ZotPonics: A Smart and Scalable Hydroponics System

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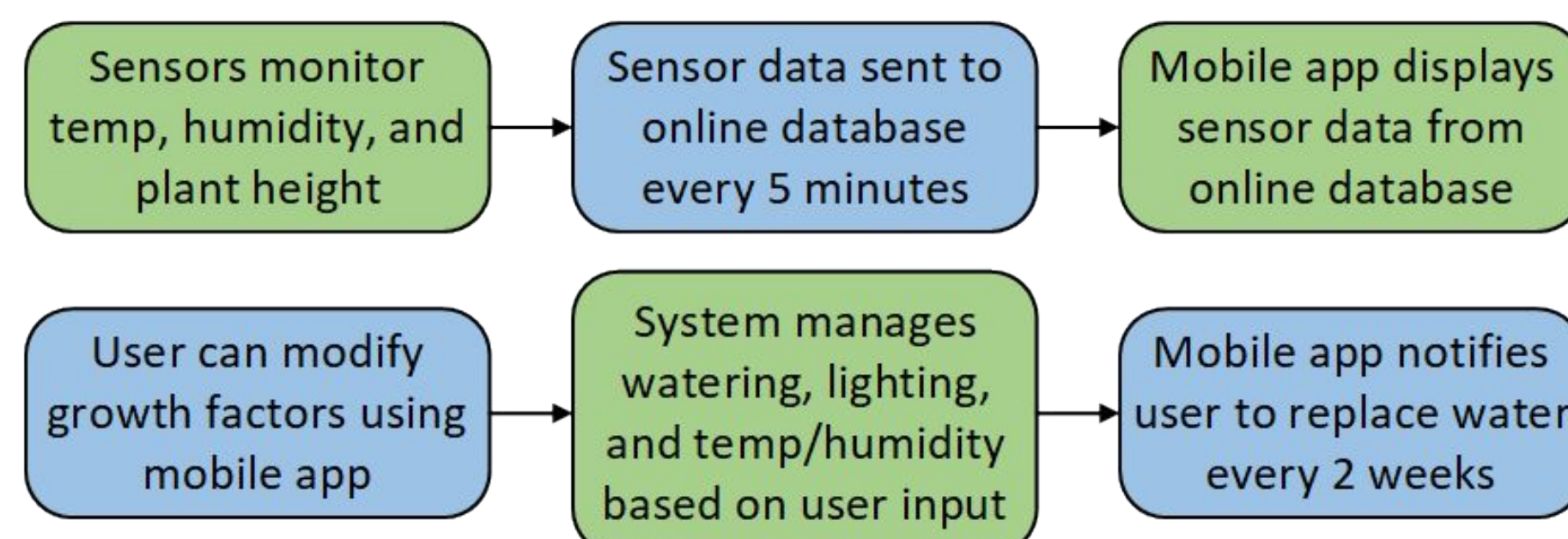
Winter 2020

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].

PROJECT GOAL

ZotPonics is an automated indoor hydroponics system that allows users to grow plants inside their homes. The farm will automatically distribute water to plants and maintain specified growing conditions. Our system will include a mobile app allowing users to monitor and control the farm as well as notifying the user when human intervention is required.

IMPLEMENTATION

- Sensors monitor temp, humidity, and plant height
- Sensor data sent to online database every 5 minutes
- Mobile app displays sensor data from online database
- User can modify growth factors using mobile app
- System manages watering, lighting, and temp/humidity based on user input
- Mobile app notifies user to replace water every 2 weeks

