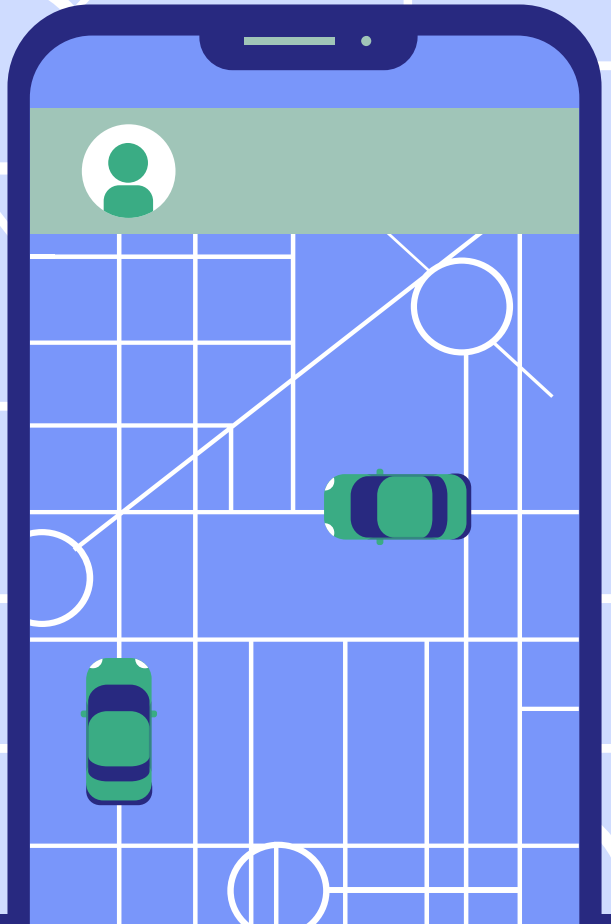
SmartPark

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

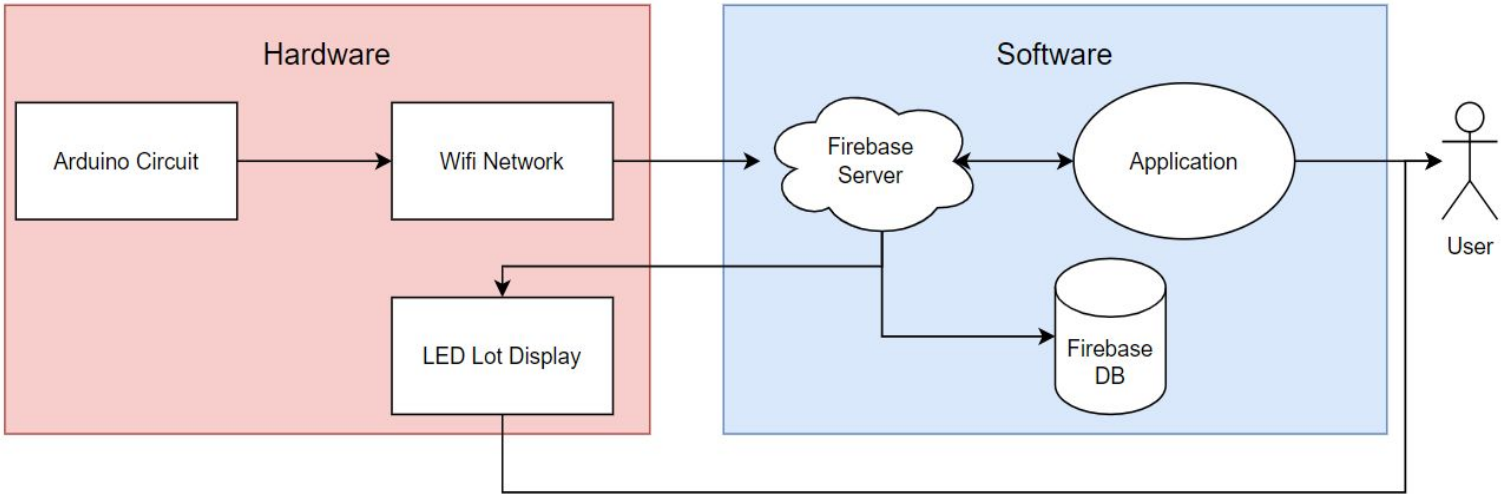
Guide

Be **guided** directly to your parking space

