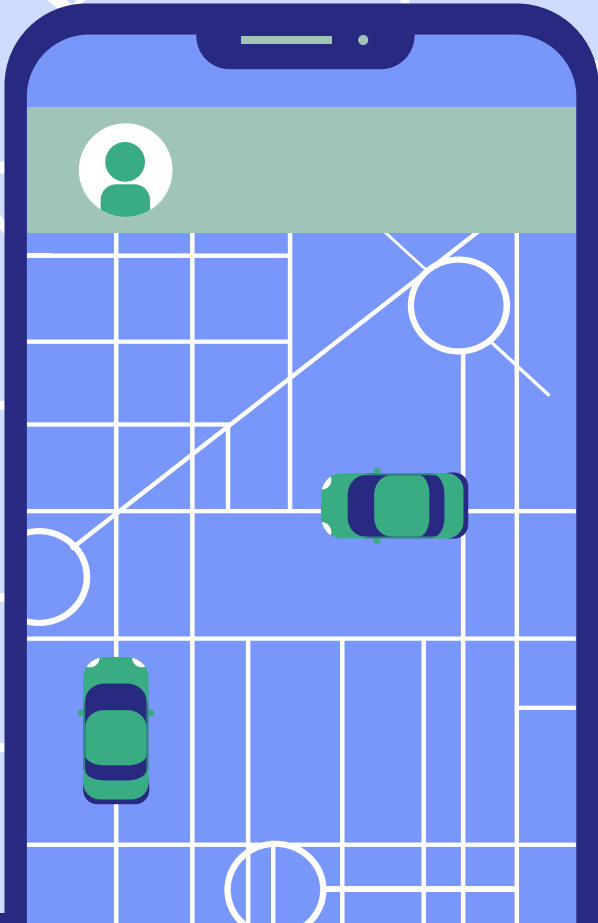


SmartPark

**IoT-Driven Automatic
Parking Solution**

SD 491: Senior Design I - Team sddec24-17





About Us

Team Members :

