear out and create brake dust
  - Air quality sensors can detect that dust



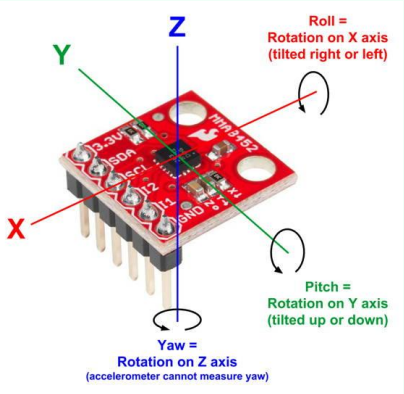
Final Pitch Deck

Acceptance & Desirability

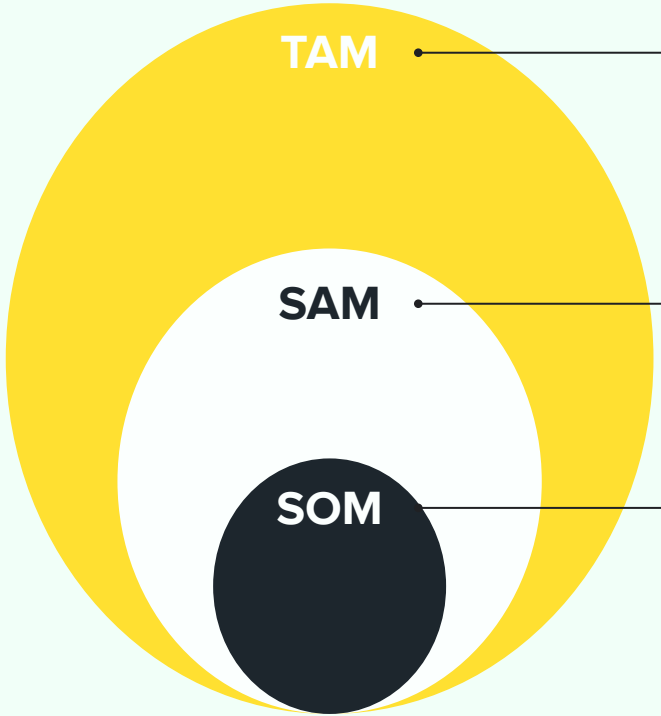
- **3.5 million** truck drivers in the United States
- Trucks move about **73%** of the nation's freight (by weight)
- In 2022 the trucking industry generated **$940.8 billion** in revenue
- **750,000+** active motor carriers in the US
- Towing can cost **$250-500** for the hookup, and **$20-50** per mile after that
- A truck losing its brake effectiveness on the road can lead to:
    - Missed **deadlines**
    - Disrupted **supply chains**
    - **Delays**

Technical Feasibility

- Brake pad wear can be determined from concentration of particles in the air via air quality sensors, which can be found for <$5 each.
- We can compare sensor readings from near the brake pad and compare it to ambient air readings to develop a better picture.
- Classifier model can be feasibly implemented to determine likelihood of needing replacement.
- Latency and scalability is not much of an issue as we can provide notice in long intervals (end of drive, weekly, monthly, etc.)
- There are many existing datasets centered around air quality. Brake pad dust particles are larger than most particles they track, so this is a sign that we can feasibly gather this data, perhaps in a pilot test of a semi truck fleet.



