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Proposal for the development of Greenhouse Monitoring System

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https://github.com/PrincessHernandez/GreenhouseMonitoringSystem

Executive Summary

As a student in the Computer Engineering Technology program, I will be integrating the knowledge and skills I have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the hardware portion that will connect to a database as well as to a mobile device application. The internet connected hardware will include a custom PCB with the following sensors and actuators AM2315 Humidity/Temp (0x5C), CCS811 VOC (0x5B), SSD1306 OLED (0x3C). The database will store temperature, humidity and gas level data retrieved from the device. The mobile device functionality will include a series readings of temperature and humidity, as well as a variety of organic compound levels found in the air. There will be warnings when the data retrieved is below or above acceptable ranges. and will be further detailed in the mobile application proposal. I will be collaborating with the following company/department Colin Blakley, Kenneth Chen, and Princess Hernandez. In the winter semester I plan to form a group with the following students, who are also building similar hardware this term and working on the mobile application with me #REF!. The hardware will be completed in CENG 317 Hardware Production Techniques independently and the application will be completed in CENG 319 Software Project. These will be integrated together in the subsequent term in CENG 355 Computer Systems Project as a member of a 2 or 3 student group.

Background

The problem solved by this project is temperature, humidity and carbon dioxide (CO2) levels are the key factors in monitoring and manage the growth process of plants. Plants become more prone to diseases when temperature is too low or deteriorate when it is too high. Low relative humidity can attract pests like red spider mites because of little to no moisture in plants. The temperature and humidity maintenance play a big impact in contributing to the generation carbon dioxide level. Carbon dioxide is essential for plant growth as it supplies the nutrients.. A bit of background about this topic is greenhouses are closed environments where conditions are optimized for plant growth. Ideally, in greenhouses, temperature should be 25 degrees Celsius, 95% relative humidity and 300 - 500 ppm CO2 level. Measuring and maintaining an ideal temperature, humidity and carbon dioxide (CO2) in greenhouses decreases the dependency on pesticides. Farmers can rely on real-time data of temperature, humidity and CO2 to determine wether their agriculture is at risk. They are able to use the monitoring system to encourage themselves to increase yields. This is an important need for framers in a world where consumers demand more and corporations demand increased profits and cannot afford substantial loses.These sensors will become a staple in the framer community where greenhouse and any structure that need to have a maintained climate..

Existing products on the market include (Jones, 2013). I have searched for prior art via Humber's IEEE subscription selecting "My Subscribed Content" (IEEE, 2015) and have found and read (Dan, Yang, Jianqiu, 2016) which provides insight into similar efforts.

In the Computer Engineering Technology program we have learned about the following topics from the respective relevant courses:

- Java Docs from CENG 212 Programming Techniques In Java,
- Construction of circuits from CENG 215 Digital And Interfacing Systems,
- Rapid application development and Gantt charts from CENG 216 Intro to Software Engineering,
- Micro computing from CENG 252 Embedded Systems,
- SQL from CENG 254 Database With Java,
- Web access of databases from CENG 256 Internet Scripting; and,
- Wireless protocols such as 802.11 from TECH152 Telecom Networks.

This knowledge and skill set will enable me to build the subsystems and integrate them together as my capstone project.

Methodology

This proposal is assigned in the first week of class and is due at the beginning of class in the second week of the fall semester. My coursework will focus on the first two of the 3 phases of this project:

Phase 1 Hardware build.
Phase 2 System integration.
Phase 3 Demonstration to future employers.

Phase 1 Hardware build

The hardware build will be completed in the fall term. It will fit within the CENG Project maximum dimensions of 12 13/16" x 6" x 2 7/8" (32.5cm x 15.25cm x 7.25cm) which represents the space below the tray in the parts kit. The highest AC voltage that will be used is 16Vrms from a wall adaptor from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will be 20 Watts.

Phase 2 System integration

The system integration will be completed in the fall term.

Phase 3 Demonstration to future employers

This project will showcase the knowledge and skills that I have learned to potential employers.

The brief description below provides rough effort and non-labour estimates respectively for each phase. A Gantt chart will be added by week 3 to provide more project schedule details and a more complete budget will be added by week 4. It is important to start tasks as soon as possible to be able to meet deadlines.
OLED screen from Ebay, USB powered fan from Amazon

Concluding remarks

This proposal presents a plan for providing an IoT solution for the atmospheric factors that can be controlled in greenhouses are temperature, humidity and CO2 levels. High humidity and low temperature allows for plants to grow at an ideal rate. The temperature and humidity sensor will gather data to help manage a greenhouse. If the temperatures were to go out of range the yield of the plants could be effected in a negative way, and in a worst case scenario - kill the plants. By tracking and monitoring the data, adjustments can be made to the greenhouse to ensure maximum yield. Therefore, using humidifiers and circulation fans helps maintain an ideal greenhouse environment where plants can freely grow at the best rate. Better control of temperature and humidity can regulate precise CO2 levels and create a secure environment for growing plants.. This is an opportunity to integrate the knowledge and skills developed in our program to create a

collaborative IoT capstone project demonstrating my ability to learn how to support projects such as the initiative described by (Dan, Yang, Jianqiu, 2016). I request approval of this project.

References

Jones, J.B. (2013, December 1). *Maintaining Control in the Greenhouse*. Retrieved from https://www.maximumyield.com/maintaining-control-in-the-greenhouse/2/949

Institute of Electrical and Electronics Engineers. (2015, August 28). IEEE Xplore Digital Library [Online]. Available: https://ieeexplore.ieee.org/search/advsearch.jsp

Dan, L., Jianmei, S., Yang, Y., & Jianqiu, X. (2016). Precise Agricultural Greenhouses Based on the IoT and Fuzzy Control. 2016 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS). doi:10.1109/icitbs.2016.19