William Clemmons, SE

Zachary Sears, CPRE

Brian Witherspoon, EE

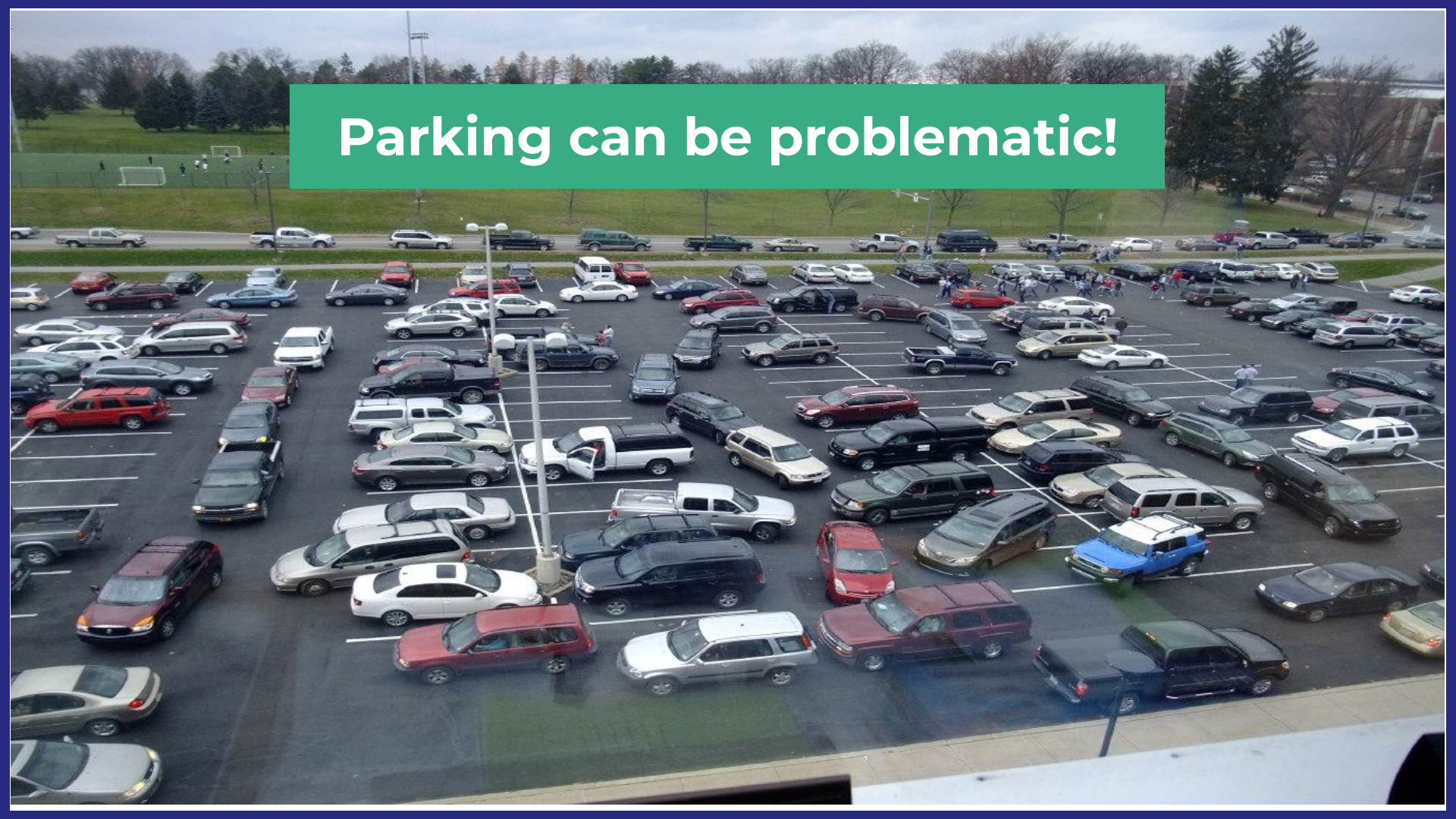
Kennedey Reiling, EE

Mubassir Serneabat Sudipto, CYBE

Ethan Haberer, EE

Client/Advisor : Md Maruf Ahamed

Parking can be problematic!



Project Plan



Problem Statement

Streamline parking experience

Create a detection-based system to monitor parking spots

Develop an app for students, teachers, etc. to view and reserve available parking

Eliminate issues such as staff-only parking, full lots, and time-consuming searches

User Needs

Quick Parking

Availability

Easy Payment

Stress Relief

Requirements

Functional

- **Hardware**
 - Sensors update in real-time
- **Application**
 - Users can reserve spots
 - User is directed to their parking space
 - Payment feature

Non-Functional

- **Hardware**
 - Low-maintenance
- **Application**
 - Secure payments
 - Availability
 - Low-latency

Market Research

SpotHero

- Reservation
- Various pricing options
- Availability based off meter timing



ParkMobile

- On campus competitor
- Selective parking based on needs (Handicap, etc.)
- Availability based off meter timing



Our Solution



WHAT SETS US APART?



