# GateMate

## Remote Rice Farming

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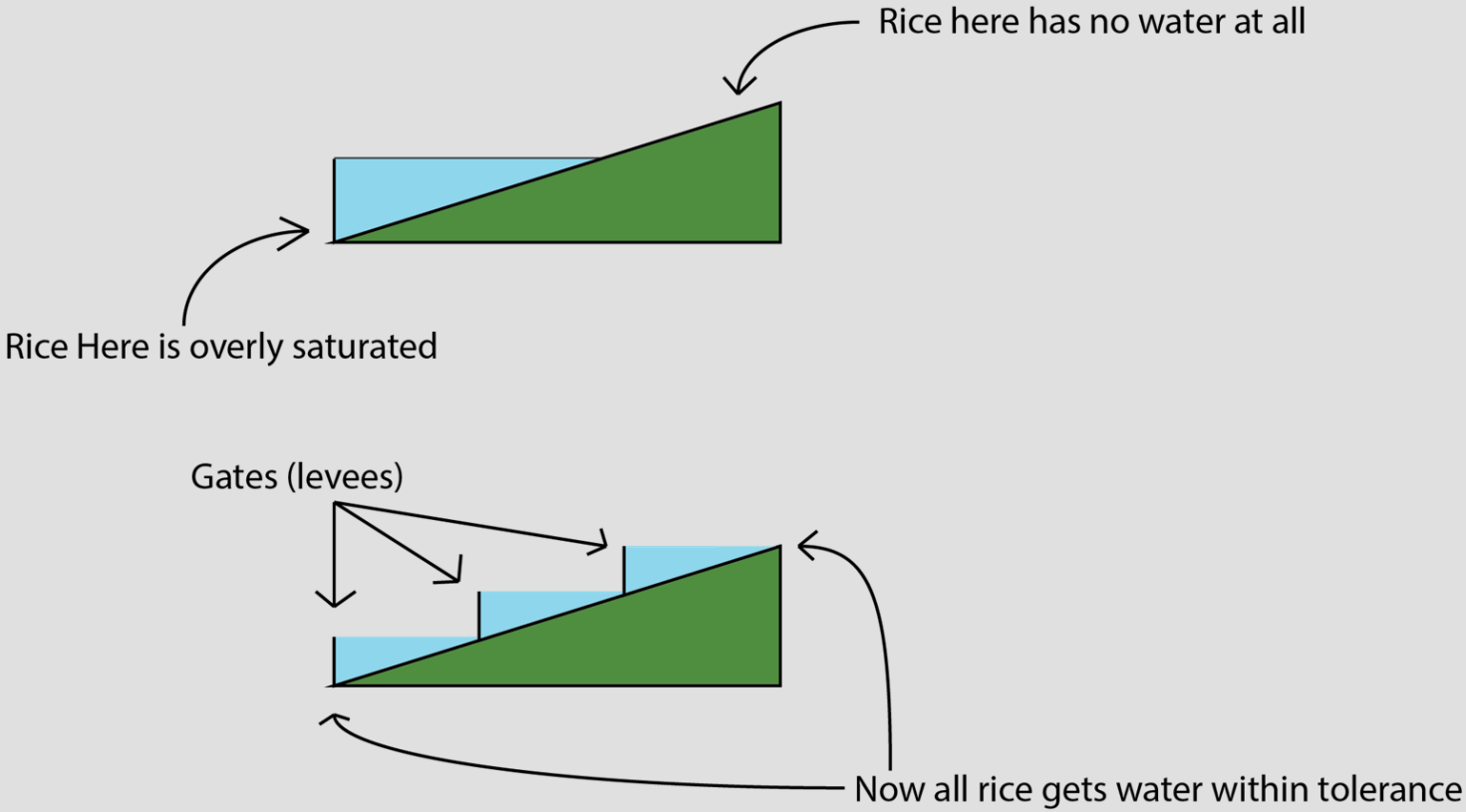
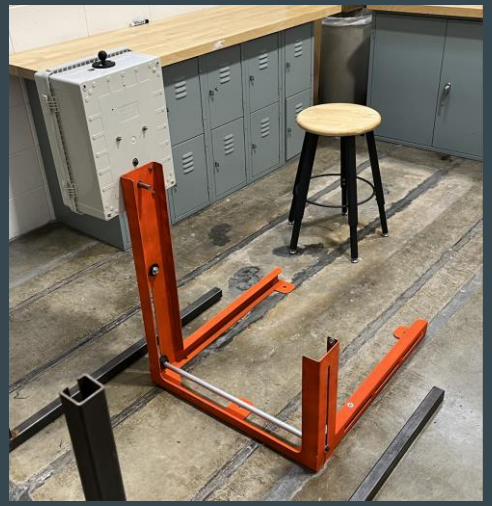
# Problem

