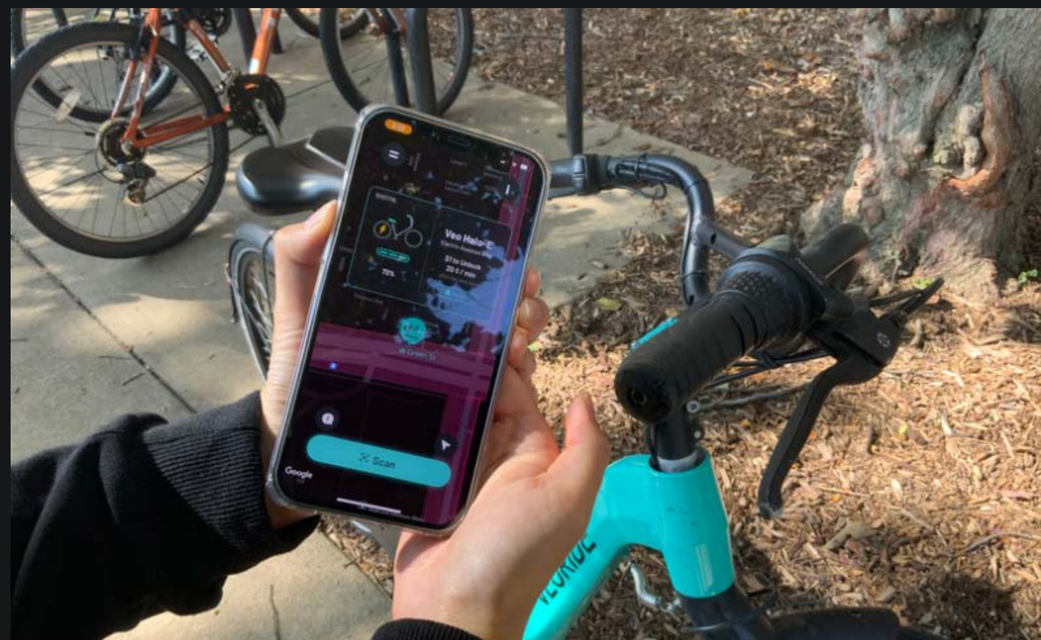
Dymo--A Dynamic Scooter Distribution System

This is a group project by Junting (David) Zhu, Zezhi (Jimmy) Guo, and Yuhe (Ruby) Cui of designing a futuristic dynamic campus scooter distribution system and a smart scooter that can provide a safer and better user experience. My role is to evaluate and propose the algorithm implementation and design the overall user experience. (research and paper in progress)

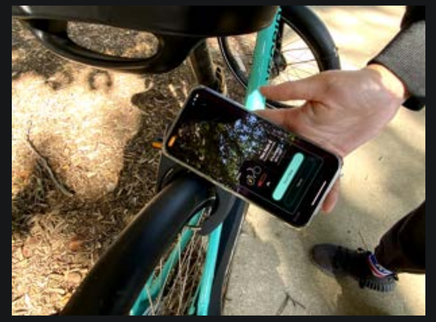
GROUP PROJECT | INDUSTRIAL DESIGN | PROPOSAL

August 22, 2022 to current
Abstract being accepted at AMPS journal>
Presentation Document Link>





Background and Investigation







Our Starting Point

To have a further understanding of the scooter and the current transportation system's problems, we spent 3 weeks researching the current bike/scooter-sharing system and people's opinions about scooters.

By digging into the topic from various perspectives, we hope to design a dynamic campus scooter distribution system and a smart scooter that can provide a safer and better user experience.