RESERVATIONS

Reserve a spot from the comfort of your home

LIVE DATA

Our server will hold **LIVE DATA** to ensure accuracy



Guide

Be **guided** directly to your parking space

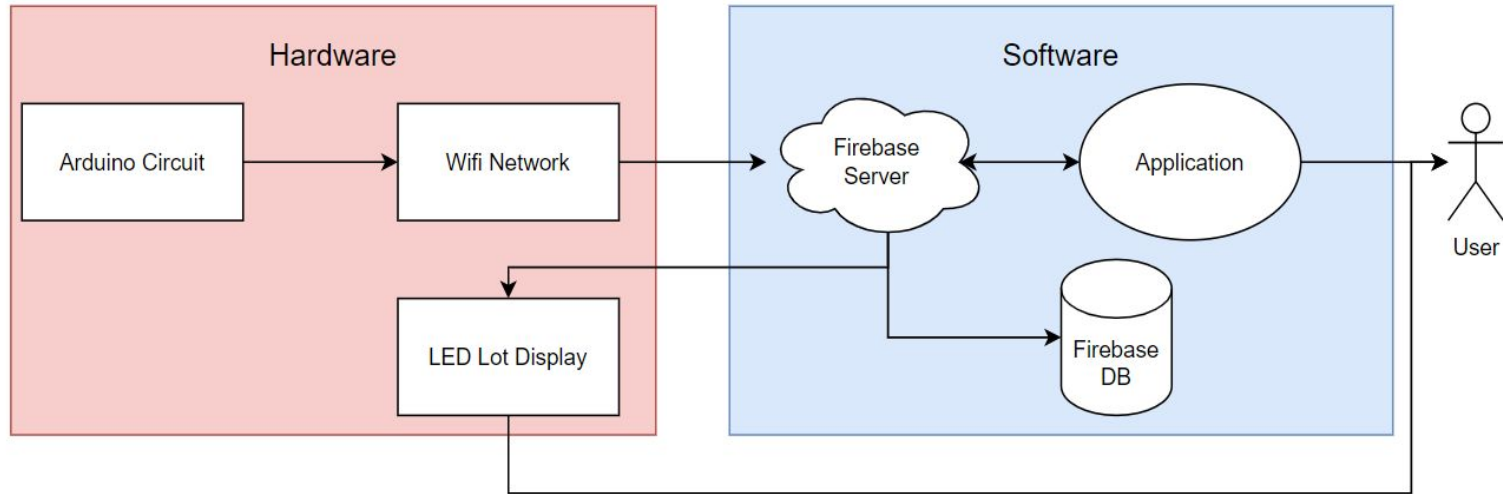


Sensor Based

Real-time data and automation



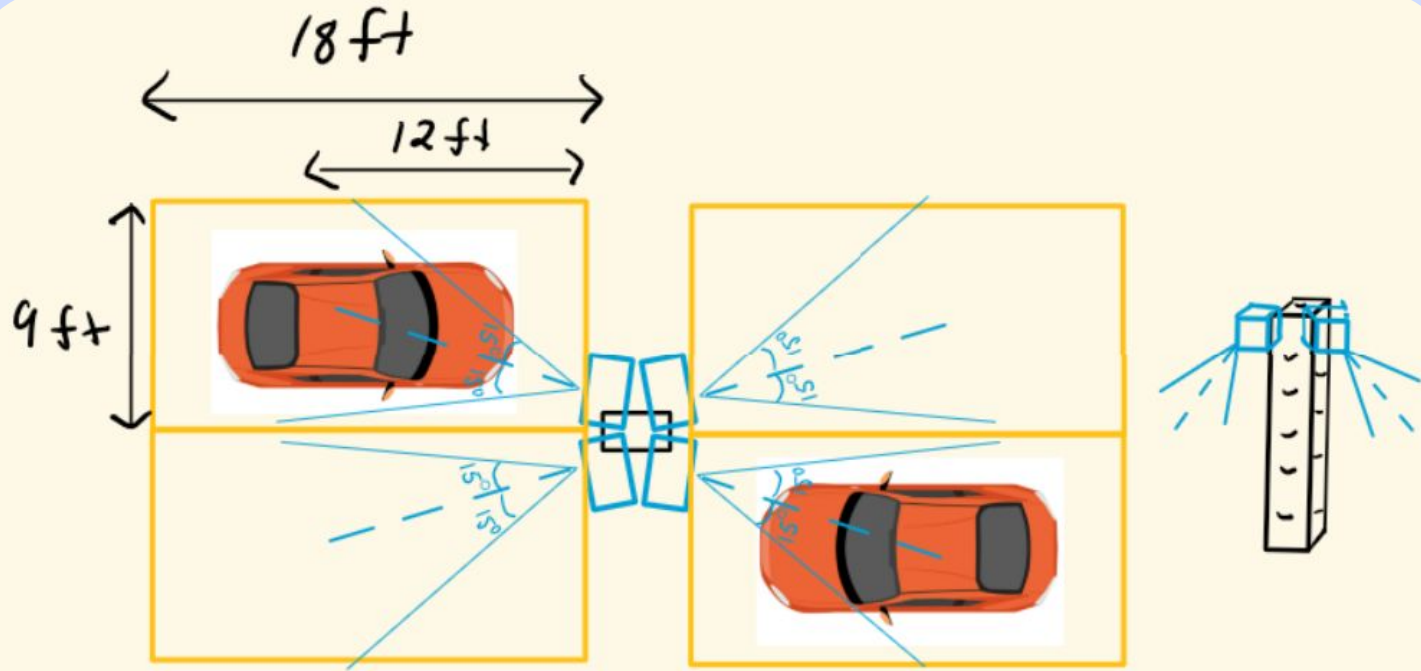
Overall Design



Hardware Design

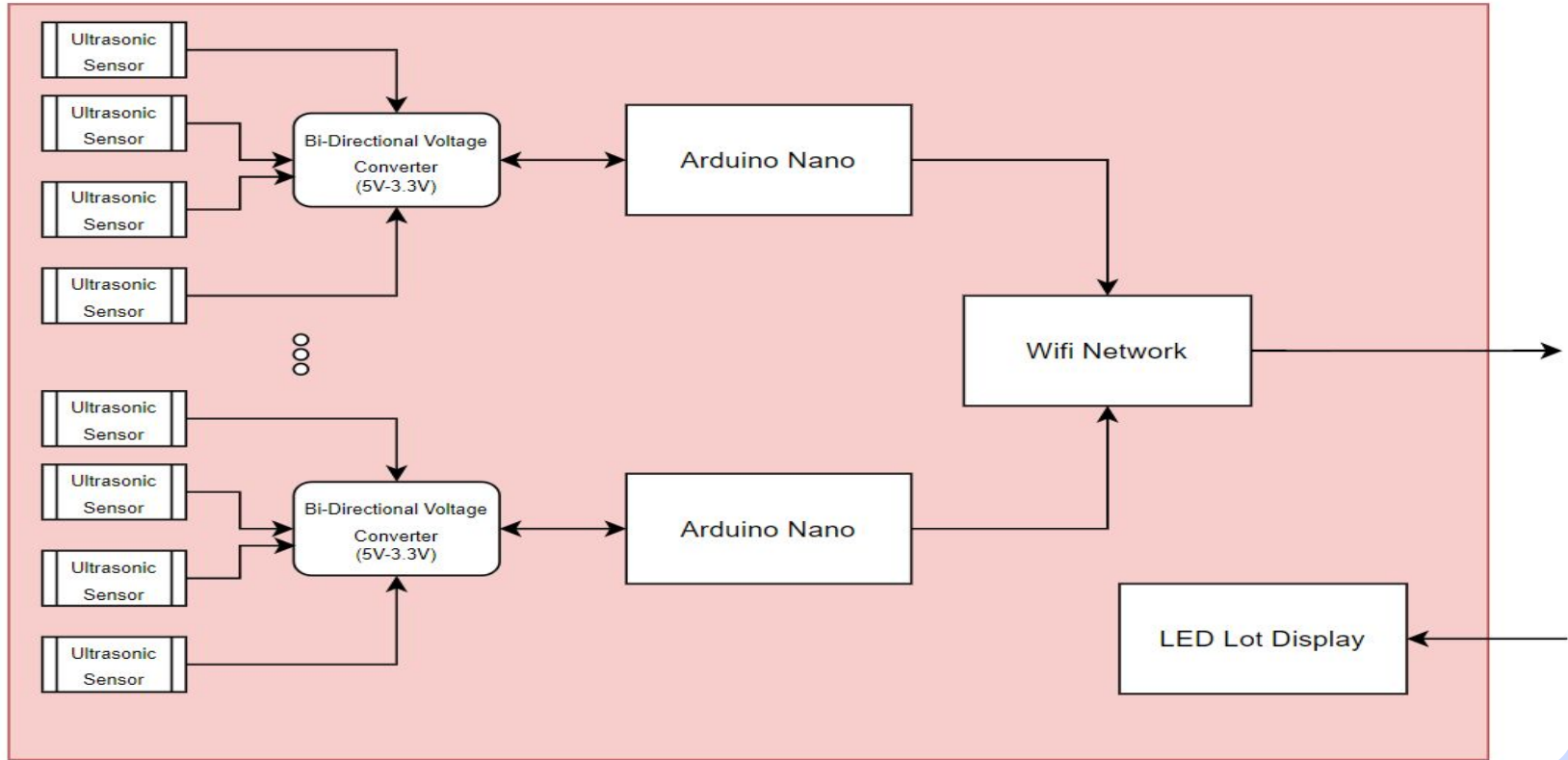