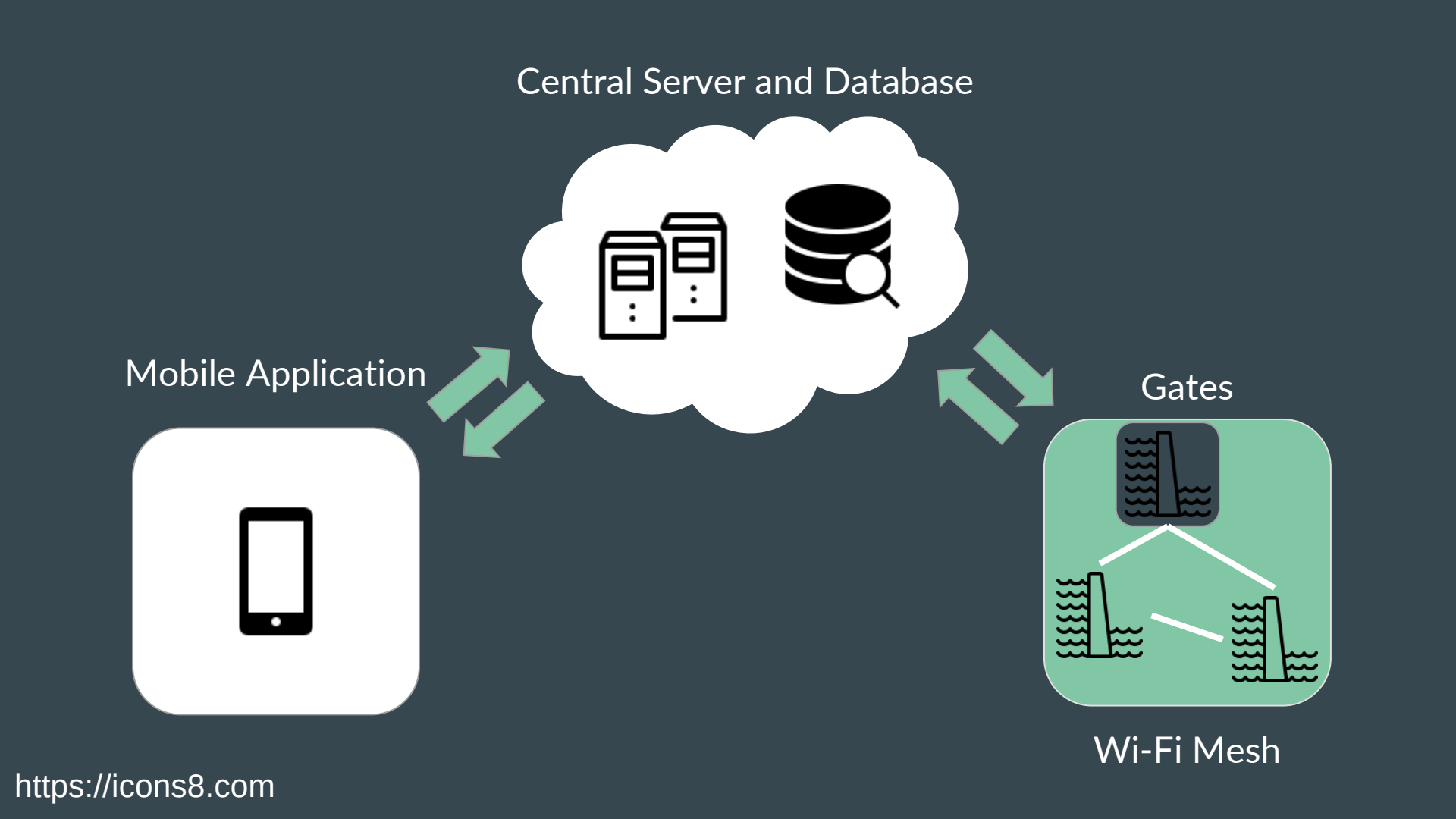
- Rice
  - Provides 21% of global human per capita energy
  - Provides 15% of per capita protein
  - US rice production exceeded $3 billion
- Alternate Wetting and Drying
  - Labor intensive
  - Prone to human error
  - Time consuming
  - Errors lead to lost yield, lost profit, and wasted water
- Growing strain on natural resources


Rice here has no water at all
Rice Here is overly saturated
Gates (levees)
Now all rice gets water within tolerance

