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Permalink

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Publication Date

2022-03-21

Copyright Information

Peer reviewed

ZotPonics 3.0: A Smart and Scalable Hydroponics Network

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**Winter 2022**

BACKGROUND

We are faced with a future where there will not be enough land to produce food for the entire population. By 2050, the world population is projected to increase to about 9 billion people[2]. However, 50% of the world's arable land may be unusable by then, as traditional agricultural practices in the last 50 years have left 60% of all ecosystems degraded[2].

In an effort to mitigate these issues, producers are increasingly interested in controlled environment agriculture, especially in regions where there are concerns about soil and groundwater pollution[1]. One promising solution is hydroponics, a highly productive, resource efficient, and eco-friendly alternative to traditional farming[1].
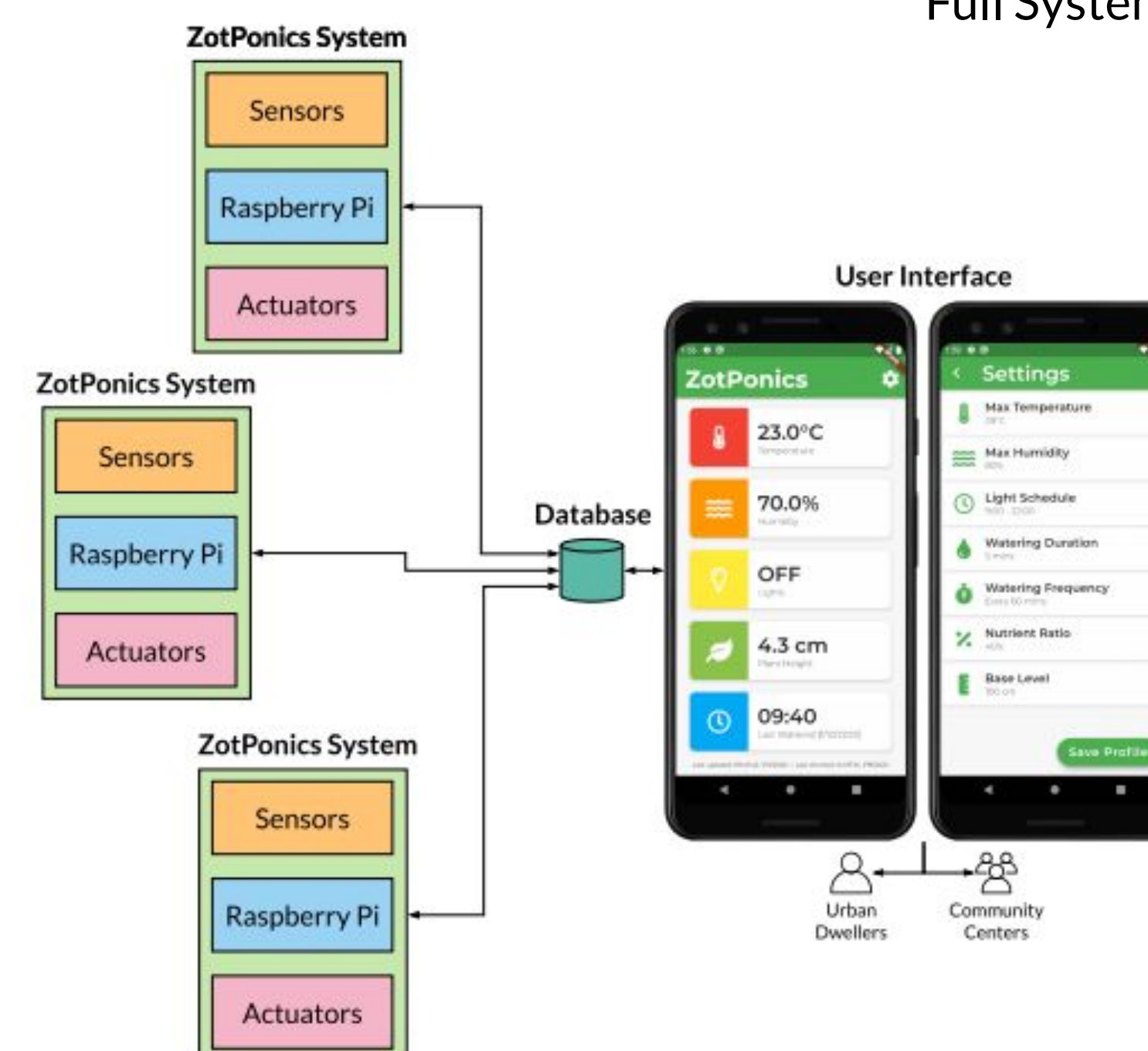
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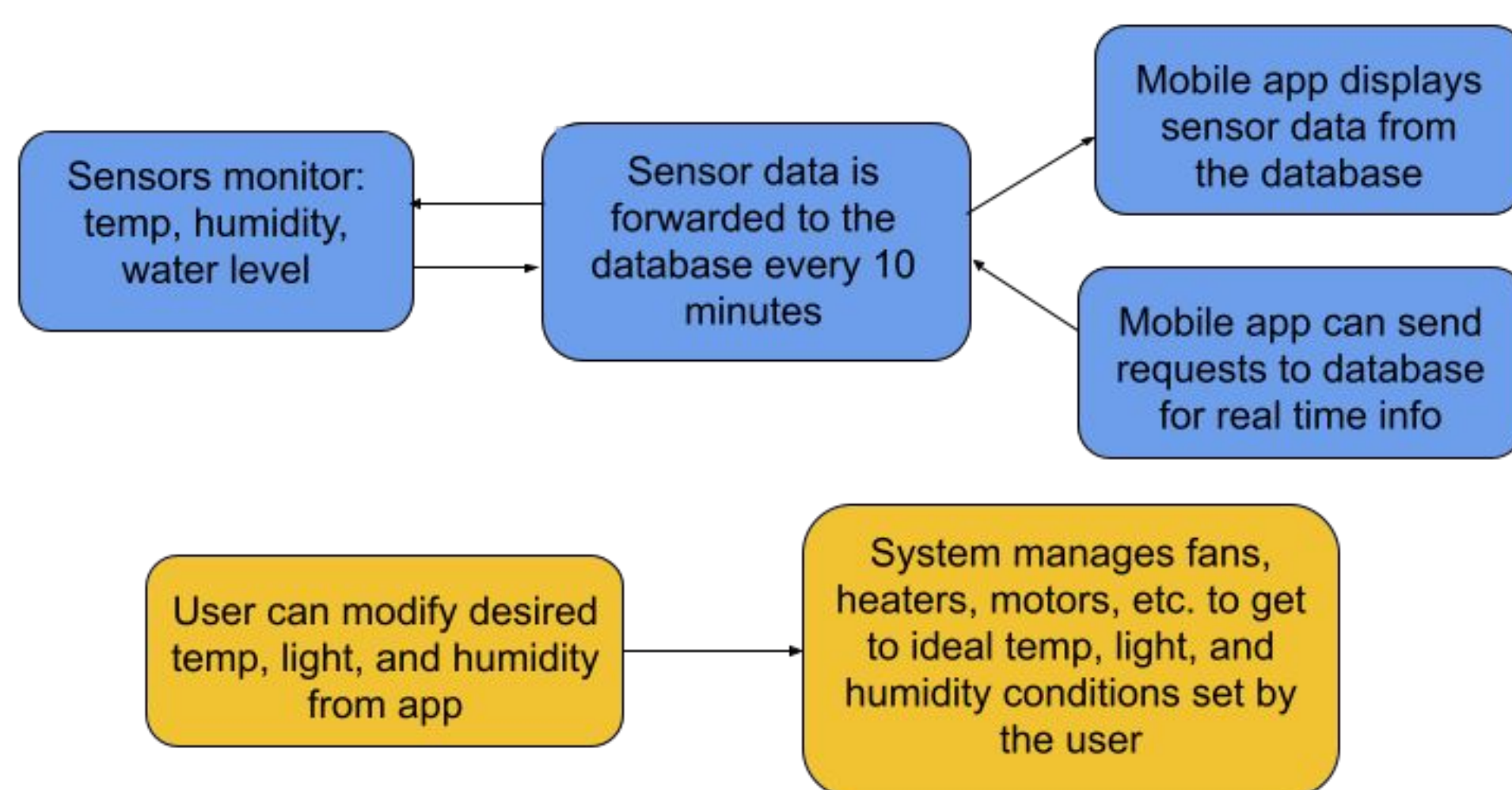
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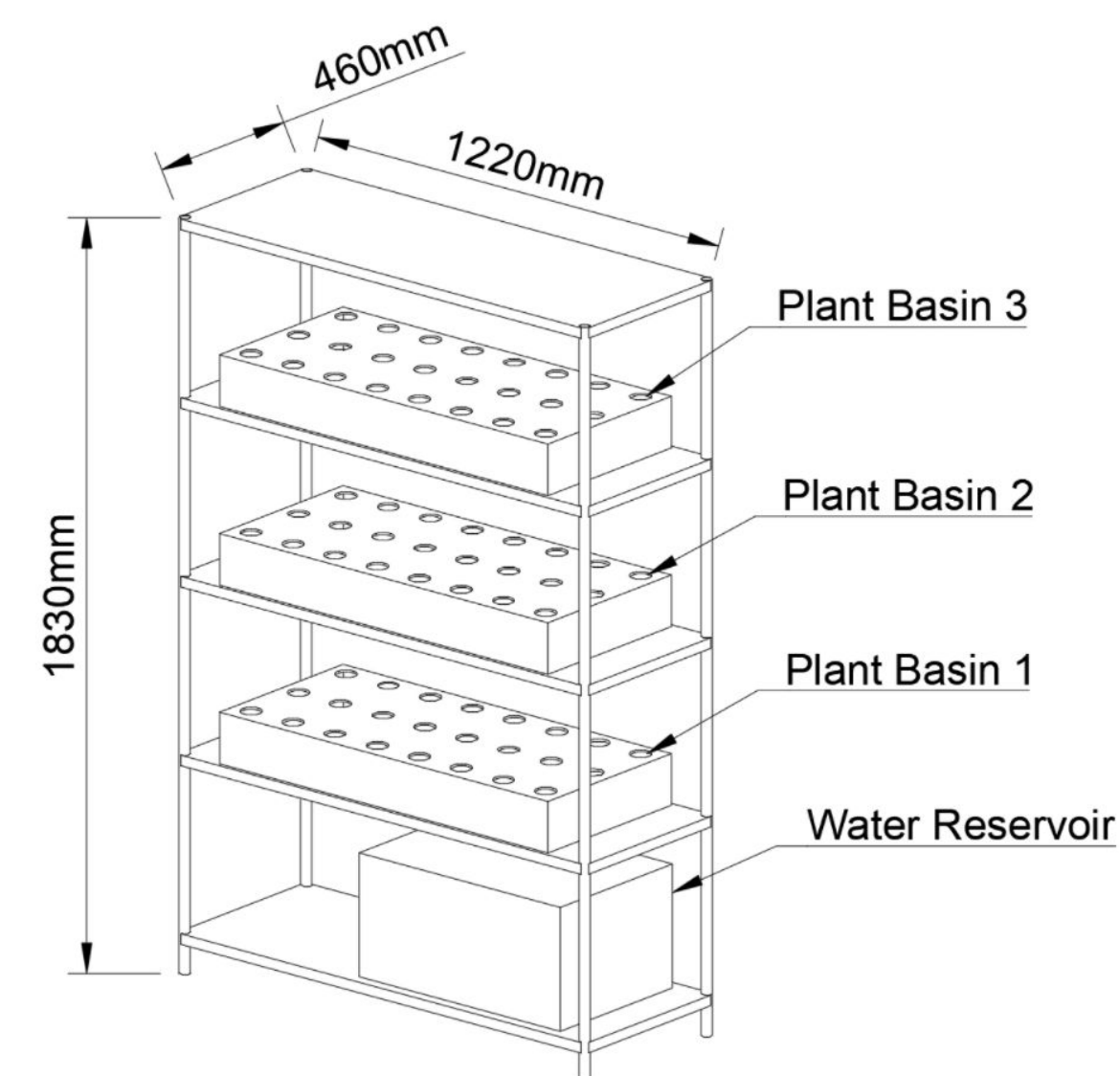
ZotPonics 3.0 Physical Schematic

