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Improving Smart Irrigation and Monitoring System: IoT Systems for Green House Agriculture in Gamo Gofa Region, Ethiopia

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ABSTRACT
This article discusses the Internet of Things (IoT) in order to deal with the smart irrigation system that handle the use of water resources and significantly reduce their use. The system of IoT-based irrigation and monitoring discourages excessive water utilization. In this methodology the soil content moisture is assessed and water is restrained in order to speed up plant growth and the water irrigation system is computerized. This system is computerized if the ground humidity and temperature drop below the threshold. When the threshold is fairly low, alerts are periodically relayed to the mobile gardeners / farmers. In order to quantify the intensity of the sunlight in the greenhouse, light intensity sensors are used. Field conditions can be supervised by gardeners / farmer. This model will irrigate farming fields effectively. The idea of this research is to build an IoT greenhouse automated structure for devices-people interaction. To increase the growth of the shrubs and health, Arduino boards can receive, analyze and transmit data. In this Arduino project, the information is dispatched to the database. This server linked to the global web server that used to access the user's smart phone for graphical forum data from sensors. Nevertheless, with the specific android application the consumer view the environmental survey of the nursery conservatory from far away. This initiative associated with water saving, efficiency increase and reduced environmental effects for the production of plants. This demonstrates how the built-in system was used in the monitoring system for future ambition. The IoT leads the crucial methodology in the near future. The results have been tested using a prototype quasi-design.

Key words: Internet of Things, Sensors, Thinkspeak, Node MCU.

1. INTRODUCTION

Agricultural irrigation through online technique is established on the plants growth nature. With the help of online technique and with the alignment of the sensors where used to reduce H2O, the watering structure for the nursery will increase the shrubs growth. (Sanbo et.al, 2013).

The conservatory nursery is worn the growth of the plants yields which desire the regular controlling to attain huge amount of production. At this moment many of the nurseries are functioning with the help of human physical involvements. This practice of conservatory style is intense to human involvements. IOT Technology has been used to shorten the gap among the human and intelligent systems to increase the digital mannerism. The IoT theory is applied in the nursery to produce more productivity with the increased amount of sensors to attain the environmental level. The IoT is a group of devices which connects through the internet for communicating with opponents. Thus this structure is based to perform the continuous involvement to audit the system to maintain the humidity inside the nursery. This system is designed with many sensors such like controllers, humidity, LDR, soil content audit sensors to control the concerned parameters for the collection of data. When the above mentioned sensors grasp the particular threshold values then the collected data will be dropped to the microcontroller from that the desired results will be processed.

2. LITERATURE SURVEY

Cui Wenshun et.al (2013) analyzed the observed data from the system is applied in the conservatory nursery to upgrade the level of the structured system. Here the IoT is applied to monitor and audit the systems measures. Current technologies like data mining and cloud computing are used in order to analyze the structure of this particular designed model. By applying this methodology the conservatory nursery will be able to reduce any conflicts. Through this the shrubs will be grown easily and increase more productivity.

Prakash. H. Patil et.al (2013) grown-up the self-regulating humidity auditing system with the involvements of various sensors and SMS technique. This system is applied to measure the levels of detected values that have been used to determine the environmental structure of the shrubs growth with various

sensors. Here the structure is used to wide-awake the famers to carry out the preventive measures. Ashwini Raut, et.al (2015) they found that watering structure will be fine-tuned the shrubs levels for their growth and productivity. A.Kumar, et.al (2014) in their study they stated by the usage of lowering sensors are crucial to find the lands moisture levels. Through that the data will be gathered and sends to the servers.Gunawan Wang, et.al (2019) stated that the implementation of Internet of Things will improve the customer satisfaction with respect to every insurance company. Ovchinkin, L. V., et.al (2019) in their study focuses about the monitoring systems to improve the efficiency of the student's involvement to enhance their level of improve mental studies.

3. STATEMENT OF THE PROBLEM

The government of Ethiopia is increasingly aware of the potential growth of irrigation system in order to improve the agriculture's yield. Even though the government is extending its support to encourage the crop yield, yet it has not been attained at their target level. The use of manual monitoring process is creating significant problems for the farm owners/gardeners due to inadequate man power to maintain the manual irrigation system, irregular time interval for irrigating the crops, increasing labors, lack of maintaining time intervals for irrigating the crops, lack of knowledge in predicting the soil moisture and light intensity results in damaging the crops, the manual process involves huge amount of cost in maintaining the manual irrigation systems, due to human negligence and ignorance. Also it increases the cost of replacement of new crops could cost additional burden to the farm owners; consequently it will reduce the profit of agriculture.