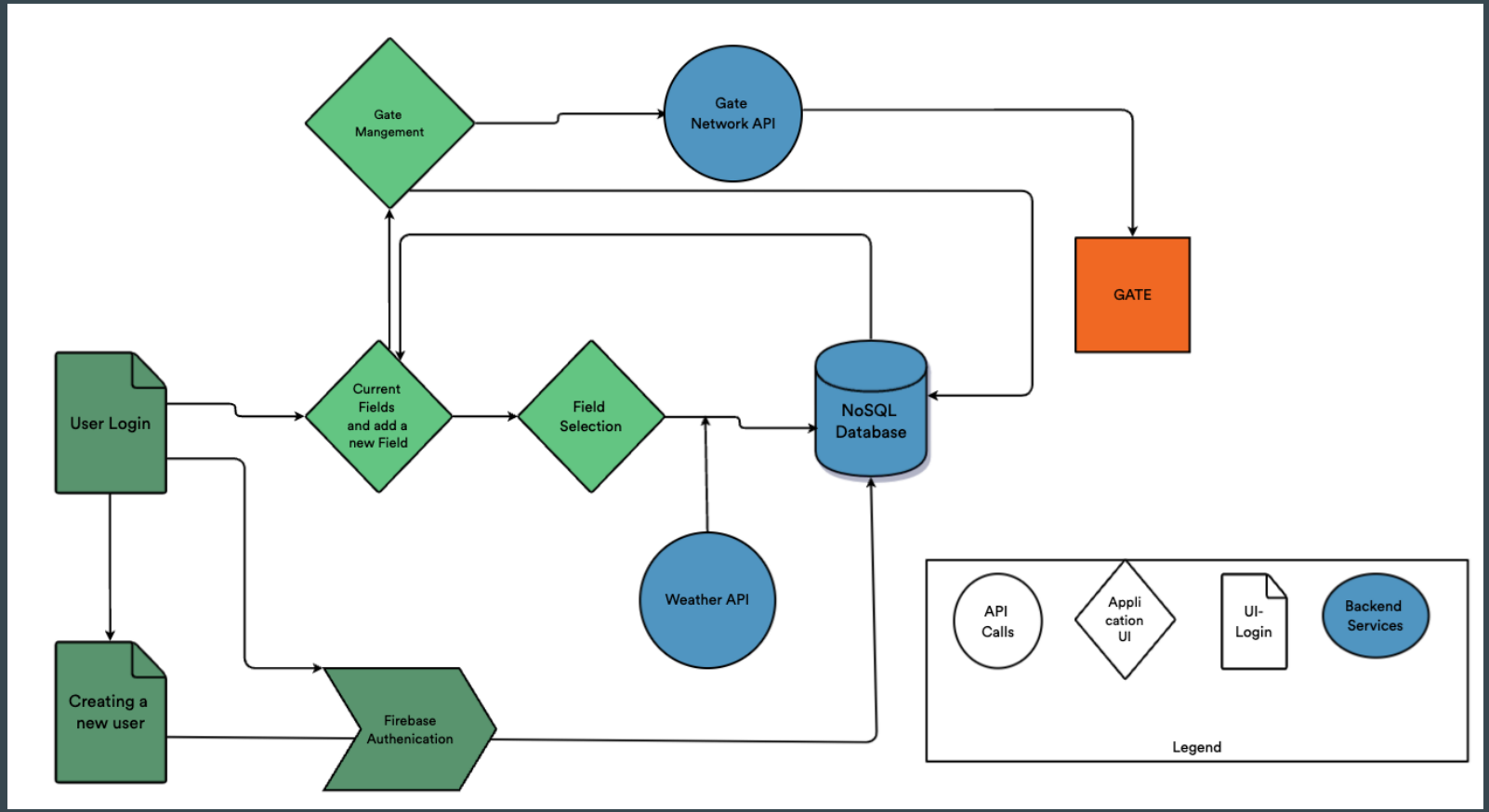
# Solution

- Mobile interface to raise and lower gates remotely
- Assist with the initial gate placement
- Keep user informed