Sensor Based

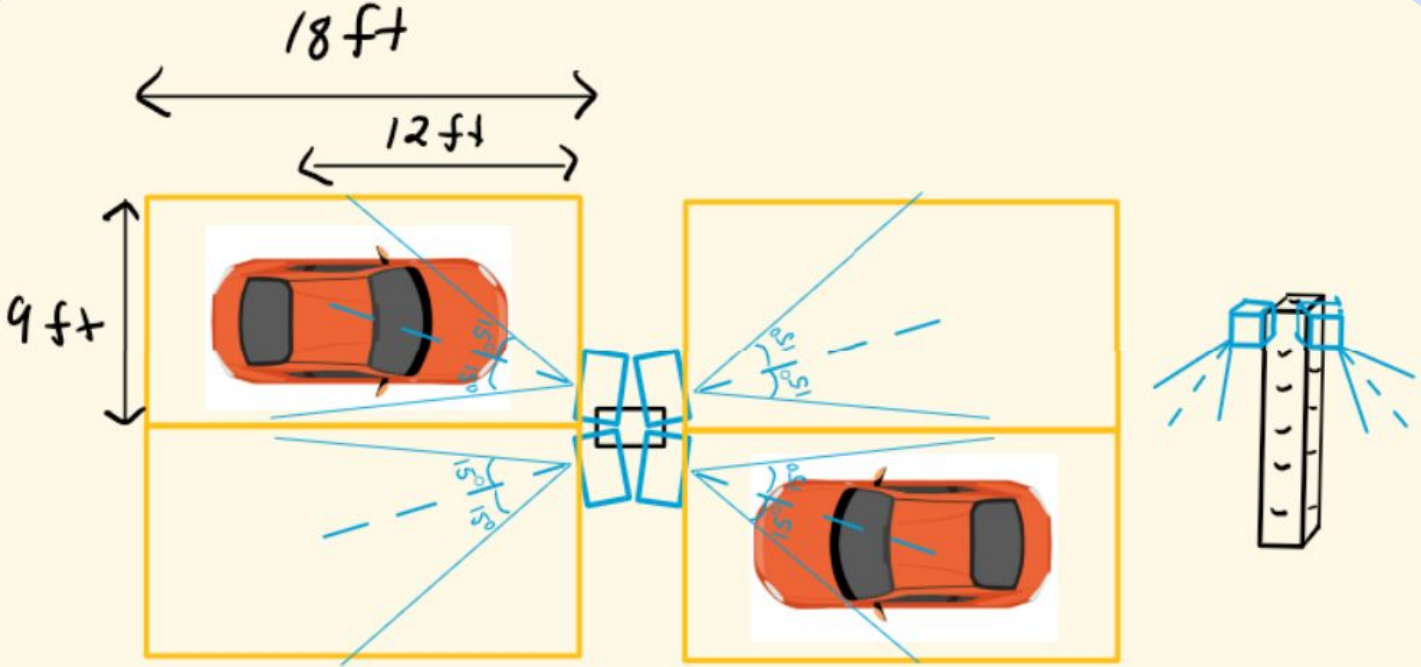
Real-time data and automation

Overall Design

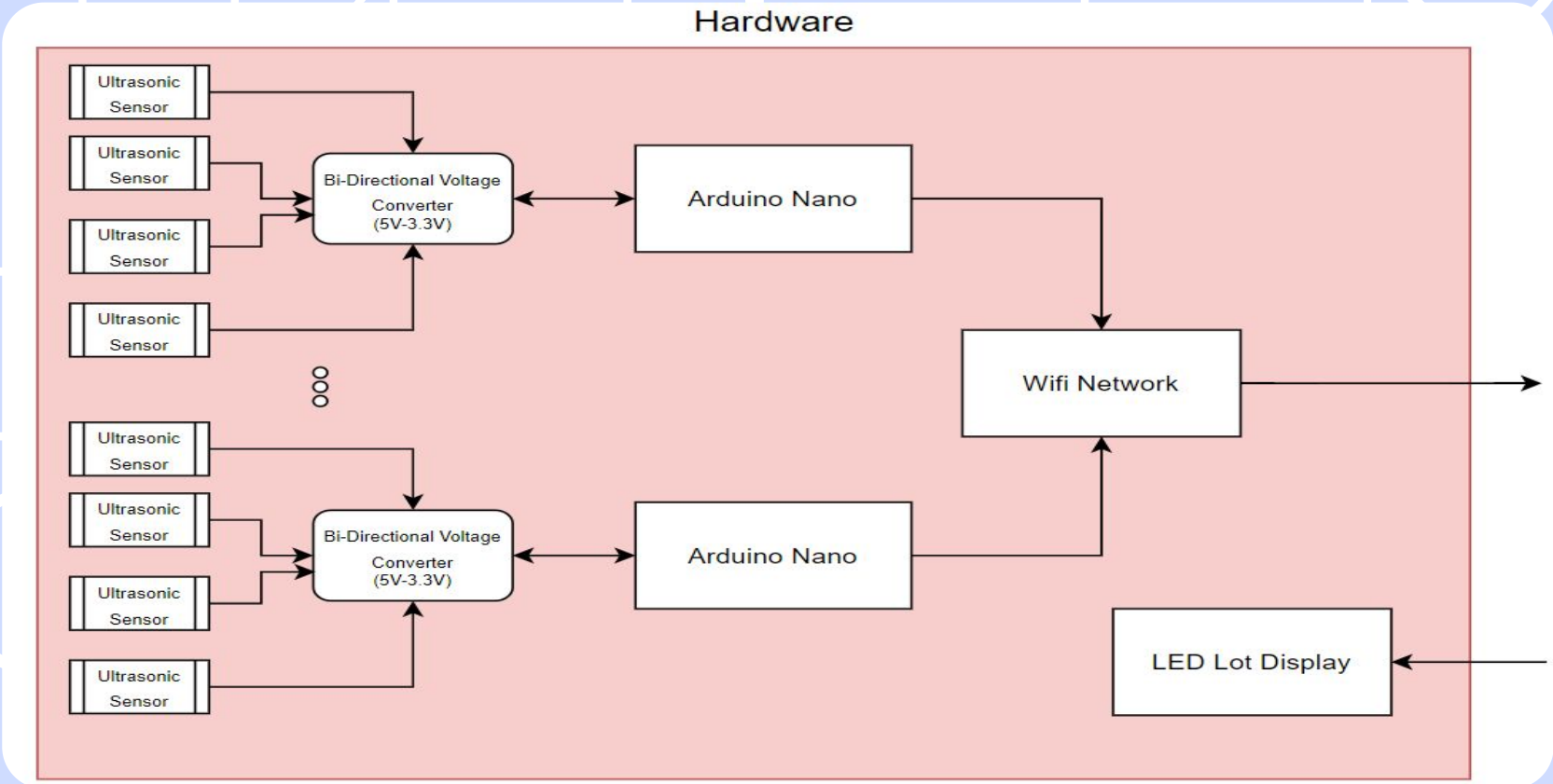


Hardware Design

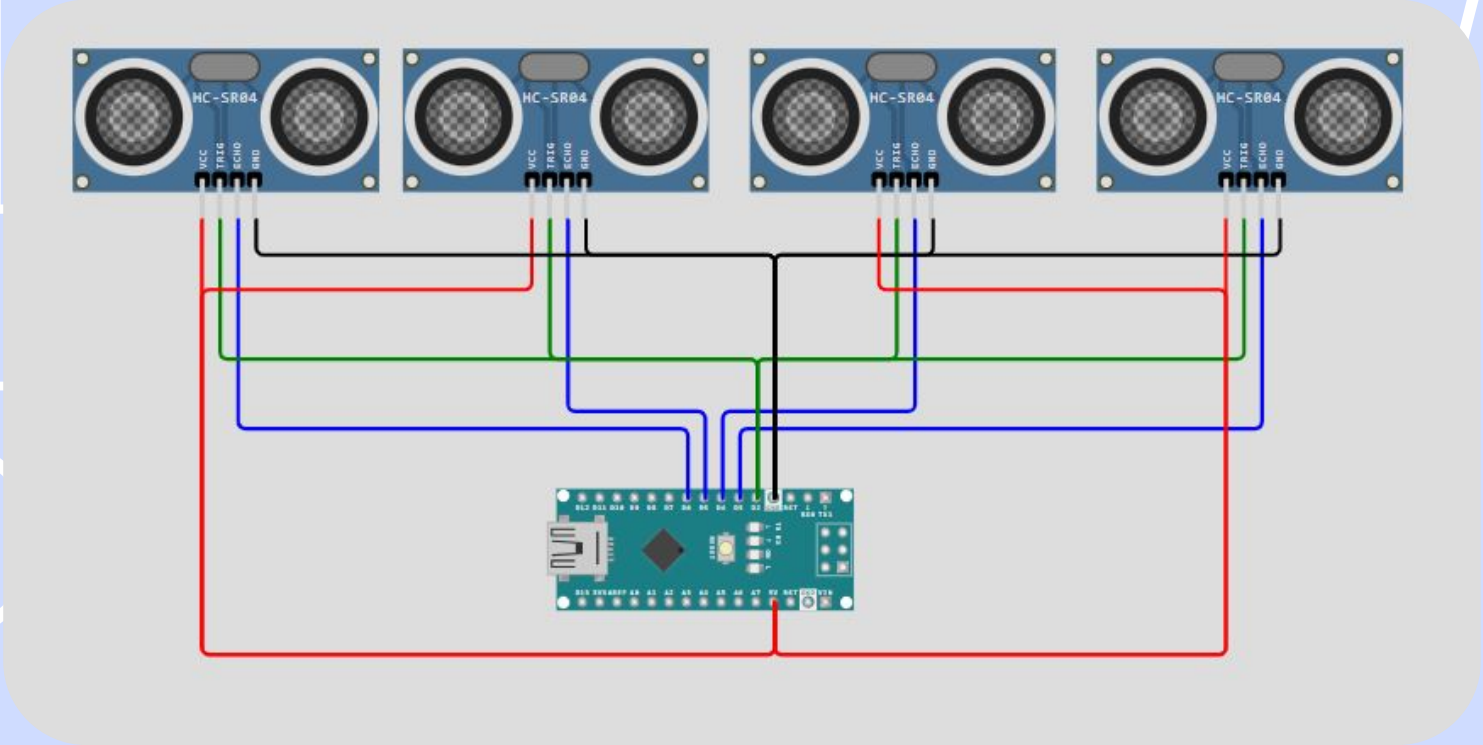