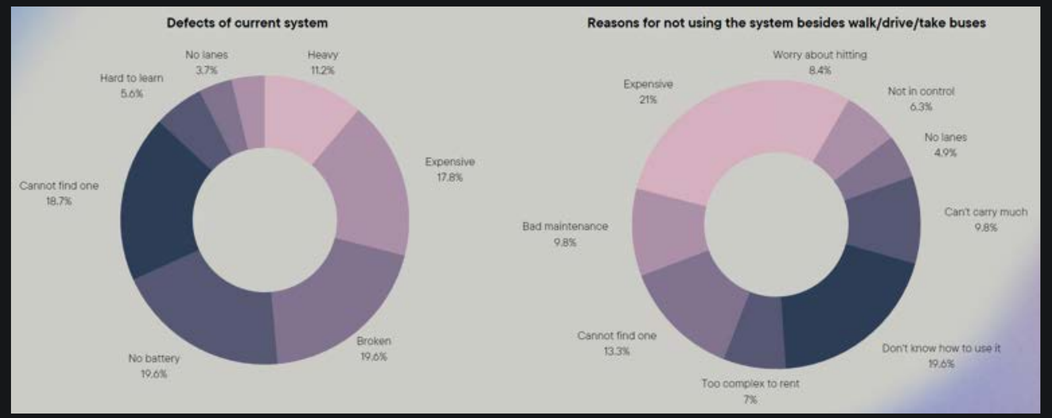
details can be found in presentation>

Interview

Based on the preliminary research, we created a survey about the current bike sharing system and distributed it to college students. Here are some takeaways from our 110 responses:

65.5% haven't used the system, 71% expect to find a vehicle in less than 5 min, 58% spend 5-10 mins each trip, 47.4% don't think the price is reasonable and affordable

To obtain a deeper insight, we also conducted semi-structured interviews with 10 people living on campus and asked about their thoughts about the current bike-sharing system and scooters.



Safty

- People do not wear helmets
- Bike lanes are not well planned
- Pedestrians worry about speed

"Scooters' speeds are too fast."

"the bike lanes don't always follow the road sometimes they go into the sidewalks."

Quality of Service

- Broken/no battery
- Distribution
- Forbidden area
- Need more instructions
- Improper usage

"I have to select a functional one among different quality bikes."

"Previous user put the vehicle on the ground when it was raining."

Scooter

- Expensive to buy one
- Heavy to carry around
- Balance

"I don't want to buy one because it is too expensive."

" I feel it is too heavy for me to carry around."

System

- Weather Influence
- Second choice
- Price

"I would be too concerned about ice."

"If I miss the bus and I need to get to somewhere fast really quick I will use the system."

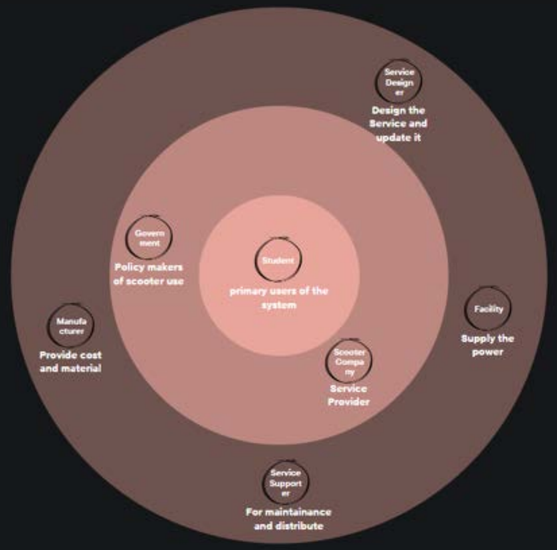
Market Research

Market Research

From comparing different companies, we have a better idea about the current bike/scooter sharing industries and their advantages and weaknesses. Some insights can be used in our scooter and system design.

The stakeholder's map is on the right side. The circles indicate relevance: various stakeholders are in different places according to how close they are involved in our proposal.

The research process went about 3 weeks from 2022.8 to 2022.9. We mostly traveled to scooter placeholders nearby, investigated the applications on phone, and talked to the workers in these scooters sharing companies.