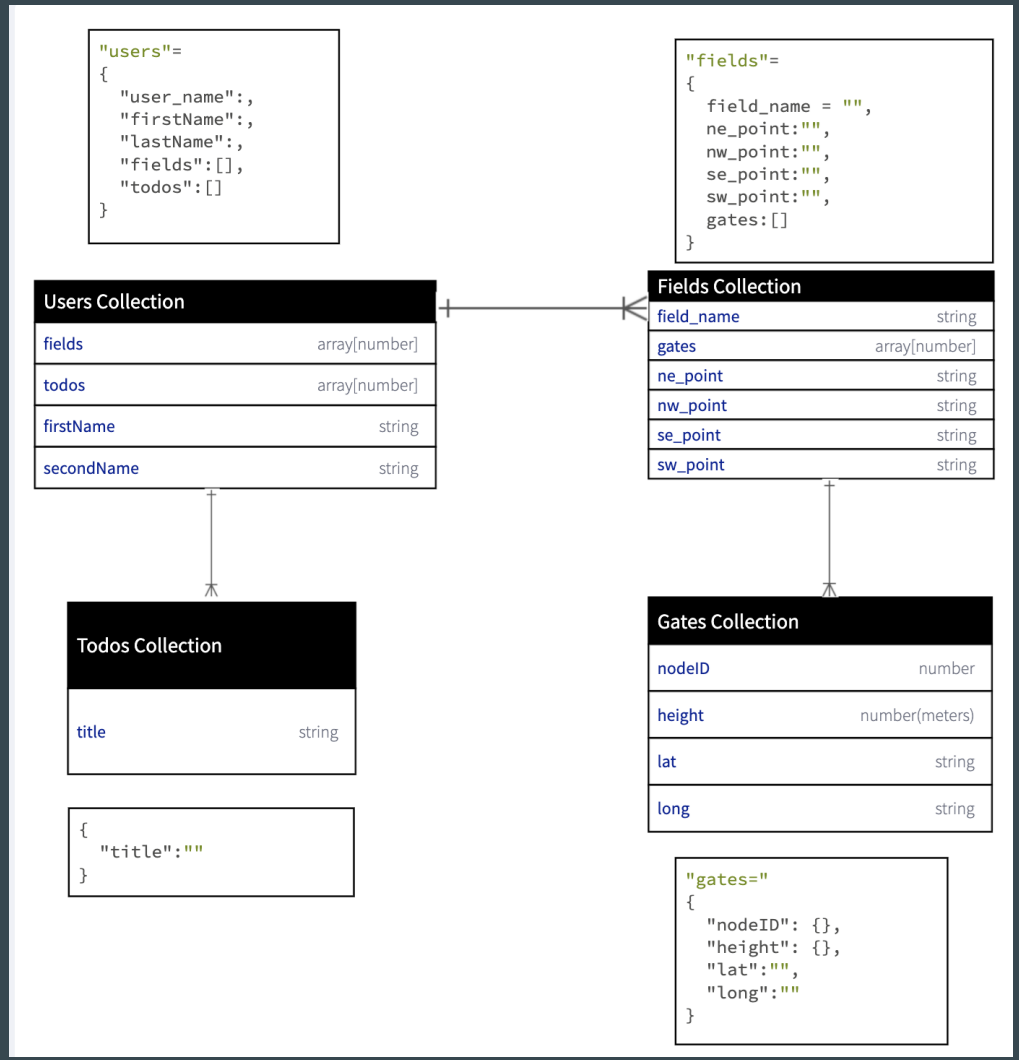



Central Server and Database
Mobile Application
Gates
Wi-Fi Mesh
https://icons8.com

# Updated High-Level Architecture

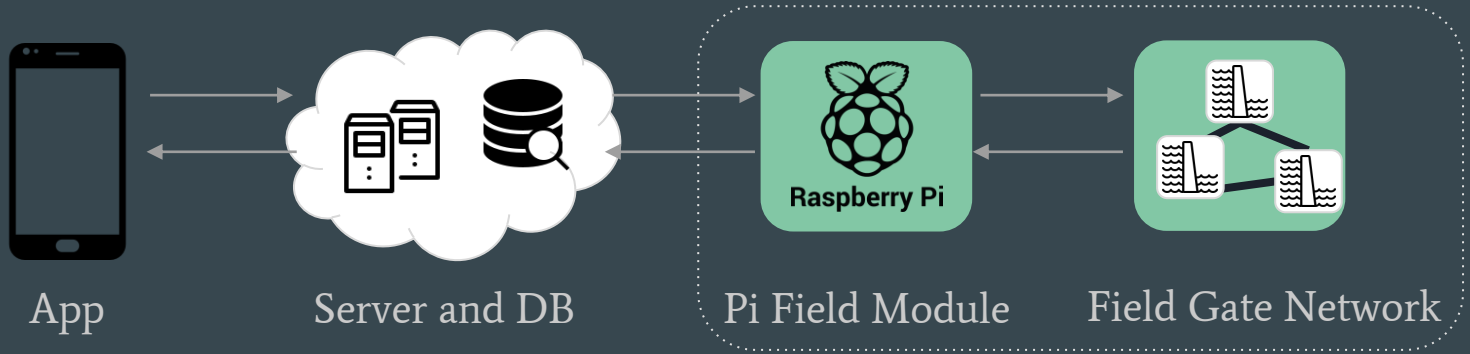


# Updated Database Schema



# Gate Network Architecture

- Mesh WiFi network allows for communication between gates across a vast field
- Gates have uniquely generated ids within the network
- Raspberry Pi module acts as an in-between for network and backend



# Connection to Front End

- Utilizing MVVM to separate design components and data
- Widgets observe data in viewmodels and are rebuilt anytime changes in state occur
- Viewmodels are singletons; accomplished using GetIt package
- All remote requests (except authentication) are served by application server

# Background Work

- Client application periodically queries application server for weather data
  - Enough rainfall will trigger a notification to the user