Conceptual Sketch of Parking Lot



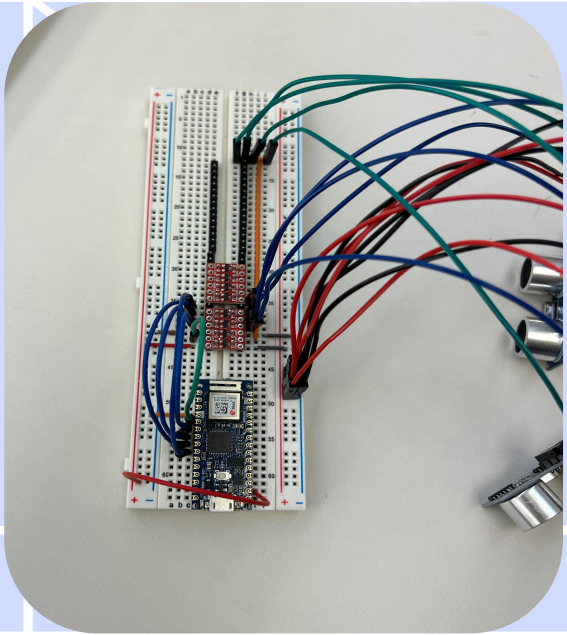
Design FlowChart

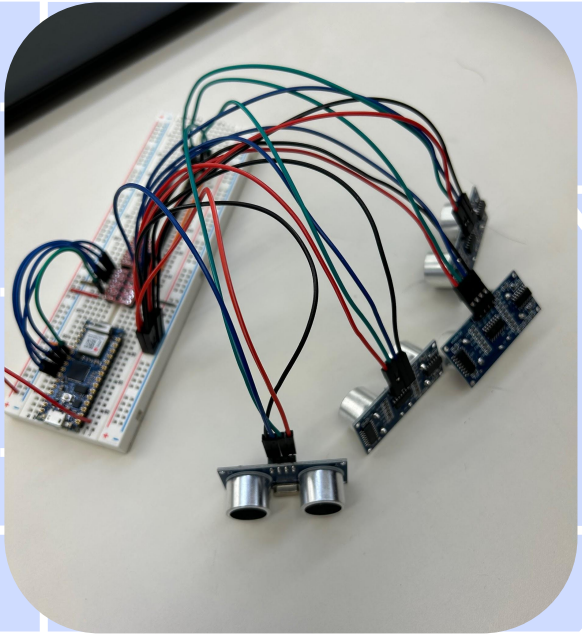


Simulated Hardware Design



Arduino Circuit



