Automatic Nurturing Terrarium (ANT)

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Team members:

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1 Project description

In today's climate of individuals with increasingly busy schedules, it can be difficult to keep track of everything you have to do on a day-to-day basis. One of which is keeping personal plants in the proper condition. Too often house or garden plants will go neglected because hard-working individuals don't have time to keep up with the task or they simply forget about it. The Automatic Nurturing Terrarium (A.N.T.) looks to solve this problem. Our terrarium/pot implements luminosity and moisture sensors to measure the current water level of the soil and the amount of light in the environment around the plant. If the moisture level gets too low, the pump-fed system will push water into the soil for optimum consumption. Likewise, if the light in the environment is not correct, the LED lamp will brighten or dim to the optimum point. The A.N.T. allows for users to simply fill the water container and forget about it for weeks on end. Once the water-level gets too low, the system will alert the user to fill up the container. This greatly reduces the frequency in which customers will have to water their plants. The A.N.T. smart-home app offers intuitive control from a smartphone or tablet and tracks the data of plant growth and other measurements to store them in a database for user reference. This app will allow for real-time observation of the plant-condition as well as the ability to control the height of the lamp if needed. While our product keeps everything in a constant state of homeostasis, customers can feel confident that their plants are being taken care of without having to stress over yet another daily task.

The robust design of the A.N.T. allows for a flexible implementation of the system. The built-in LED lamp can extend/retract based on the size of the plant over time. In other smart terrariums that include LED lamps, the light is fixed. This restricts the size of the plant that can be placed in the terrarium. Our product allows for a wide range of plants to be nurtured at a much lower cost than competitors. Overall, the superior cost, flexibility, and accuracy of the A.N.T. make it the best choice for smart-terrariums.

2 Background

This article discusses about the issues the world faces with water scarcity and how to use automatic irrigation system to prevent those issues. It provides a foundation on implementing the project with graphs and circuit information along with how it could be properly be wired on the Arduino board.

S, N. (n.d.). Automatic Plant Irrigation System using Arduino. Retrieved February 08, 2021, from https://www.ijser.org/researchpaper/Automatic-Plant-Irrigation-System-using-Arduino.pdf

This article is based on a more advanced project that was implemented on improving agriculture in third world countries. It uses more sophisticated components and parts to create the project that is somewhat

alike to ours. This article will help us to find out what type of sensors and detectors we would need to order for our project.

Alejandro Giraldo Santiago, G. (n.d.). Smart Crops: Implementing IoT in Conventional Agriculture! Retrieved February 08, 2021, from https://create.arduino.cc/projecthub/gabogiraldo/smart-crops-implementing-iot-in-conventional-agriculture-3674a6

This last article will help us with properly connecting the wires and provide us with reference Arduino codes. We still would need to change the code since we will be adding light sensors which will turn the bulb on with different light intensity. This project will also give us an idea to further improve our project for senior design class where we can add servo motor to change the hose angle to water different plants.

Team, E. (2021, February 02). Automatic plant watering SYSTEM: Full circuit with source code. Retrieved February 08, 2021, from https://www.electronicsforu.com/electronics-projects/hardware-diy/automatic-plant-watering-system

3 Context:

3. 1 Ethical

N/A

3.2 Professional

N/A

3.3 Global

Though the project is geared towards the care of houseplants, in the future the project could be upscaled to something much larger. The project will serve as a further step towards automation which will make plant care easier, and thus may one day expand to assist in farming.

3.4 Economic

In certain parts of the world water is a very scarce resource, the same goes for electricity. While using the Automatic Nurturing Terrarium (A.N.T.) the automation process ensures that only the exact amount of water and lighting needed are used. This helps customers to conserve both while also not endangering their plants lives by guessing how much water they need. The A.N.T. operates at maximum efficiency there for saving money and sacred resources by only feeding the plant what it needs, when it needs it.

3.5 Environmental

Growing crops and plants are difficult no matter how extensive your expertise is in the matter. If not taken care of around the clock they will wither and turn into a waste of space, soil, and water. The Automatic Nurturing Terrarium systems will work to eliminate this waste with precision plant caregiving. (A.N.T.) will maximize the growth and development of plants by keeping them in constant photosynthesis. The (A.N.T.) will be processing data from a light sensor and soil humidity sensor to ensure that the plant is getting the precise amount of food to ensure it produces the max amount of growth. This automatic precision will not only eliminate the need for constant care and scary fertilizers but also maximize output. This product will therefore be minimizing the harsh effects on farm fields due to over watering and over planting because

of expected low produce output. This product will also make it possible for very dry regions to grow crops without giving away unneeded amount of water or energy. All in all, this product will help the environment by maximizing results, reducing waste, and completely cutting out the overuse of very important resources for those who need it most.