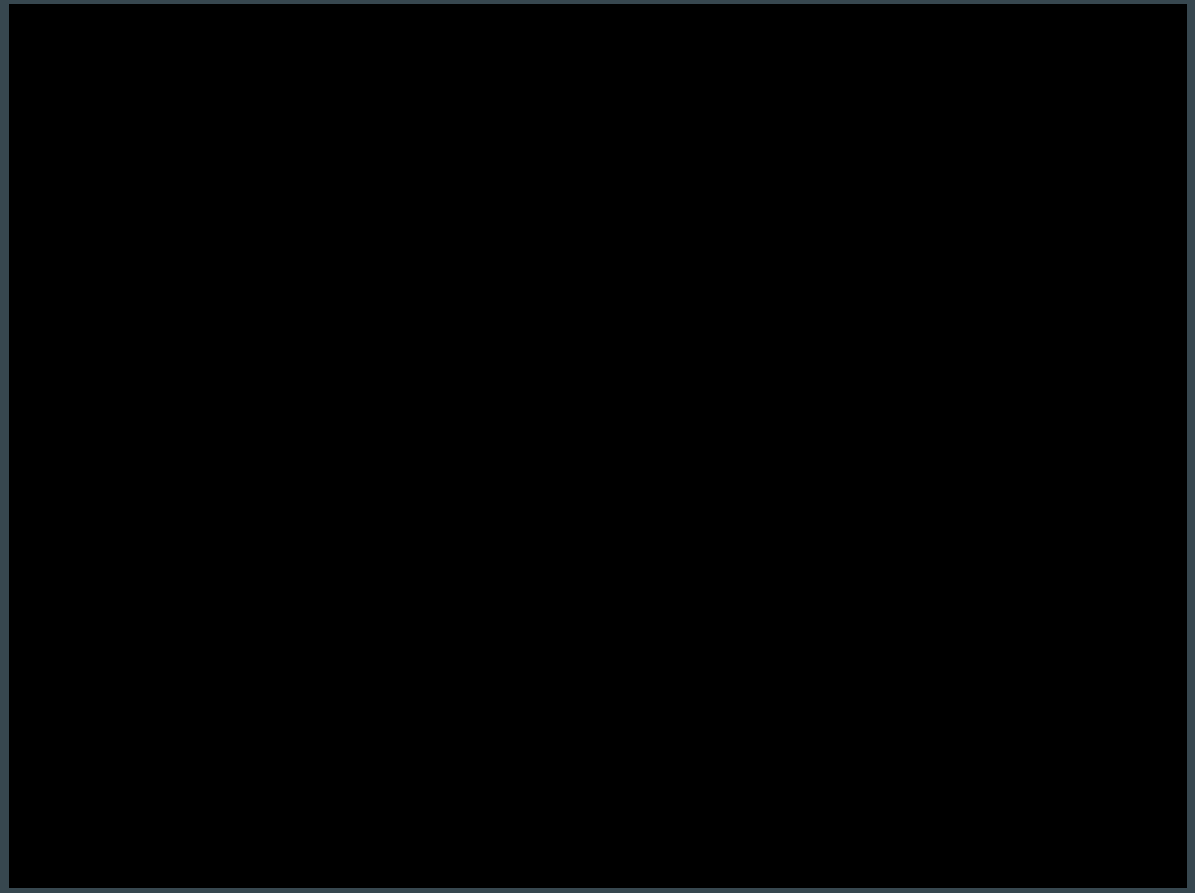
- Workmanager package schedules long-running, periodic background tasks

# Authentication

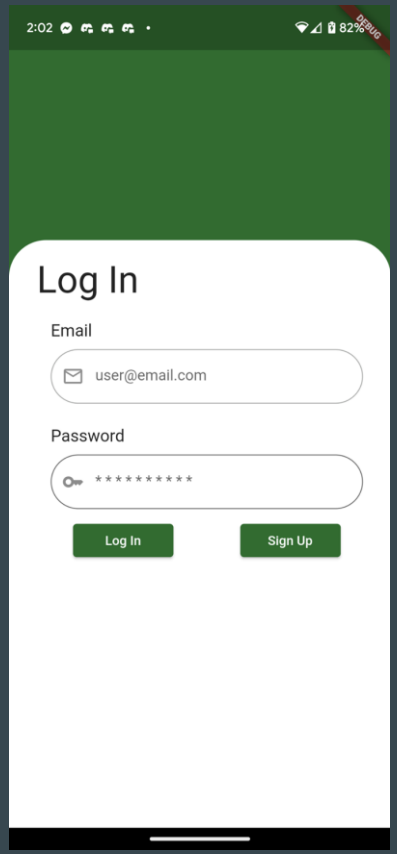
- Users sign up and log in using an email and password
  - Accomplished directly through the Firebase API