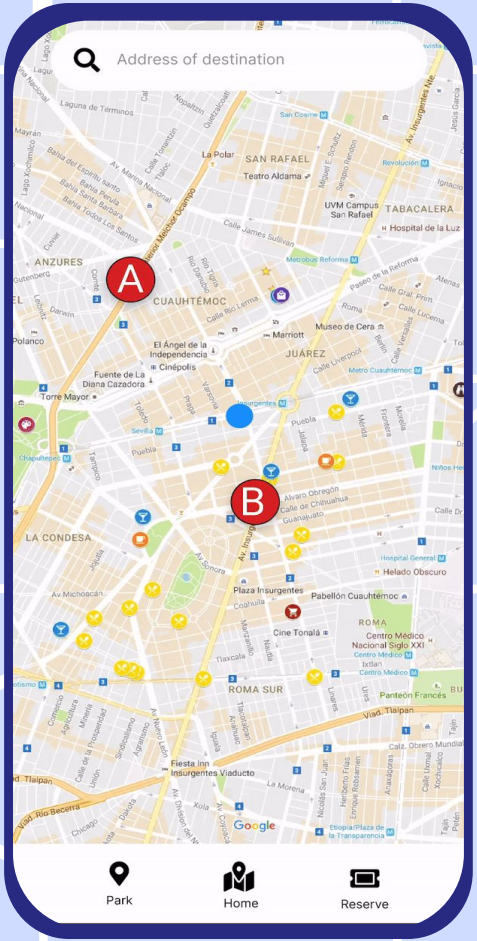


Hardware Components

Arduino Nano 33 IoT	WiFi (NINA)	Ultrasonic Sensor
• WiFi capability • Low cost	• Board communication to server	• Accurate • Team familiarity