3.6 Societal

In our increasingly busy society, it is hard to find time to take up hobbies such as tending to a plant, which may also be part of an effort to protect our environment. With this system, people will be able to keep a plant in their home without thinking that it will die like all the other forgotten plants and focus on other aspects of their lives.

4. Detailed design plan

Hardware:

- Sensors (Dylan)
    - To measure the humidity of the soil and the light reflection, a fork shaped sensor will be placed on the soil and the light detector will be placed on the edge of the pot.
    - Readings from those sensors will be sent to Arduino board where further actions will be taken.
- Power (Luke)
    - The best option for this device would be directly connected to the outlet since the plant will be not be moved from its location.
    - The power should both charge the pump, the lamp, and Arduino at the same time.
- Lamp (Luke/Dylan)
    - There will be a lamp that will be dimmable and be attached to the pot. It will be paired with Arduino and light detector where it will work in accordance with light intensity.

Software:

- Sensors (Han)
    - There will be a code that will read the information from the detectors and constantly up-date it which can be changed easily.
    - The code will be set the minimum humidity and light intensity where either pump or lamp will be activated.
- Lamp (Chandler)
    - The lamp will have code with relay and the light detector will send signal if it needs to be activated or not. It will be updated once in a while.
- Pump (Isaac)
    - Similar to the lamp, the pump will be updated by the humidity detector whether the plant needs water or not.
- User Interface (Han, Chandler, Isaac)
    - In the future, we hope to develop an app that will tell the owner of the plant how much water and light the plant needs and gets from the device. With future improvements, the user should be able to pick a plant type and size where the app will automatically adjust the needs for healthy growth.

5. Responsibilities

The group leader is Han. Han has a variety of technical information, and he is a strong guide for what direction this project will take. Han, Chandler, and Isaac are comfortable with programming and will be designing the Arduino code utilized in the project. Luke has expressed that he is interested in working in the circuitry and that he works well with his hands and a concrete system in front of him, so he will be the lead on our circuitry construction. Dylan will be assisting him as he is more knowledgeable with circuits rather than programming. Project presentations and documents will be a collaborative effort involving all members.

6. Timeline

Each minor assignment will be completed 3 days prior to the due date and be internally review. Major assignments will be completed 5-7 days prior for thorough internal inspection

Week 6: -Finalize project proposal
-Team members work together to complete their assigned parts to completion
-Parts order #1
-Programming and design team work together to identify parts needed to complete project and put together a cost-efficient list that is ran by Lab mentor.

Week 7: Design Review 1 (10-12 minute overview of project to Lab peers) - February 21
-Whole team does a rehearsal mock presentation to identify weaknesses 3-5 days prior and again, on day of project to identify possible questions from peers
-Team evaluation #1
-Team does evaluation individually and then meet in person to address possible prob-lems within group that need to be addressed
-Parts order #2
-Team identifies any extra parts needed that were overlooked

Week 8: Peer Review of Design Review 1
- Team completes and meet as a group to identify peer review of our project and talk over any concerns peers may have about the project.
-Complete parts order #2

Week 9, 10: -Work on project
-Team works together to get as much done in time frame as possible

Week 11: -Team Evaluation #2
-Team does evaluation individually and then meet in person to address possible problems within group that need to be addressed.

Week 12: - Work to finalize project prototype

-Team works together to get as much done in time frame as possible

Week 13: -Venture Capital Video presentation (90 second elevator pitch)
- Whole team does a rehearsal mock presentation to identify weaknesses 3-5 days prior and again, on day of project to identify possible questions from peers

Week 14: -Design Review 2 (10- 12 minute overview of project to Lab instructors) April 11
- Whole team does a rehearsal mock presentation to identify weaknesses 3-5 days prior and again, on day of project to identify possible questions from peers
-Team Evaluation 3 – April 27
-Demo project prototype - April 27
- Whole team does a rehearsal mock presentation to identify weaknesses 3-5 days prior and again, on day of project to identify possible questions from peers

Week 15: - Peer review of Design Review 2

7. Team Meeting Time/Date

The team will meet before and/or after our scheduled lab time on Tuesdays at 4:25PM. The length of these meetings will likely be over an hour. If need be, we will meet twice a week and this meeting will be flexible to work around everyone's schedule. Besides our weekly face-to-face meetings, our primary method for team communication will be over Microsoft Teams and GroupMe.