Financial Viability



Operational semi-trucks in USA
2 million

Operational semi-trucks in CA & TX
600,000

5% of trucks in CA & TX
30,000

Financial Viability

$450M loss from brake-related *accidents*

$25,000 per truck on *breakdowns* annually

$10,000 per truck on *inspections* annually

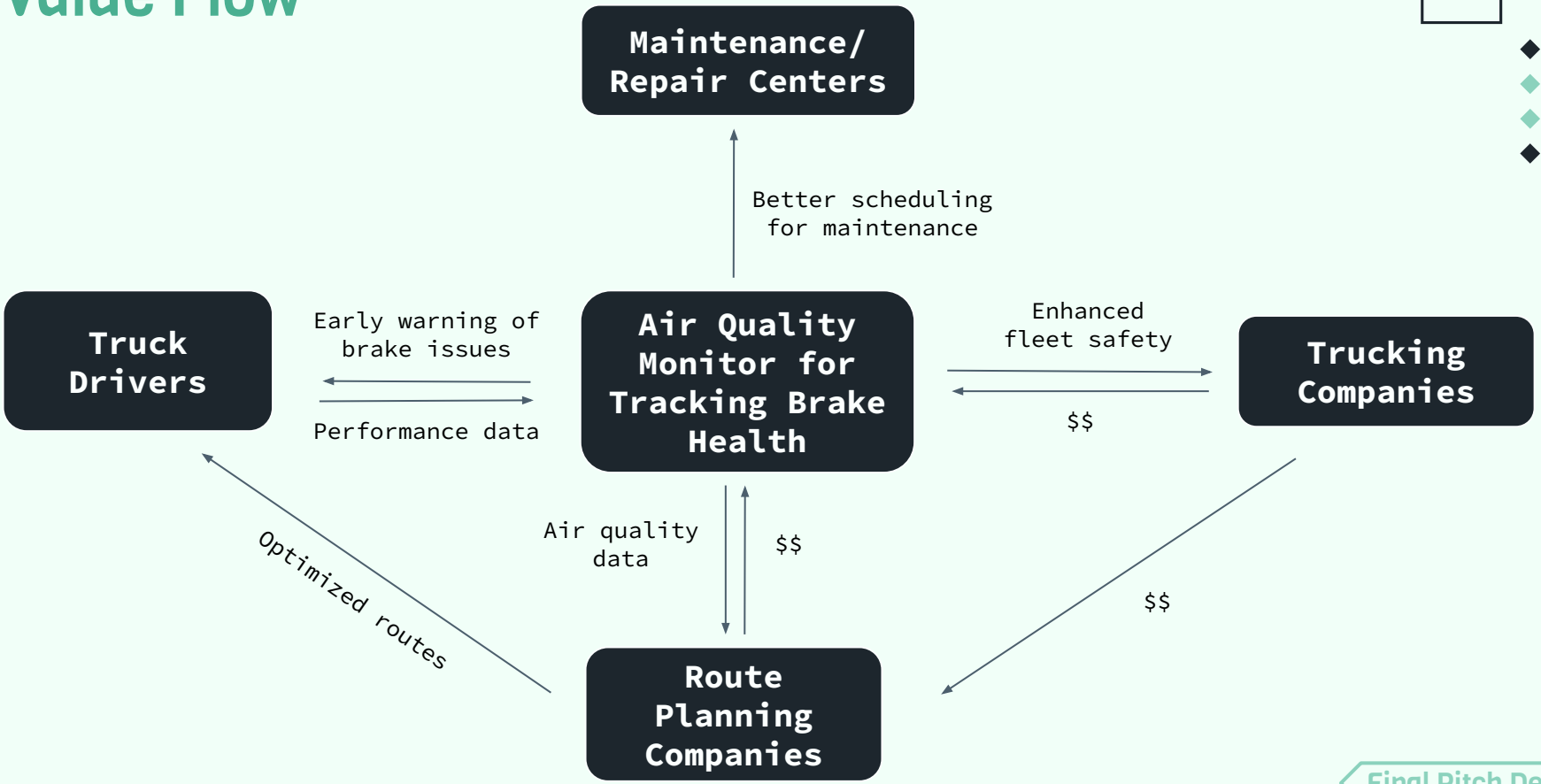
$1.5 billion total loss annually

**estimate based on 30k trucks*

Component Cost • Particle sensor, transmitter, mounting, power supply, GPS	$750K
Installation Cost	$900K
Operating Cost	$6M
AI Model Cost • Development, maintenance, processing	$20K
Total Year 1 Cost	**$7.8M**

**estimate adopted by 30k trucks*

Value Flow


Maintenance/ Repair Centers
Better scheduling for maintenance
Truck Drivers
Early warning of brake issues
Performance data
Air Quality Monitor for Tracking Brake Health
Enhanced fleet safety
$$
Trucking Companies
Air quality data
$$
Optimized routes
$$
Route Planning Companies

Risks and Value

Low Risk

- Manual inspections can still be performed by drivers (they should be performing pre-trip inspections)
- Annual inspections can also help catch brake pads that need to be replaced
- Preventative maintenance nature

High Value

- A breakdown (w/o injury) costs thousands per day
- An accident (w/ injury) can cost millions
- Preventing brake failure helps fleets avoid those situations and limiting liability

07

Project Reflections

Group Reflection &
Individual Reflections

Group Reflections

Although our group's initial concept selection to the top five ideas was relatively easy and straightforward, using the impact effort matrix and rapid assessment, it was difficult to commit to a concept once we started digging into them. We either found the concept to already exist in the market, is not viable financially, or lacked demand from target customers. Looking back at it now, it would have been more effective to not try and make the perfect decision then and there. We should have just picked an idea and immediately started refinement. That process quickly unearthed more of the positives and negatives of each concept.