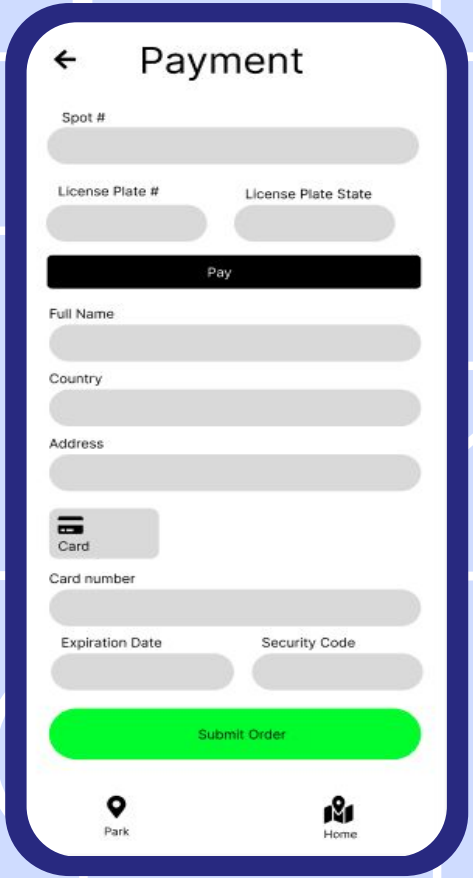
Software Design

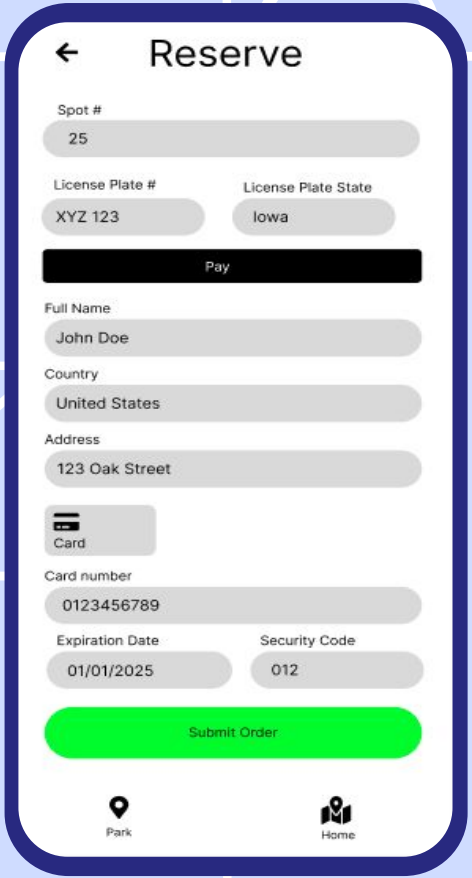
Conceptual Sketch App Interface



Conceptual Sketch App Interface

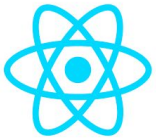
Conceptual Sketch App Interface (Continued)





Software Components

React Native	Stripe	Firebase
• Uses Javascript • Large community • Our team has experience	• Easy to use API • No setup or monthly fees • Customizable	• 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