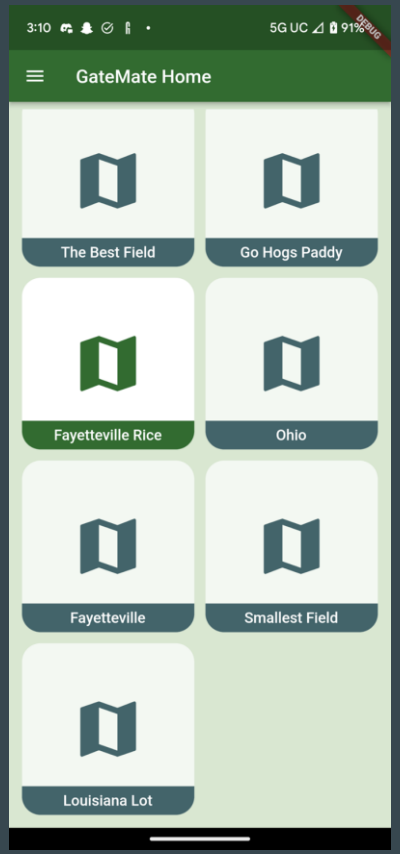
- All other online interactions take place through the application server
  - Client app obtains an authorization token using the Firebase API
  - Remote application server verifies the token using the Firebase API
  - All communications occur over HTTPS

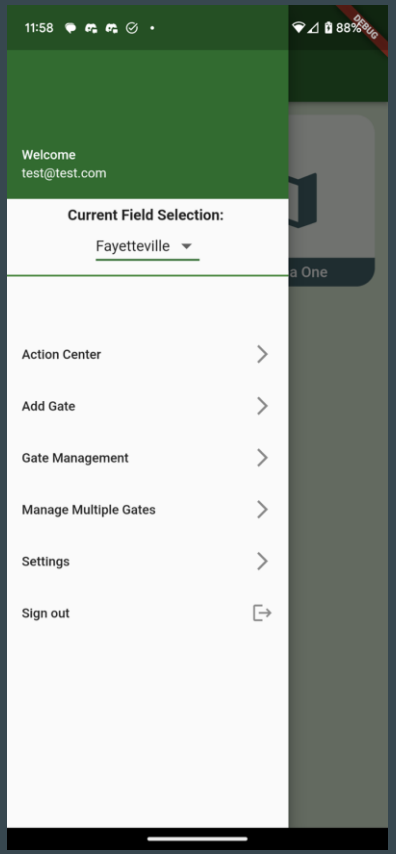
# Demo



# User Interfaces



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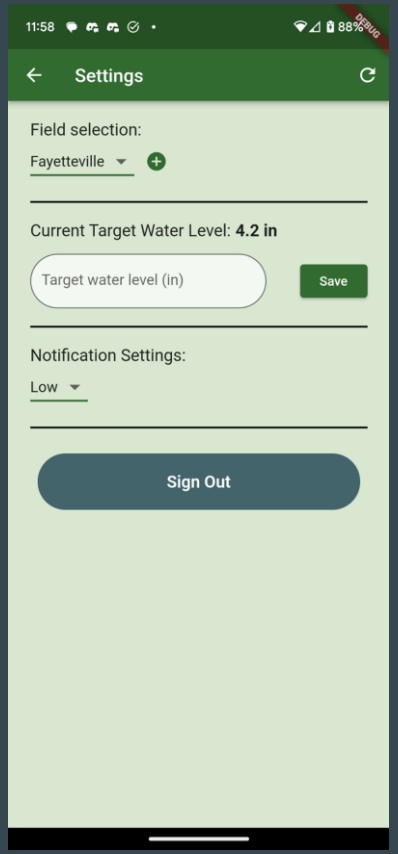