REFERENCES

1. Jensen, Merle H. "Hydroponics." HortScience, vol. 32, no. 6, Oct. 1997, pp. 1018–1021., doi:10.21273/hortsci.32.6.1018.
2. Okemwa, Ezekiel. "EFFECTIVENESS OF AQUAPONIC AND HYDROPONIC GARDENING TO TRADITIONAL GARDENING." *International Journal of Scientific Research and Innovative Technology*, vol. 2, no. 12, Dec. 2015, pp. 21–52.
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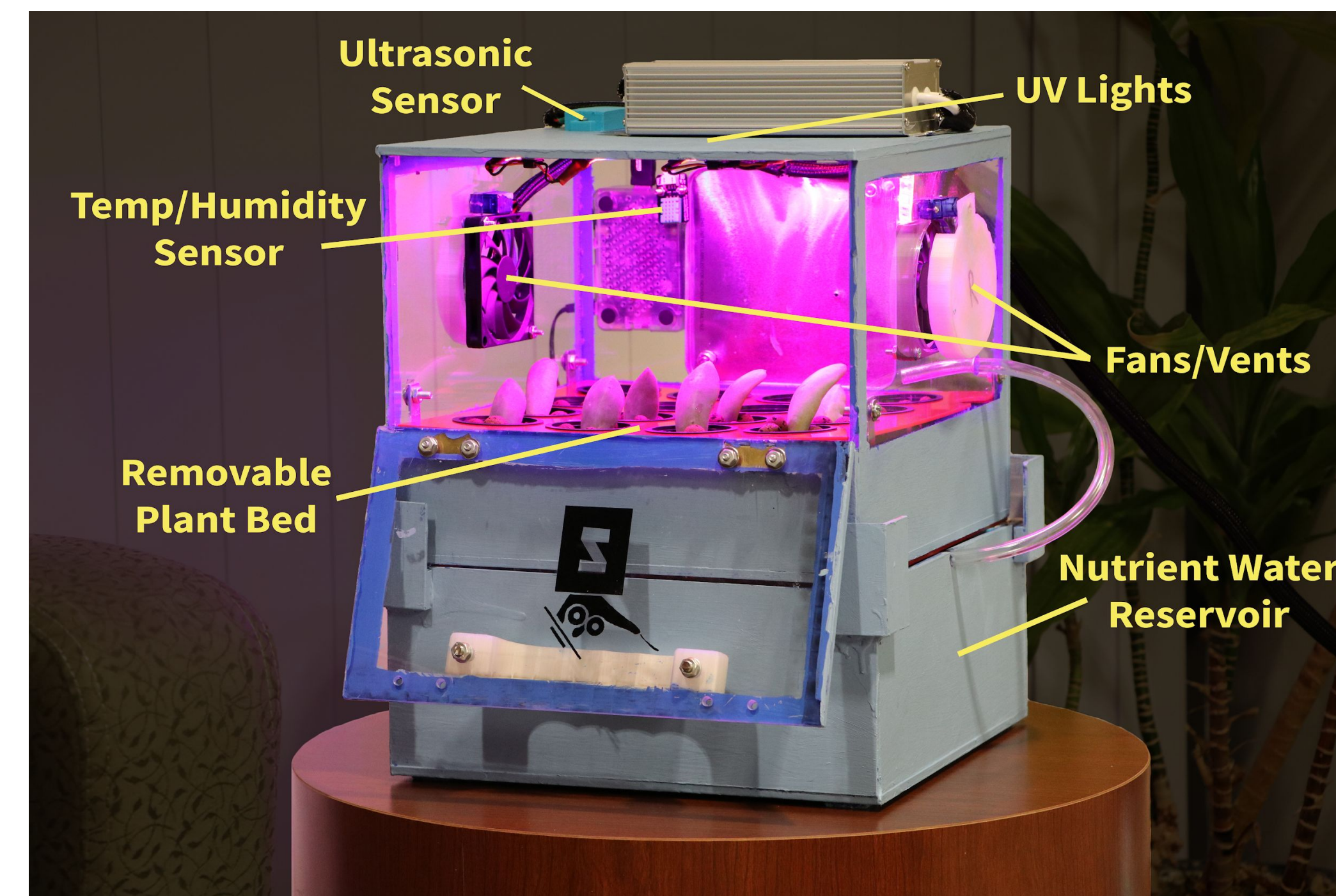
DIAGRAMS
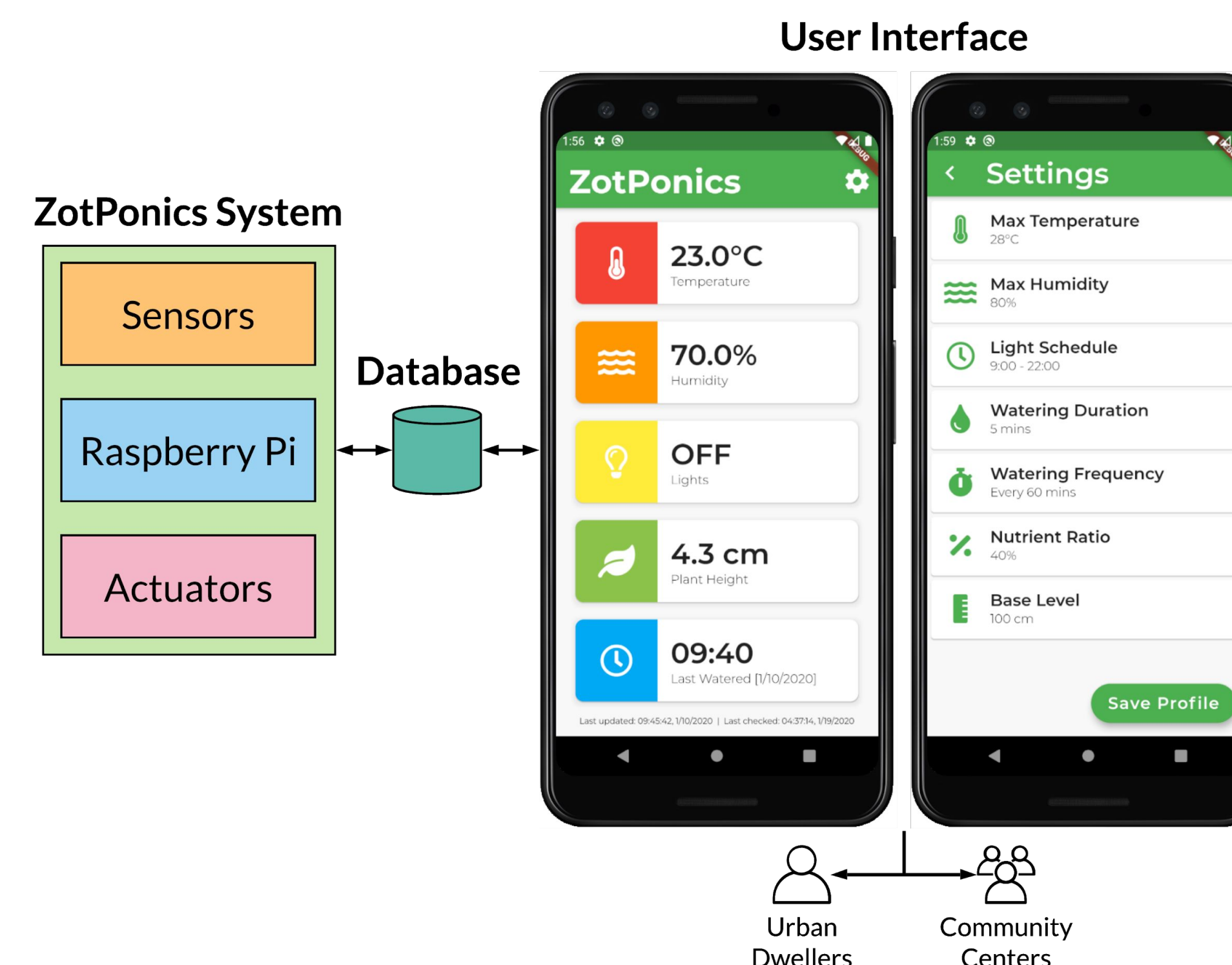

Figure 1. Structural Diagram

Figure 2. Systems Diagram

RESULTS / IMPROVEMENTS

- ✓ Completed initial ZotPonics system
- ✓ Tested farm system by growing microgreens
- ✓ Partnered with FRESH Basic Needs Hub
- ✓ Implementing farm system at FRESH Hub in Spring
- ☐ Plans to implement large-scale ZotPonics system at FRESH Hub in the future

UCI News

Rookie researchers

UCI undergrads partner with faculty in projects promoting sustainability

by Eliza Partika, UCI | February 14, 2020

Quoc-Viet Dang (left), UCI assistant professor of teaching in electrical engineering & computer science, is faculty mentor for the ZotPonics undergraduate research project. Team members are (from right) Owen Kai Yang, Kathy M. Nguyen, Sidney Lau and Jason Chour Lim. Steve Zylius / UCI

Figure 3. ZotPonics feature in UCI News[3]