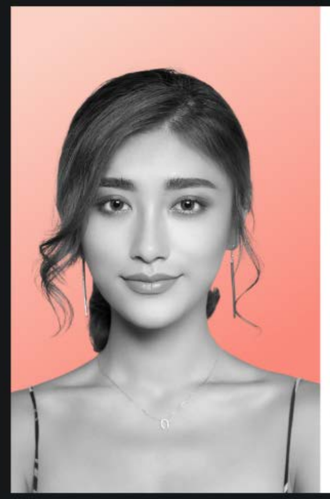


Competitor Analysis	Current Strategies	Pricing	Station Types	Competitive Advantages	Weakness
Veo	• Vehicle type: e-scooter, e-bike, bike; • Value quality; • Vertical supply chain	$1 to Unlock 36 ¢/ minute	Free-floating E-scooter sharing	• Smart geofenced regulations; • Swappable Battery • Distribution based on yesterday's tracking;	• Bad Quality; • Unclear App indications; • Safety Problem;
Lyft	• Vehicle type: e-scooter, bike; • Target underserved neighborhoods	$1 to Unlock 37 ¢/ minute	Free-floating E-scooter sharing	• Convenient Paying; • Free Helmet; • Lower Price; • Easy Accessing Portal;	• Bad Quality; • Easy to theft;
Bird	• Vehicle type: e-scooter, bike; • Eco-conscious design • Sell scooters and bikes	$1 to Unlock 49 ¢/ minute	Station bound E-scooter sharing	• State-of-the-Art Vehicle Diagnostics • Advanced anti-theft long used battery • Stability on complex roads	• Consumer quality parts; • Weak headlight - dangerous at night; • Small and solid wheels; • Outdated Distribution system;
Lime	• Have a valid U.S. driver's license to drive • Target universities and college campuses	$1 to Unlock 39 ¢/ minute	Station bound E-scooter sharing	• Affordability; • Light Weight & Better Control;	• Damage notification; • Warnings of automated speed reduction; • Inefficient maintenance; • Outdated Distribution system;

Personas

The two personas and scenarios are depicted as the potential users of our proposed system. These people are made up profiles based on our survey and interview results.

We currently focus more on university students who would travel on a short path, such as going to the classroom.



Name: Amy
Gender: Female
Age: 19
Location: Urbana, Champaign
Home: University Housing
Identity: Freshman College Student

Bio:

Amy just entered university this year and lives in University Housing. She lives far from the school, so she needs to walk to the bus stop near her home every day and take a bus of a certain route to the place where she attends her class. Frequent late arrivals of the bus or getting up late usually cause late arrivals. Amy is distressed.

Frustrations:

1. Delays in the public transport system lead to late arrivals.
2. It takes time to wait for the bus to arrive.
3. Buses can only reach fixed locations. (Unable to complete last mile transportation)

Wants:

1. More flexible method of transportation.
2. Reduce waiting time.
3. The system can be accessed from any location.



Name: Mike
Gender: Male
Age: 22
Location: Urbana, Champaign
Home: Apartment
Identity: Senior College Student

Bio:

Mike is a senior student in UIUC. He lives far from the bus station. Consider the price, portability, and security problems of buying a bike/scooter, he get used to the shared bicycle system on campus as the main way of transportation when he needs to go to some specific places. However, various problems with the system made it difficult for him to use it. Mike was frustrated at the thought of spending money and not having good riding experience.

Frustrations:

1. Unclear app guide and instructions.
2. Spend lots of time but can't find a scooter that can be used.
3. A damaged scooter leads to a dangerous ride.
4. Using the system is quite Expensive.

Wants:

1. Better user experience with clear App guidelines.
2. Shorter searching time.
3. Safer driving experience.
4. More affordable price.