Reflection – Ashley

I found generating concepts for a specific AI-IoT to be relatively easy, as each technology had multiple capabilities and could be used in a broad spectrum of applications. Two of my ideas were selected as candidates for the final concept, but they required more complex models. Initially, I thought my idea for recognizing nutritional content from images of meals to only require a camera. But discussion with professors shed light on the need for assisting technologies such as weight scales to obtain meaningful measurements, which rendered this concept too expensive and not viable.

One interesting aspect that I realized was that multiple technologies and capabilities could address the same problem. It was fun debating which technology to use and weighing the pros and cons of each.

I found evaluating financial viability to be challenging and ambiguous as we were conceptualizing a product that does not exist and therefore doesn't have existing price and cost benchmarks. I did a lot of research and guess work to estimate projected profits. I found using the TAM/SAM/SOM framework to be very helpful in determining the market size and serving as a foundational basis for my estimations.

Reflection – Sophie

Three Starting Places

1. Applications for Artificial Intelligence Internet of Things

    Making predictions or inferences about the state of the world (ie. predictive maintenance)

2. Potential Use Cases

    Shops, airports, stations, mobile devices, data centers, factories, cities, marketing firms, logistics, natural resource management, warehouses

3. Under what circumstances would individuals prefer to use IoT devices over non-IoT devices?

    Increase efficiency, avoid downtime, minimize risks, go where humans can't go, detect fraud

Reflection – Sophie

Matchmaking

Now that I have had multiple opportunities to practice matchmaking I feel much more confident in my abilities to think broadly and creatively. For this project I chose to focus my matchmaking on RADAR. Within RADAR I focused on four capabilities. These included motion detection, activity recognition, object recognition, and obstacle detection. I noticed that when I was going through this activity I had a hard time thinking beyond applications related to safety. Going into this project I associated RADAR with safety and security so it was difficult for me to think past that. What ultimately helped me to get past this however was reading up on RADAR technologies and use cases. Once I was able to see the breadth of RADAR applications I was able to better understand the areas of missed opportunities and this helped me immensely in my matchmaking process.

Reflection – Sophie

Critique

I found that the critique we received during this process to be very insightful. One aspect we struggled with the most was reframing our technology to find the best suitable customer. We had originally decided to target parents of teenagers, and insurance companies. After our first critique however, we were informed that teenagers might actually pull the technology out of their cars, and this technology already exists among insurance companies. These points led us to shift our target customer to be school districts who might use this technology to monitor the safety of their school bus drivers. We were confident in our new user group until we presented our initial pitch. It was during this critique session that we were told that school districts are actually short on bus drivers so with this increased demand for bus drivers we might not be able to sell the school districts a product that might take more bus drivers off the road. To me this was a very valuable insight that I wouldn't have thought of on my own. I realized after this that I was thinking of our concept outside of its real-world context. This was okay in theory, but since our concepts have to be financially viable, this contextual piece was the missing key to our concept. Once we took context and finances into account we were able to clearly think and that's when we shifted to our brake-health concept.

Reflection – Melody

Overall, I think this project was a good exercise to build off of the ideation and concept ranking skills we had learned previously, while as a group, we also practiced using new tools, particularly in the rapid assessment phase. I enjoyed this project in particular, because as a mechanical engineering major, I have learned about and worked with sensors in the past, so it was easy for me to envision how products might work. I have never thought about them in relation to AI though, and I thought reframing sensors in that way was good practice in thinking more deeply about the sensors' capabilities. This project also helped broaden my understanding of the applications of AI and sensors. For instance, I didn't even know that predictive maintenance existed, let alone how feasible and useful it can be. Although it was easy to come up with applications, it was harder for us to come up with unique applications that would also be profitable. Although we had to pivot a couple of times, I think that experience was also helpful for me to understand the importance of the market and the money.