Since the large scale agricultural lands are very difficult to manage the manual monitoring process. To minimize these difficulties the IoT based irrigation systems have to be considered in-order to sustain the full fledge irrigation. To attain irrigation potentials, the IoT can be replaced with manual processing system. Since there are no green house concept in Gamo Gofa zone, therefore the researchers has taken initiative to introduce IoT based green house system.

RESEARCH QUESTIONS:

1. What are the existing information technologies could support and enhance the agriculture?
2. Whether the farmers using IoT based technology in their agricultural farms or not?
3. What are the probable positive impacts that can enhance the Agri sectors with IoT?
4. What are the possible benefits derived to the farmers by using IoT?

SPECIFIC OBJECTIVES OF THE RESEARCH

This research expected:

- To assess the availability of automated irrigation mechanisms.
- To identify the gap between conventional and smart technology.
- To measure the soil moisturizing and light intensity in green house.
- To determine the automation irrigation system to decrease the burden to farmers.
- To evaluate the availability of green house in Gamo Gofa region.

SCOPE OF THE STUDY

In this research, the researchers studied the challenges of aligning the modern irrigation system in urban and rural areas in the case of Gama Gofa region with the parameters of Soil moisture sensors, humidity and temperature sensors, and light intensity sensors.

SIGNIFICANCE OF RESEARCH

- It shortens the H20 misuse.
- Developing the incubators through Arba Minch University and collaborating the industry linkage between existed farm houses in Ethiopia.
- Generating the awareness among the common people to adapt this technique.
- Gamo Gofa regional people can perform their routine tasks efficiently and effectively.
- The power consumption would be reduced.
- This structure is crucial to reduce the water deficit.
- This proposed model is useful to increase the shrubs productivity.
- It will be more beneficial in cost effective manner.

4. INTERNET OF THINGS

Apparent Technique

IoT is one of the relevant technologies in this current era. It is trending everywhere and inclined with real time surroundings where we can retrieve data through internet. The real objects are appointed with an IP address to collect the real time data. IoT keep up weighed as a store of real objects, controller, sensors, actuators and online in fitting the real time data. The Internet of Things becoming commodities to reveal and audit the gathered information's through the framework, which makes very efficient and improvement manner.

The obtained information enrich the consumer commitment, upgrade information gathering, automation development, moreover shortening misuse. The Researchers are adapting this technology in this research. The real considerations are considered in our conservatory green house with several sensors. We record those information's with sensors like light, temperature, soil and humidity sensors. Drizzle can additionally be splendid in spite of the truth to reduce the temperature. Entire the above conveyed information's are audited carefully and it will be automated when we involve automation process. Naturally, the assessment of the data collected from the framework is involved the betterment of the green house. Hereby the improvement of the green house with all automation process increases the growth of the shrubs.

Traditional Watering Style

The traditional watering styles such as drizzle the shrubs for growth. The whole land outward will be watering. This impacts the leaflet infection. H2O is given regularly for consistency of the shrubs.

Complications in Conventional Structure

Here the watering structure will be carried out by the producer in physical manner. Due to this the higher possibility of shrubs decay may occur because of more watering. Without the alignment of automation process the farmer's growth will be decreased. We should consider the global warming and water crunch nowadays. Few countries are alerting their citizens for usage of waters because it leads to zero days in near future. We assume this might be the deliberate complications of wasting the waters.

Restrictions against the Existing Model

- Manual flow among the farmers to audit the smart irrigation.
- Loss of water.
- Loss of time.
- Possibility of diseases spreading due to stagnant of water.