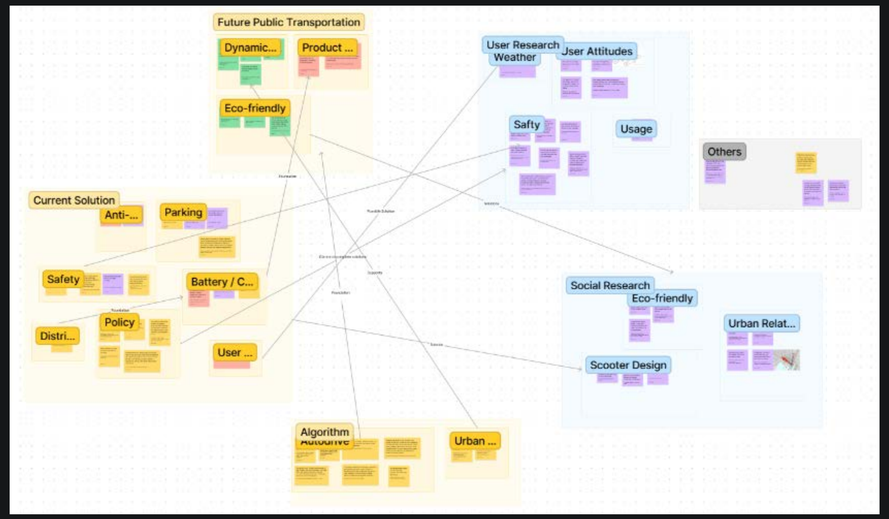
Literature Review

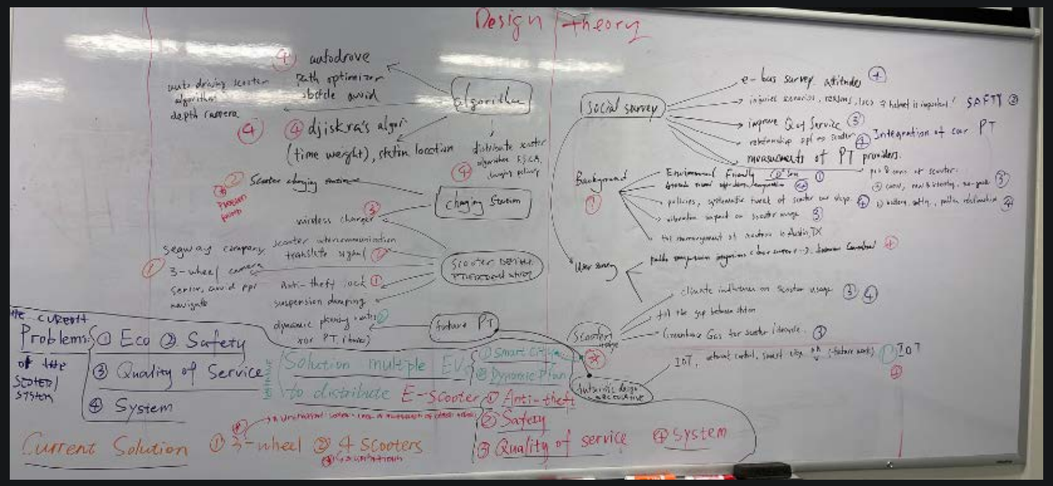
Literature Review

After having our own perception of the topic, we decided to move our focus to secondary research. We spent two weeks finding 28 articles that related to either scooter design or scooter public transportation systems with different focuses and analyzing them one by one. Then, we categorized the key information of each article into two main categories (Design & Theory) and several small categories. (Scooter's Design & Usage, Social Survey, Machine Algorithm, etc.)

Then, by putting them on a map and teasing out their relationships. we had a clearer view of all the information.

the whole literature map can be found here>





Frequent strong vibration when riding on complex road will make riders feel not comfortable.

Set speed limit when riding on a specific road.