Reflection – Joey

3 Starting + Matchmaking

I found this process to be moderately challenging. Our group decided to divide responsibilities, with each of us taking a sensor. It wasn't too challenging to come up with lots of ideas. However, it was difficult to come up with ideas that actually used AI, rather than things that could just be hard-coded. In the matchmaking process, I often had to go back and revise ideas to make sure they were using some level of inference Given the limitations of light sensors, I knew I had to focus on pretty much detecting the presence of something rather than what that thing is. One advantage I had is that the light sensor is quite affordable. I found that some of the highest-value ideas were those that the public often wouldn't see, such as the agricultural yield concept. One battle I had was self-inflicted. I knew I had an affordable sensor, so I could potentially deploy many of them effectively. However, that generated many ideas which I felt were too expensive, even if they would be far cheaper than if done with another sensor. Ultimately, I also felt that not many of my ideas were novel as through research we discovered they had already been done before.

Critique

Practicing this was very helpful for our group to redirect and refine our idea. Learning things such as school buses not having much financial viability were crucial in pivoting. We moved from semi trucks to school buses, and back to semi trucks, but with each switch we had new knowledge to apply to each scenario. It was also interesting to listen to other groups' concepts. In the few groups who we critiqued, we saw some similar ideas we came across in matchmaking, but also some new ideas and concepts. Some people used sensors in very interesting and novel ways. This ultimately influenced our approach in our final pitch, where we used air quality sensors in a unique way.

Reflection – Joey

Refinement

After the critique, we settled on focusing on semi trucks. This group is already heavily monitored so they would likely be more accepting of having additional sensors on their vehicle. Furthermore, there is large financial viability in this sector. The U.S. market is nearly $1 trillion annually. We entered this phase hoping to modify our driver score tech to meet a certain need. But after deliberating with my teammates, we decided that a score for a driver might not be too useful to anybody. There would be very little financial viability with just providing a score. You could make the argument that drivers might pay to be monitored so they can get certifications or their licenses faster, but that would produce an audience with high churn. Furthermore, we would have to navigate regulations from the DMV, which is something that we wanted to directly avoid for this project.

It was fun to see how many different methods/technologies we could use to solve the final problem we settled on. I found that we couldn't just straight up pick the best technology. We would have to pick the optimal technology/application pair, considering both sides of the same coin. We initially tried to force the accelerometer/gyroscope sensor pair to the trucking application. It just wasn't working. Everything was either low financial value, or had clearly been done before. We made the switch to predictive maintenance, which led us to find brake pads. It didn't take us long to figure out that we could potentially measure wear through dust and air quality sensors.

Reflection- Charu

Reflection on the Starting + Matchmaking Assignment

The Starting + Matchmaking assignment in our Design of AI Products class presented both challenges and opportunities for our team. Our goal was to explore various applications of AI using sensors, with each team member assigned to a specific sensor. Here, I will reflect on the process and share insights from my teammates' experiences.

First, I'd like to highlight some observations made by my team members:

Ideation and AI Integration: The initial phase of generating ideas appeared to be relatively straightforward. However, it was challenging to ensure that these ideas truly leveraged AI capabilities and weren't simply hard-coded solutions. This required us to continuously revise and adapt our concepts to incorporate AI-driven features. This aspect emphasizes the need for creativity and a deep understanding of AI's potential.

Sensor Limitations: The choice of sensors played a significant role in shaping our ideas. For instance, one teammate worked with light sensors, which had limitations in terms of what they could detect. This led to a focus on detecting the presence of objects rather than identifying them. It's crucial to consider sensor capabilities and constraints when brainstorming ideas for AI applications.

Value in Unseen Applications: The team recognized the potential in exploring applications that the general public might not immediately consider. For example, the agricultural yield concept showcased how AI can be used to enhance productivity in less visible industries. Identifying such unexplored areas can be a valuable approach in AI product design.

Reflection- Charu

Critique:

Learning from Pivots: Our team's journey through the assignment involved several shifts in focus, from semi-trucks to school buses and back. Each pivot was accompanied by new insights that helped us refine our ideas. This iterative process of learning and adapting was crucial for our project's development.

Financial Viability: We learned that some ideas, like school buses, didn't have strong financial viability. This lesson prompted us to reevaluate our choices and make informed decisions, ultimately leading us to a more promising direction.

Refinement:

Exploring Multiple Technologies: The refinement phase was a fascinating exploration of various technologies and their suitability for solving the identified problem. It became apparent that there isn't a one-size-fits-all solution; the choice of technology should align with the specific problem at hand. Selecting the optimal technology-application pair is a critical step in AI product design.

08

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