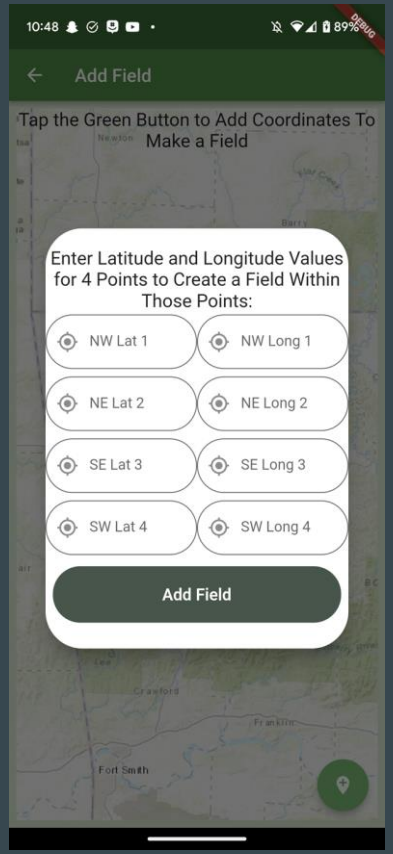


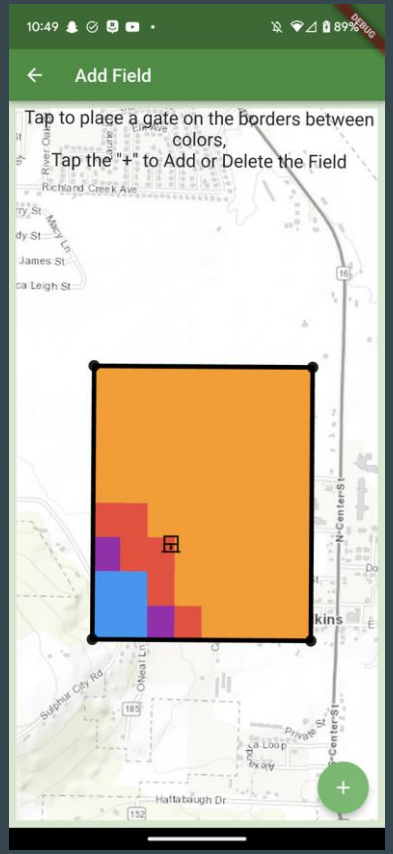


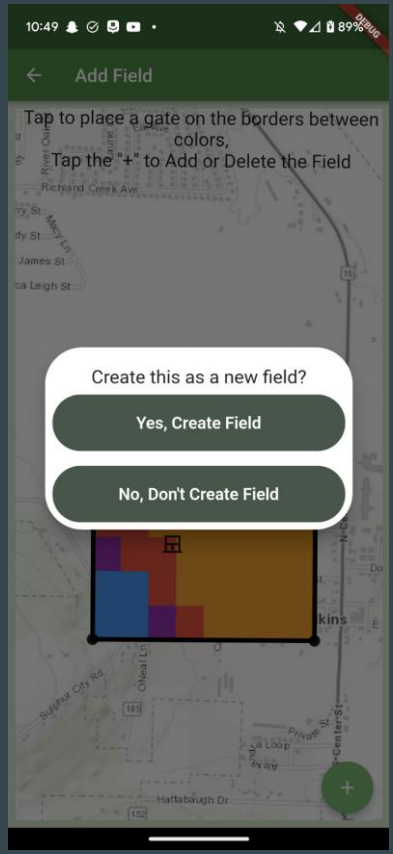

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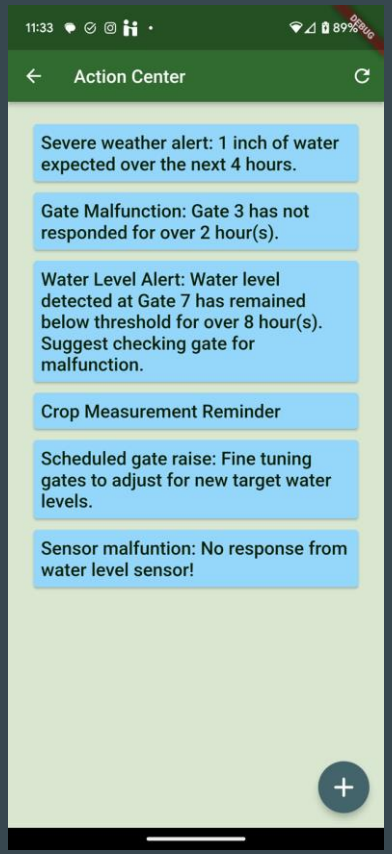