Full System Build

ZotPonics 3.0 Systems Diagram

PROJECT GOAL

ZotPonics 3.0 is a continuation of the 2021 Senior Design project, which aimed to scale and improve the original ZotPonics system, a cost efficient, smart indoor hydroponics system that can be controlled on your phone. Our main goal is to install a completed ZotPonics system at the FRESH Hub. This year, we added additional features to the mobile application including social media integration, a search engine, and plant statistics. On the hardware side, we continued the previous year's work of expanding the unit to house 3 shelves.

RESULTS

- ✔ Test and debug version 2.0
- ✔ Mobile app views that display monthly plant statistics
- ✔ Local search engine and filters to sort through plants and shelves
- ✔ Enhance plant profile system to display plants on each shelf
- ✔ Test hardware design with breadboards
- ✔ Create system documentation
- ✔ Build operable system
- ✔ Integrate social media platform(s) into mobile app

IMPROVEMENTS/ FUTURE WORK

- ☐ Fix bugs with mobile application after initial use by FRESH Hub
- ☐ Host event with FRESH Hub to showcase the ZotPonics project and explain impact
- ☐ Schedule notifications when water reservoir needs to be refilled

MATERIALS

- Raspberry Pi Zero W
- 5V Fans
- LED Light Strips
- Ultrasonic Distance Sensor Module
- Temperature and Humidity Sensors
- Servos
- Real Time Clock Module
- 12V Relay Module
- Plant Basins and Reservoir
- Water Pumps
- 12V PSU

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