IOWA STATE UNIVERSITY

Department of Electrical and Computer Engineering

IntelliSpray
sdmay20-53

Kevin Davis (CPR E), David Hayes (CPR E), Madison Kriege (CPR E), Sean Doran (S E), Donald Laracuente (S E), Shuangquan Li (S E)

Smart Backpack Sprayer System

Introduction

Problem Statement: To create an backpack sprayer that can keep track of when chemical has been applied

Intended Users

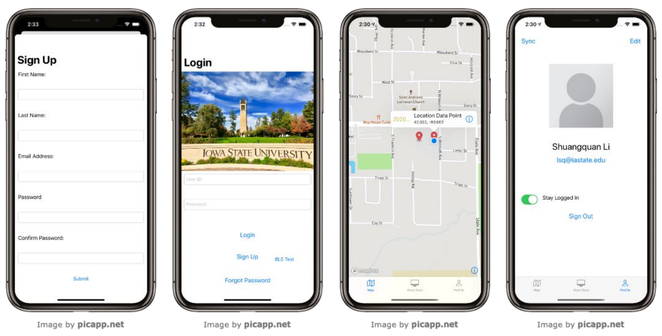
- Farmers
- City Employees

Goals

- Track when user is spraying
- Track where the user is
- Track amount of chemicals used

Intended Use Cases

- Orchards
- Small farms and gardens
- Parks and sidewalks



Design Approach

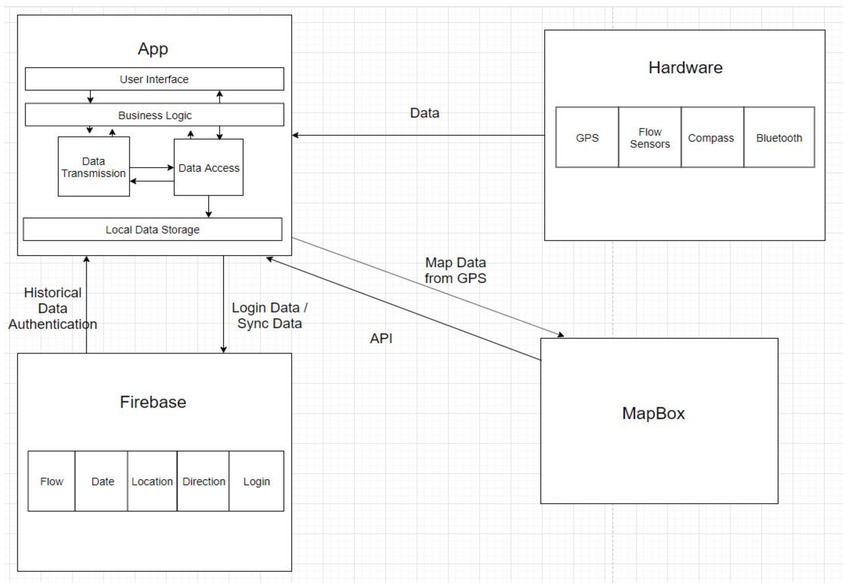
- iOS application presents data to user
- Bluetooth communication between application and hardware
- iOS application connects backend features
- Hardware collects and packages data

Conceptual Sketch

Technical Details

The solution will be composed of 3 primary components: iOS Application, API Integration, and Hardware.

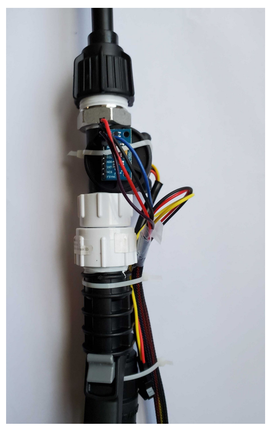
- iOS
  - Xcode (IDE), Swift (Language)
  - UIKit, SwiftUI, CoreData, CoreBlutooth, CoreLocation (SDKs)
- API
  - Mapbox
  - Firebase
- Hardware
  - Arduino (IDE)
  - Circuit Maker



Block Diagram

Testing

- iOS
  - Simulator (iOS 13) Testing
  - Real Device Testing
  - Component/Unit Testing
  - Integration Testing
  - Acceptance Testing
- Hardware
  - Component Accuracy
  - Reliability
  - Integration
- API
  - Integration Testing
  - Component/Unit Testing



Requirements

- The hardware shall
  - Use a flow sensor with accuracy to 10% of the duty cycle
  - Use a GPS sensor with accuracy to 3 meters
  - Use a compass Sensor with accuracy to 30 degrees
  - Be mountable inside backpack sprayer
  - Package data in JSON format
  - Be able to send data using Bluetooth
- Data shall be collected in 1 second intervals
- Data collection shall be time-stamped with 24 hour time format
- The system shall
  - Be water resistant
  - Be operable in temperatures between 0-40C
  - Be under 50 pounds
  - Be wearable on one's back
- Display the row data
- Display data in the map with a pin
- Support multi-user usability
- Support editing the type of chemicals
- Sync data between cloud and local
- Support offline data access
- The code base shall easy to maintain
- Data shall only accessible to authorized user
- The system shall support large amount data transmission

Project Resources

- $750 initial budget
  - Under budget
- ETG resources
  - Acquisition of PCB
- Adviser
  - Daji Qiao
- Client
  - IntelliSpray

Engineering Standards and Design Practices

- ISO/IEC 12207
- IEEE 1016

Acknowledgements:
Client: IntelliSpray
Faculty Adviser: Daji Qiao
Additional Support: ETG