5. PROPOSED SYSTEM

The proposed system uses the following sensors like temperature, soil moisture and LDR or light sensor. The proposed system will start monitoring when its sensor is connected to the embedded system using Node MCU which is the heart of this research. Node MCU is an on chip WIFI Transceiver so that user can view the sensor data through the Think speak website. In this proposed system, if there is no available sunlight in the current place the sensor sends signal to the Node MCU which is suddenly switched ON the light in the current place. If the water content in the soil is not enough for the plant's growth, then the soil moisture sensor send signal to the Node MCU which triggers the motor for feeding water on the plant through relay. Finally, the temperature of the plant is monitored by the temperature sensor. All the sensor details are viewed on the Think speak website which shows graph of each sensor and motor. This website also used to access user's smart phone for getting data of the sensors in graphical forum.

Proposed block diagram

a) Green House Proposed Model

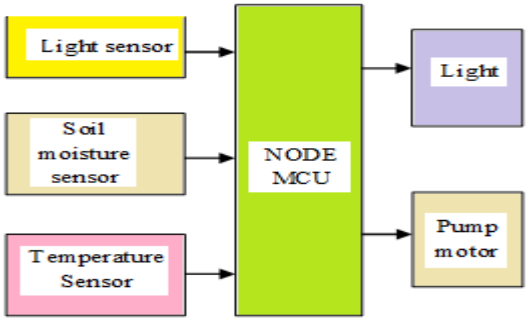

Figure 1: Diagrammatic Representation of Proposed green house farm Monitoring System

Figure 1, shows the proposed model of the green house farm monitoring system; here the researchers implemented this framework in the Gamo Gofa Region, Ethiopia for their research study.

b) GUI Design

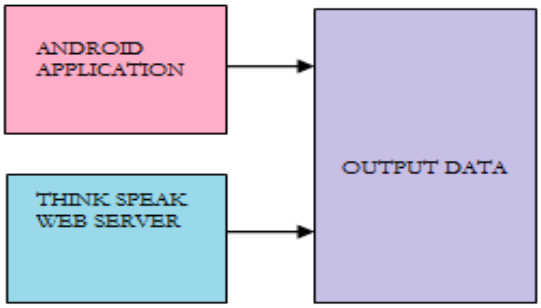

Figure 2: Prototype of Intelligent Irrigation & Monitoring System

Figure 2, represents the prototype model of the Intelligent Irrigation & Monitoring System, where the famers receive the output data from the system.

6. METHODOLOGY

There are couples of operating items in this system, which are sensors module and the IOT module. Thus the work of the moisture sensor is to feels the temperature content present in the soil, and also it measures moisture level in the soil. The temperature and LDR sensors are used to monitor temperature and light intensity of the day. The motor driver interrupts the signal to, water pump supplies water to the plants when the sand is in dry state. This system uses microcontroller NODE MCU is been audited with the motor and sensor devices. When the threshold value decreases the system will initiate the motor to run. The irrigation system will starts and precedes the actions. These sensor details are sending wirelessly to the Think speak website. So user can monitor anywhere in the world through the Think speak application.

7. RESULTS AND DISCUSSION

All the deployed objects tenacious the soil moisture level, Humidity, Temperature at the root zone. Microcontroller received the data in every minute. It gathered the data and analyzed the monitoring progress. A microcontroller transfers the gathered data and supply water flow as per requirements. Measured sensor readings are view by user after login in Think speak website. Productive developments will increases the shrubs productivity and growth. The hardware implementations were successfully proved that the reliable data through different sensors which results accurate results. In Figure 3, shows the proposed design circuit where the researchers used for their implementation.

