Smart Greenhouse

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Executive Summary

Earthwise is a smart greenhouse that provides the ideal growing environment for plants, while requiring very minimal intervention from the user. Earthwise regulates the conditions inside the greenhouse, providing the perfect temperature, light, humidity, and moisture levels needed for the plant to grow and remain healthy. Users can use the Earthwise mobile application to select the environment settings that their plant needs. Using the Earthwise app, users can also create custom settings to accommodate any plant as well as to monitor the conditions inside the greenhouse and to receive alerts in the case of an emergency.

Background

The process of gardening can often be a tiresome and challenging task. Providing the ideal environment for plants to thrive in is difficult, as it requires for the gardener to regularly monitor the amount of light and water the plant receives, a task which is tedious and time-consuming. People often grow overwhelmed and discouraged when attempting to keep their plants healthy, leading them to give up on gardening all together. In recent years, however, there has been growing distrust among the public about the pesticides and fertilizers used in industrial agriculture and the adverse effects they may have on people's health and the environment.

This, among other reasons, is why people are now becoming more interested in gardening. Products readily available in the market aimed at helping inexperienced gardeners grow healthy plants, fail at providing a solution for busy people who do not have the time or patience to nurture a garden. The few products available on the market which solve this problem by automating the process of gardening, are expensive and require for the costumer to use special hydroponic pods which need to be repurchased every time they wish to plant new fruits and vegetables. The aim for our project is to provide a solution that makes gardening simple by requiring little to no intervention from the user. Our greenhouse improves on other automated gardening systems as it does not require special soil and it regulates temperature, light and humidity which differs from other systems that only water plants.

Requirements

- Greenhouse should be able to self regulate environmental conditions automatically using Arduino Uno WiFi Rev3.
- Greenhouse control 5 main systems, temperature, irrigation, lighting, fire extinguishing, and display system.
- The watering system will activate when the soil moisture is to low.
- The lighting system will activate the growth lights when below optimal light.
- The temperature system will activate the heater to heat the greenhouse and activate the fans to remove heat depending on the plants needs.
- The display system will display all greenhouse information to a LCD as well as update the android app to allow user to see greenhouse data.
- The Fire extinguishing system will notify user of fire and take action to potential damage.
- Greenhouse environment data will be uploaded to a firebase database for each user.
- An android application called "Earthwise" will be developed to allow users to make an account and monitor their greenhouse.
- The user can designate desired greenhouse settings through the Earthwise app.
- The user can create custom guides that better fit their needs.
- Earthwise app will alert the user in the event of an emergency or low water levels.
- Code for the Arduino system, android application, and firebase will be managed at https://github.com/Earthwise-SD/smartgreenhouse

Detailed Design Phase

The Architectural Design Specification of the Smart Greenhouse will have six layers: Control and Communication, Irrigation, Temperature, Light, Fire Extinguisher, and Display. The main processor of the Smart Green House will be Control and Communication layer. The purposes of other systems, except the display system, are to provide useful values such as soil moisture level, light duration, and other necessary data, and be controlled by the control and communication layer based on usersâ settings of an Android app. The Display layer has the responsibility to display the current status of the Smart Greenhouse.

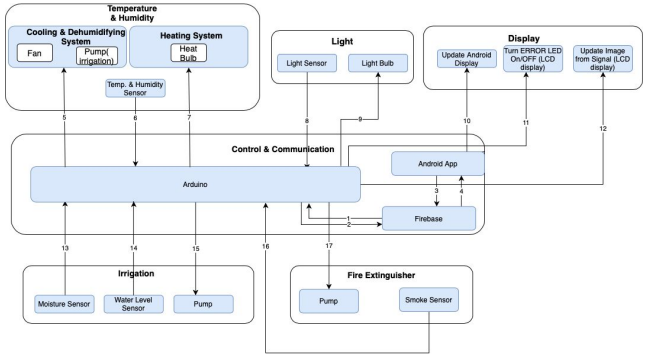

Figure 1: Description Diagram

Prototypes & Testing

Figure 2: App Login Screen

Figure 3: App Greenhouse State

Figure 3: App Guides

Figure 4: App Add Guides

Figure 5: Firebase DB

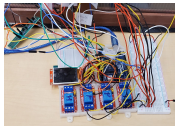

Figure 6: Arduino System

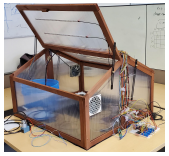

Figure 7: Complete Greenhouse

Future Requirements

Our project is far from perfect as we were unable to meet certain requirements because of time and budget limitations. So we have listed few requirements that can be covered in future so that the product will be ready to hit the market.

- Algorithm needs be updated to avoid delays in code and if possible to support parallel processing.
- More testing needs to be done on developer site as well as user site.
- Electrical short circuits and fire needs to be handled in safer manner.
- User manual needs to prepared.
- A better approach is needed to control humidity inside greenhouse. Currently, we can only turn the fans and water on.
- Solar battery can be a good upgrade so that greenhouse can be easily used outdoors without any power problem.
- Wiring needs to managed and circuits need to protected inside some 3d case to minimize any water damage or any external interference.

Conclusion

The way current tech is changing and evolving everyday, our team realized maybe there is a need for a change on gardening techniques. Although the big farms and conservatories aren't new to these technologies, we don't think there is enough knowledge and infrastructure for general people who want to pursue gardening for their hobby. So the smart greenhouse hub we designed was small effort of our team to change the traditional gardening ways and make it smarter using current technologies.

Our mission was to keep this project as simple and user friendly as we can and also within the budget limit of general people. We hope we were able to at least inspire other people to continue this project or similar project like this and take it to newer heights so that gardening techniques can get smarter and easier.