Conceptual Sketch of Parking Lot

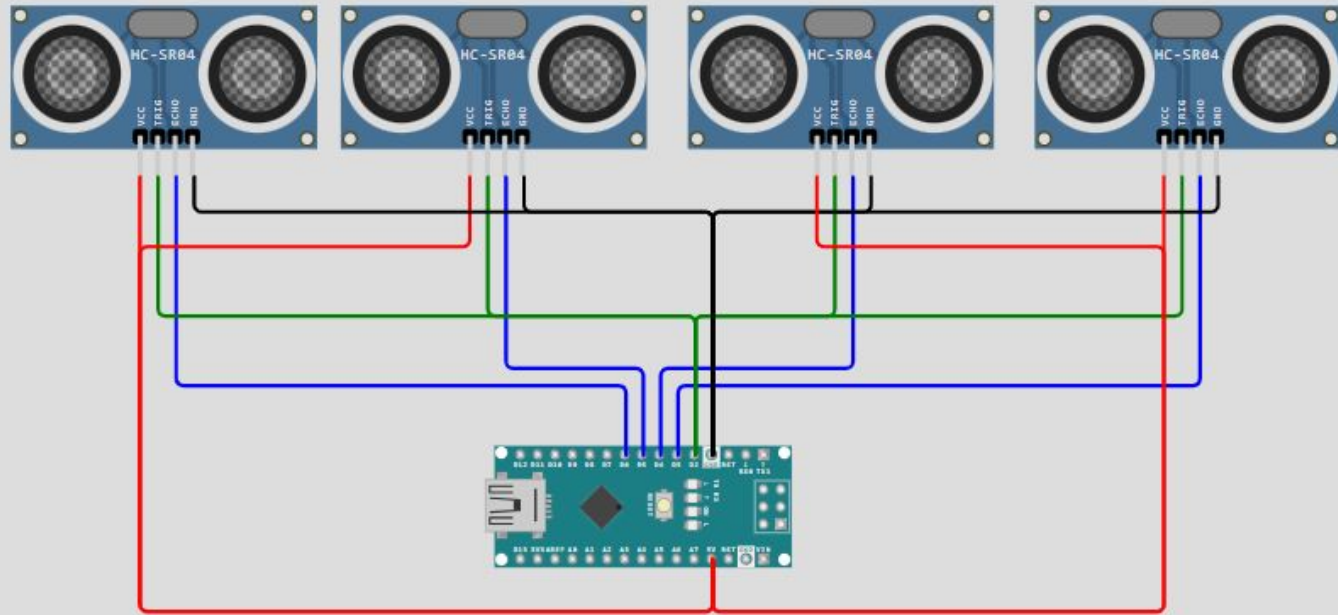


Design FlowChart

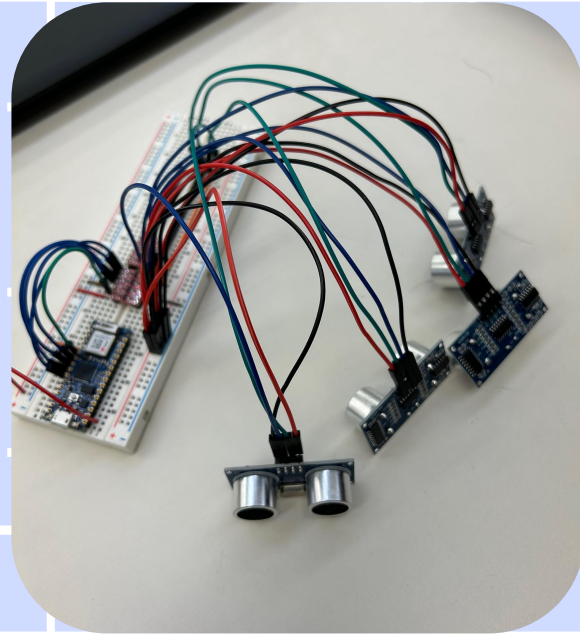
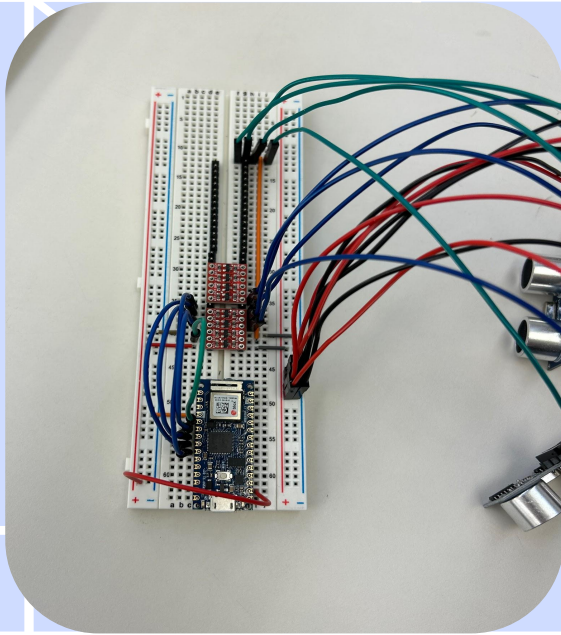
Hardware