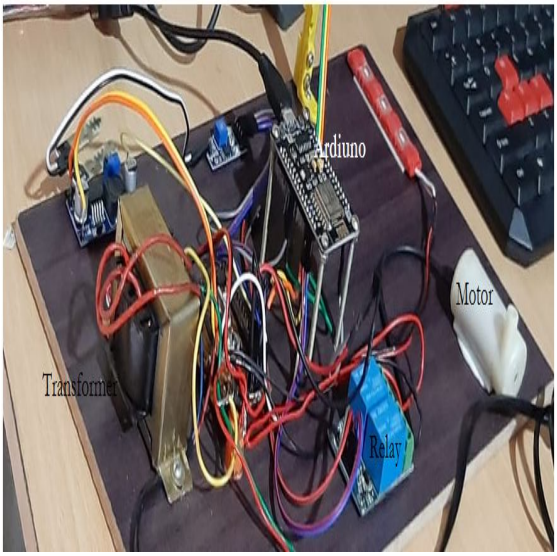

Figure 3: Smart irrigation prototype

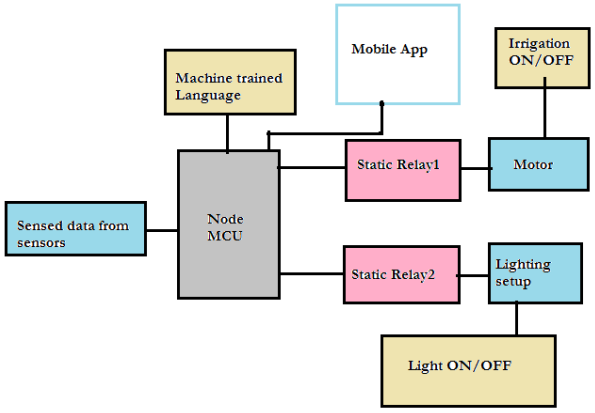

Figure 4: Systematic Representation of the Real Time System

Figure 4, represents about the workings of their real time system.

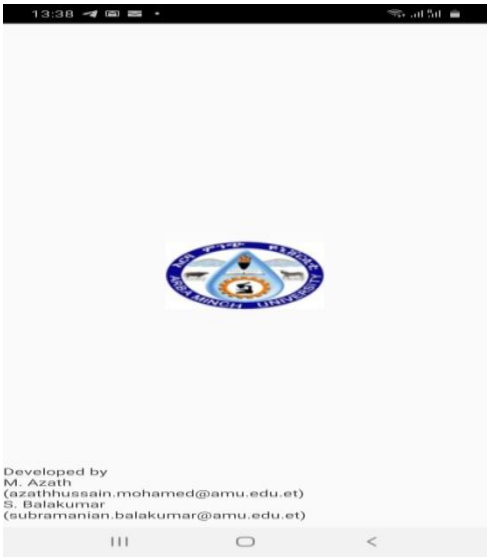

Figure 5: Android Mobile Application

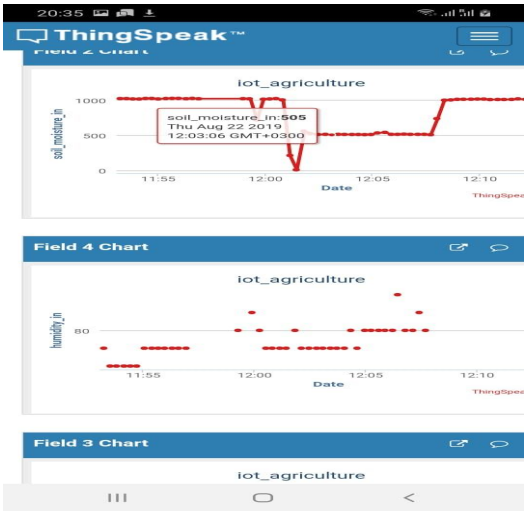

Figure 6: Results with applying different Sensors

Figure 7: Variations when threshold value varies with humidity in the greenhouse

As shown in the above Figures 5, the design of the android application. As in Figure 6 and 7 represents the graphs with different variations with respect to humidity and soil moisture.

Finally, the temperature of the plant is monitored by the temperature sensor. All the sensor details are viewed on the thinkspeak website which shows graph of each sensor and motor. This website also used to access user's smartphone for getting data of the sensors in graphical forum. Each sensor is connected to node MCU with the 3.3V to 5V power supply. Then the relays required 12V power supply in Node MCU.

Table 1: Pin Connections

S.No	Name of the sensors	Pin number to connected
1	Temperature Sensors	Pin D6
2	Light sensor	Pin D7
3	Soil Moisture sensors	Pin D1
4	Output of the motor connected to the Pin D2	

8. CONCLUSION

This System which aligned with IoT based greenhouse intelligent system is an entire structure which sketch out the monitoring and controlling the entire incidental framework inside the green house. While the existing system increasing the human factors and also increases the time variant. This system decreases the cost, space and human effort. It provides a controlled environment for the plants to prevent them from damage and thus increasing the overall productivity. This intelligent greenhouse will audit several parameters required for the plants and sends the sensory data to a customized webpage and mobile application for repeated and efficient observations.

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