Data collection on roads to make new policies in one area.

utilzing djisktra's algorithms and time implementation to present a better connection design for transportation networks

Problems

- Not wearing a helmet can cause serious problems. Studies suggest low rates of helmet use and high rates of head injuries during over 40% of accidents.
- Lack of effective regulations. Scooter riders usually not chose to follow the regulations and ride on sidewalks at a fast speed.
- The bad distribution of shared scooters makes people hard to find available scooters nearby.
- The short lifetime of scooters is one of the main contributors to greenhouse gas emissions.
- The high mobility and the always-changed speed make e-scooter become an unstable factor on the road and influence the traffic.

Current Solutions

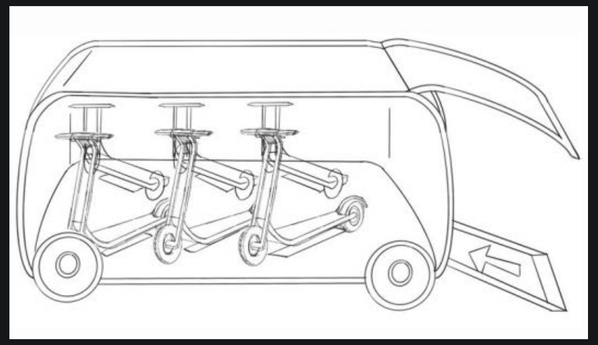
- Geofence that limits the speed/ the use of shared e-scooters in some of the areas.
- People in some countries can use mobile applications to report inappropriate scooter behaviors and obtain rewards.
- Swappable batteries can be changed efficiently and easily.
- In-depth cameras and sensors with a powerful algorithm that can detect and distinguish objects in front of/ around the scooter can help to avoid potential risks and conflicts.
- Advertising about how to ride scooters in the right and safe ways
- Policies for the government: some countries' and cities' governments have published policies to restrict riders' age. However, they are not effective and lack regulations.
- A scooter safety system utilizing Visible Light Communications (VLC) can transmit digital information among scooters and cars, but it can also make fatal mistakes and hurt drivers and other people on the street.
- Building Portable parking places is a good way to solve the charging problem, but it does not address the issue that people still have to take time to transport to the charging station
- Not well-designed Geofence mechanism brings bad riding experience. Riders cannot receive clear indications about scooter status changes and are not aware of the negative impacts of it.

Product Concept

Scooter Design

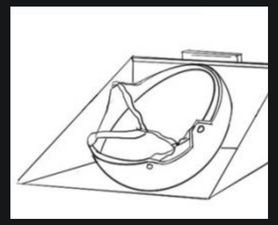
- Two front wheels: Beginner friendly
- Phone stand: Charge your phone, Map
- Helmet and basket: Move the helmet and basket to the front of the deck. Encourage riders to use the helmet
- Safety instruction: Safety instructions on the front of the deck
- Adjust height: Comfortable for all users
- LED light and solar panel: LED light on the side to send signals, solar energy

more iterations about scooter and van can be found here>

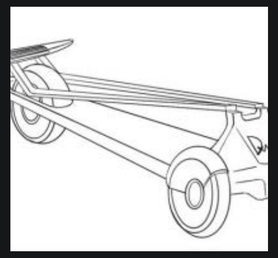












Electric Van Design

The electric van will travel around the designed area to collect used scooters, deliver scooters on request, and protect scooters from bad weather.

When collecting scooters, it will open the rear door and let the scooter go to the loading ramp. The scooter can be charged wirelessly inside the van. The distribution of the scooters inside the van is designed for autonomous scooters to easily go in and out.

UI and UX design

Based on the interview results and relative market research, we designed the mobile phone application for finding scooters and calling scooter delivery services.

The low-fidelity prototype is about clarifying the user experience and user flow. Users should be able to:

- check scooter locations nearby
- call a scooter delivery
- scan the code to unlock the scooter
- read safety instructions before the ride
- see fares and pay fares
- manage user profiles
- report unfunctional scooters and bugs