Simulated Hardware Design



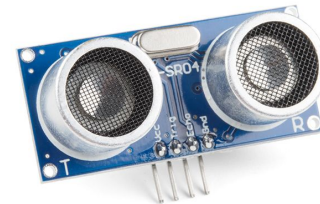
Arduino Circuit



Hardware Components



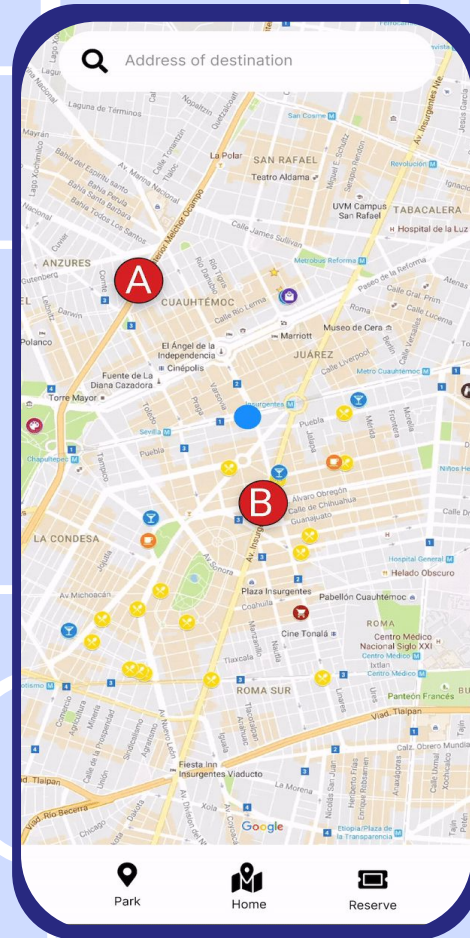
Arduino Nano 33 IoT	WiFi (NINA)	Ultrasonic Sensor
<ul style="list-style-type: none">• WiFi capability• Low cost	<ul style="list-style-type: none">• Board communication to server	<ul style="list-style-type: none">• Accurate• Team familiarity



Software Design



Conceptual Sketch App Interface



Conceptual Sketch App Interface



Conceptual Sketch App Interface (Continued)

← Payment

Spot #
[Input Field]

License Plate # [Input Field] License Plate State [Input Field]

Pay

Full Name
[Input Field]

Country
[Input Field]

Address
[Input Field]

Card
[Input Field]

Card number
[Input Field]

Expiration Date [Input Field] Security Code [Input Field]

Submit Order

Park Home

← Reserve

Spot #
25

License Plate # [Input Field] License Plate State [Input Field]

XYZ 123 Iowa

Pay

Full Name
John Doe

Country
United States

Address
123 Oak Street

Card
[Input Field]

Card number
0123456789

Expiration Date [Input Field] Security Code [Input Field]

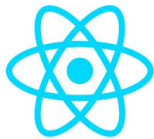
01/01/2025 012

Submit Order

Park Home

Software Components

React Native	Stripe	Firebase
<ul style="list-style-type: none">• Uses Javascript• Large community• Our team has experience	<ul style="list-style-type: none">• Easy to use API• No setup or monthly fees• Customizable	<ul style="list-style-type: none">• Scalable Backend Services• Integrated Analytics





Implementation Roadmap

Potential Design and Implementation Challenges

Phone Use

Our project will require phone use while driving.

Connectivity

Internet connectivity in parking lots can be unreliable.

Weatherproofing

Hardware systems will be exposed to the elements

Server Overload

Potential data overload during data communication.

Proposed Mitigation Techniques

Phone Use



Guiding Users to their spots

Connectivity



Use NANO's as WiFi access points

Weatherproofing



Waterproof Sensors

Server Overload



Choose the correct server for the job

Future Plans

Finish Prototyping

01

Testing

02

Adapting Design

03

**Full
Implementation**

04

Milestones

Milestone	Projected Date
Arduino Prototype	10/4/24
<ul style="list-style-type: none">• 4 sensors per Nano	4/19/24
<ul style="list-style-type: none">• Nano Boards with WiFi connection	9/6/24
App Prototype	10/4/24
<ul style="list-style-type: none">• Home Page Prototype	10/1/24
<ul style="list-style-type: none">• Payment Page Prototype	9/13/24
Server Prototype	4/05/24

The image features a dark green background with a white grid pattern. Several white circles of varying sizes are scattered across the grid, with thin white lines connecting some of them, creating a network-like structure. In the center, there is a solid blue rectangular box. Inside this box, the word "Questions?" is written in a bold, white, sans-serif font.

Questions?

Edge Case

QUESTIONS

- User parks in invalid parking spot
- User parks in an invalid spot temporarily.
- User parks poorly (takes up multiple spots)
- User parks in a correct spot but does not pay
- Someone takes a user's reserved spot

SOLUTIONS

- We will contact the parking division
- We will notify the parking division after a set amount of time.
- Have a user report it.
- Contact parking division.
- If a spot is reserved, only the user who reserved it can pay for it.