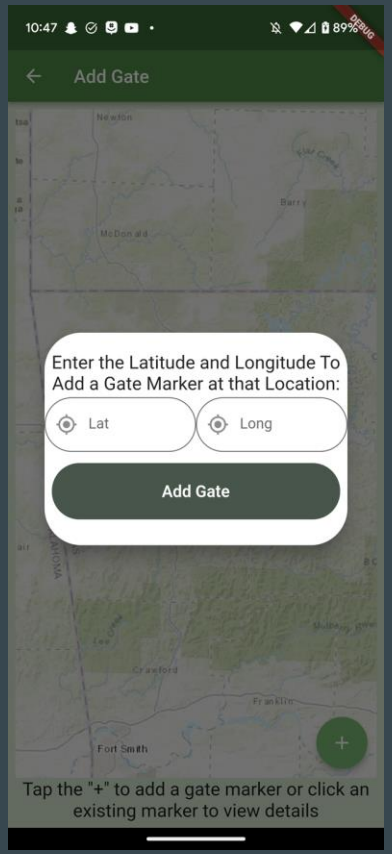


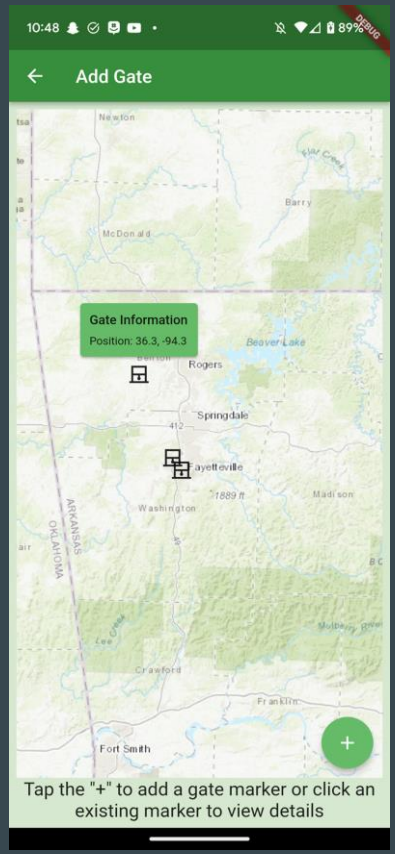

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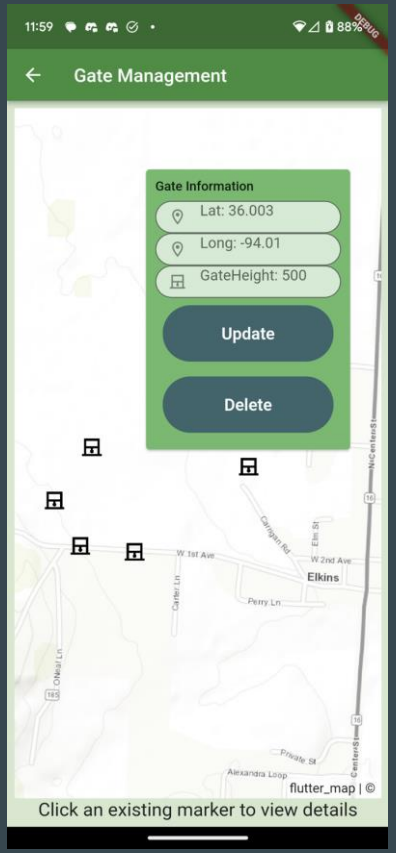
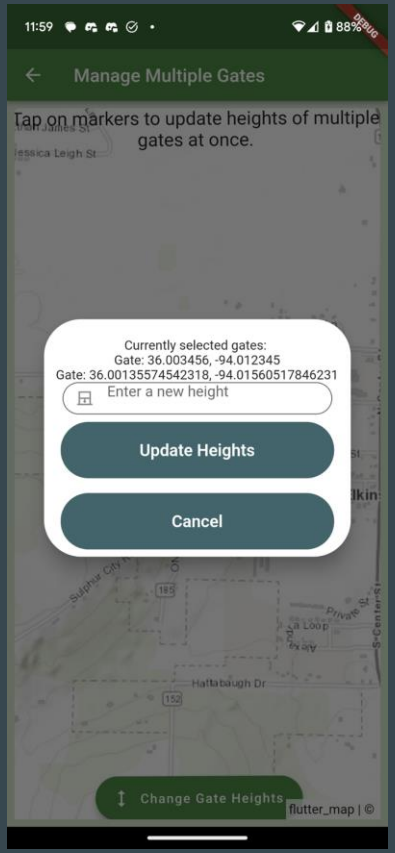






# Cost Estimates and Materials

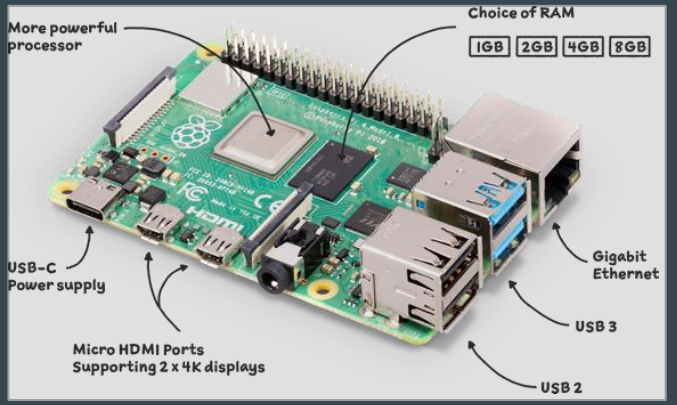
Per Gate:

- 1x ESP-32/ESP-8266 = $10

Per Field:

- Raspberry Pi 4 = $35
- Mobile Data Dongle = ~$20
- Mobile Data Plan = ~$20/month

Raspberry Pi 4




Mobile Data Dongle


https://www.raspberrypi.com/products/raspberry-pi-4-model-b/
https://www.amazon.com/EXVIST-Industrial-Adapter-Compatible-Connection/dp/B08GFM9536/ref=sr_1_4?keywords=sim%2Bcard%2Bdongle&qid=1682434321&sr=8-4&th=1

# Thank you!