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A shrewd and pervasive controlled condition farming framework

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ABSTRACT

With new technological advancement in controlled-environment agriculture systems, the level of productivity has significantly increased. Agriculture systems are now more capable, reliable, and provide enhanced productivity. An agriculture environment can range from a single plant in a house, a backyard garden, a small farm, to a large farming facility. These agricultural automated systems will help in managing and maintain safe environment especially the agricultural areas. In this paper, we propose a smart Agriculture System (AgriSys) that can analyze an agriculture environment and intervene to maintain its adequacy. The system deals with general agriculture challenges, such as temperature, humidity, pH, and nutrient support. In addition, the system deals with desert-specific challenges, such as dust, infertile sandy soil, constant wind, very low humidity, and the extreme variations in diurnal and seasonal temperatures. The system interventions are mainly intended to maintain the adequacy of the agriculture environment. For a reduced controller complexity, the adoption of fuzzy control is considered. The system implementation relies on state-of-art computer interfacing tools from National Instruments as programmed under LabVIEW.

Keywords: *Agriculture, Fuzzy logic, Control, Automation, LabVIEW, Phidget*

1. INTRODUCTION

Throughout the ages, earth exposes many pollution factors such as chemicals in water and soil, air pollution, sun exposure and plants. Human neglects the importance of preserving the environment leading to the increase of the pollution over years. They are utilizing the resources without thinking about how the earth will be like in the future. Moreover, the plants are very important and it's complete the life cycle of the earth. People are consuming the plants for foods, oxygen, and other needs. The world population has an increase that will rise to nine billion by 2050 and people are worried about food safety [1]. Different methods and study are done for agricultural production through the evolution of life and technologies. Controlled Environment Agriculture is one of the solutions is used to solve this problem. That led to the approach of greenhouse growing methods. This gives growers the chance to control the growth of their crops. These methods allow year-round growth. By combining advanced computer controllers with tools and sensors, this allows the grower to offer products with better taste to the consumer. The desert weather is hot, humid, and dusty in the summer and cold with occasional rain in winter. The desert climate has unique agricultural characteristics. The number of farms that tend to use the newest technology, in deserts, is limited. However, the advances in pervasive computing and the Internet-of-things are to reach every aspect of life including local agriculture practices. The rest of the paper is organized so that Section II surveys related works. The system design and implementation are presented in Section III. Section IV provides a thorough evaluation and Section V concludes the paper and sets the ground for future work.

2. RELATED WORK

A. Wireless Control System for Agriculture Motor In [2], the author designed and implemented their system to control the performance using Short Message Service (SMS) of cell phones. Meaning that the motors performances depend on turning ON/Off remotely using mobile phone from any brand and also by sends message when it started or done its performance. This Project has been implemented in India and deal with it weather condition. The motors will turn off as soon as the farmers get an alarm about the single phasing. They used a GSM with a digital mobile telephone system and basically what it does is compresses data and then sends it down channels with two others stream user's data. Figure 1 shows the system block diagram. B. wireless Sensor Based Crop Monitoring System for Agriculture Using Wi-Fi Network Dissertation In [3], the author used sensor devices coupled with wireless technologies to monitor the important parameters for India Agriculture such as temperature, humidity and moisture. The details of their ideas are having a wireless sensor that connects through a Wi-Fi to a Central Monitoring Station through General Packet Radio Station. In addition to that it also connects with Global Positioning System (GPS) to send message to the central monitoring station. They also had an external sensor such as soil moisture, pH and leaf wetness. Based on the value that they get from the sensors such as soil moisture; it will turn the water Sprinklers on or off. C. Controlled Environment

Agriculture- Scoping Study in [4], the author discusses the intensive form of agriculture. The proposed CEA uses hydroponics as a substitute for soil or any other soil substitute. According to the study, they used three different types of hydroponic growing programs. CEA is considered as an option to diversify for agriculture. For hydroponics, the systems are used in greenhouses, which have a relatively low level of control and technology. The CEA uses a Nutrient Film Technique (NFT) for plant production. This technique is a closed system for growing plants so that their roots stay in a short distance stream of circulating the nutrient solution again.

3. BLOCK DIAGRAM

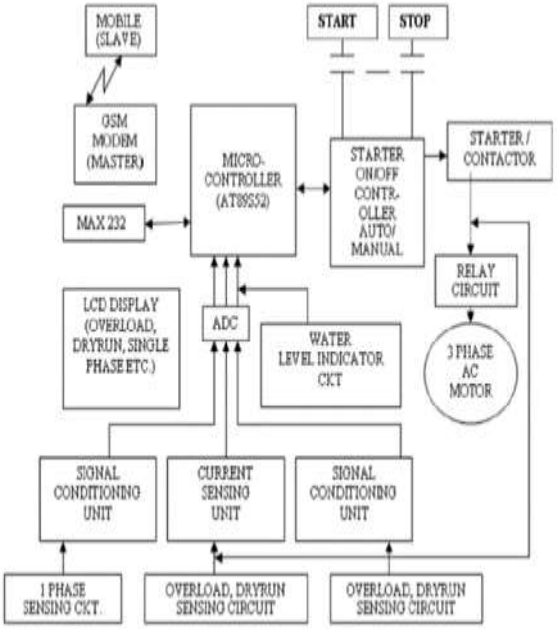

Fig. 1: Block diagram

4. METHODOLOGY

4.1 Humidity sensor:

Humidity and temperature measurement are used to control the elements for the survival of plants. They are necessary for the weather analysis and forecasts, especially agriculture. Monitoring and controlling the humidity and temperature of the environment is a must to save the plants from drought and extremes of temperature. The used temperature and humidity sensor. Furthermore, the light sensor is very important for the pant to be able to provide oxygen.

4.2 Fuzzy logic:

AgriSys is developed under LabVIEW that comprises of large set of tools for the acquisition, monitoring, analysis, and recording data, as well as tools to help to debug code. Figure 8 shows the project's implementation under LabVIEW. The complexity and number of used components are reduced with the use of a fuzzy inference system.

4.3 Sensors:

AgriSys comprises a variety of other sensors. The system includes a pH or Oxidation-Reduction Potential (ORP) Adapter Interfaces. The interface is to a pH or ORP glass electrode through another connector, the BNC connector, and gives it the data it needs to an input on the Phidget Interface board. The used pH adaptor is shown. A soil moisture sensor is used to detect the water level in the soil of the plants. It has two output configurations, namely, high and low. Moreover, the system has a Type-K Stainless Steel Thermocouple with hot and cold junctions. The hot junction is the end that is inserted in the environment of interest, and the cold one is the one used to obtain the readings from the sensor.

5. CONCLUSION

A smart Agriculture System (AgriSys) that can analyze an environment and intervene to maintain its adequacy. The system has an easy-to-upgrade bank of inference rules to control the agricultural environment. AgriSys mainly looks at inputs, such as temperature, humidity, and pH. In addition, the system deals with desert-specific challenges, such as dust, infertile sandy soil, constant wind, very low humidity, and the extreme variations in diurnal and seasonal temperatures. The system provides increased productivity, enhanced safety, instant interventions, and an advanced lifestyle. The system is ubiquitous as it enables distant access. AgriSys is an addition to the current state-of-art Internet-of-things. Future work includes incorporating additional sensors and outputs at an increased level of smart interventions by the system.

6. REFERENCES

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