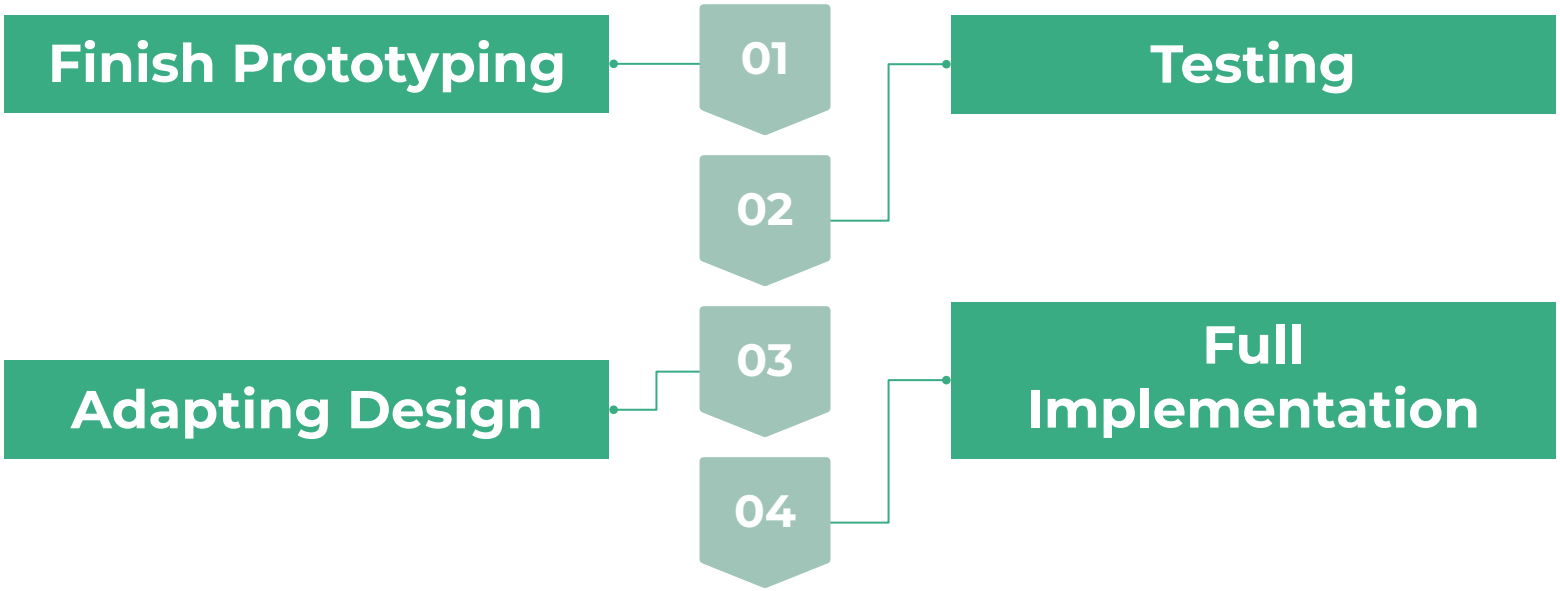
Server Overload

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



Milestones

Milestone	Projected Date
Arduino Prototype	10/4/24
• 4 sensors per Nano	4/19/24
• Nano Boards with WiFi connection	9/6/24
App Prototype	10/4/24
• Home Page Prototype	10/1/24
• Payment Page Prototype	9/13/24
Server Prototype	4/05/24

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.