



Implementation of Smart Farming using IoT

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ABSTRACT

The paper entitled "Implementation of smart farming using IoT" will be used by farmers for monitoring water supply to the fields and also providing protection for the fields from animals. It uses Thing speak platform to find the soil moisture, find the entry of animals into the fields. The need for this projects to reduce the work of farmers and increase the crop production. In the proposed system the greenhouse parameters like water level and humidity are monitored continuously and data is uploaded continuously to server system using IOT gateways technology. The purpose of Arduino Uno is that it connects all components associated with the development kit. Each I/O pin is associated with a particular component of the kit for performing particular function. The output of the sensors is monitored continuously so that the motor can be switched On/Off. The values of the sensors are continuously uploaded in the server system. As per the system working is concerned the farmer can switch ON the motor by sending a message through his mobile to the arduino by using GSM module. Similarly when animals try to enter the field a warning message is sent to the farmers mobile.

1. Introduction

Many of the farmers are facing a lot of problems while protecting fields during night times. Since protecting the field 24/7 is difficult for farmers. Watering the fields at regular intervals is necessary from increased crop production. Since farmers are very important for the food production it is important to reduce the work of the farmers. Precision Agriculture improves productivity increasing yields and profitability, reducing impact on environment. These days, Internet of Things is playing a crucial role of transforming Traditional Technology from homes to offices One of the main reasons where IoT based research is going on and new products are launching on everyday basis to make the activities smarter and efficient towards better production in "Agriculture".

IoT based agriculture convergence technology creates high value in terms of quality and increased production and also reduces burden on farmers in ample manner. In addition to Agricultural Iot, the future of agriculture is "Precision Agriculture" which is expected which is expected to grow at \$3.7 billion by 2020.

With data generated from GPS and Smart Sensors on agricultural field and integratuion of smart farming equipment along with the Big Data analytics, farmers would be able to improve crop yields and make effective use of water and in turn wastage of any sort would be reduced to a remarkable level. The current scenario of agriculture which is surrounded by many problemss, it is utmost requirement to have IoT based Smart Farming. In order to implement smart farming in real world, IoT based products are required to be developed and implemented at regular intervals also at very fast pace.

2. Literature Review

In a paper by Hamnza Benyeza, Mounir Bouchedda, Khaoula Djellout: Smart Irrigation Based on Thingspeak and Arduino explains about the use of ThingSpeak platform to display the values of sensors and tells the importance of using smart irrigation system to increase the crop production. Their system consists of Wi-Fi module to send the



data sensed by sensors from Arduino to the ThigSpeak platform. Shweta B Saraf, Dhanashrri H. Gawali et al., IoT base Smart Irrigation Monitoring and Controlling System explains about use of soil moisture sensors in identifying the conditions for supplying water to fields. This system consists of GSM module for switching the motor On/Off based on the data from soil moisture sensors and motor is switched based on a message from the farmer. Farmer can switch on the motor from anywhere he want.

G. Sushanth and S. Sujhatha et al., IoT base Smart Agriculture System gives a clear explanation about interfacing various type of sesnors to the microcontroller to demonstrate the intelligent capabilities of the microcontroller to allow the decisions to be taken on watering plants based on continuous monitoring of environmental conditions. It also aims at a predefined irrigation schedule as per farmers convenience.

M.Sathishkumar, S.Rajini et al., Smart Surveillance System Using PIR Sensor Network Surveillance is most important security systems in home, industrial, office and public places. In 3 this security system is based on the embedded system along with GSM and sensor networks. The human movement is detected using the PIR sensors. In this time, the system triggers an alarm detecting the presence of person in a specific interval of time and simultaneously sends the how many persons are intruder via message to the SMS through GSM Modem. When the security system is activated, the CCTV camera is activated. This highly reactive approach has low computational requirement. Therefore, it is well suited for home surveillance system. This surveillance security system implemented using PIC micro controller, camera, GSM and sensors. Home/office security systems have grown in popularity in recent years, a home/office owner's look for ways to protect their personal space and enhance their home values.

3. Design Methodology

Adaptors for power supply. Arduino Uno is used to interface sensors with WiFi module and GSM module. Initially data is sensed by the sensor and the data is sent to the Arduino. Arduino uses the Wi-Fi module to connect to the ThingSpeak platform where we can see the sensor values in the form of a graphical chart. GSM module is used to send messages to the farmers mobile to alert.

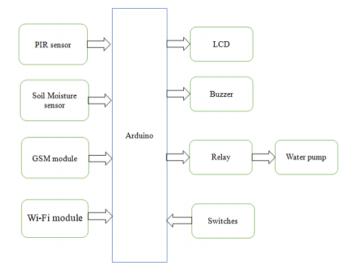


Fig.3.1. Block Diagram



A LCD display is used to display the functioning of the project. PIR sensor is used to avoid the entry of animals. They are placed around the field to detect the motion. Whenever PIR senor detects motion a signal is sent to the Arduino. Then Arduino activates the buzzer to produce sound. The data from the sensor is sent to the ThingSpeak platform by using API keys. Arduino also sends a message to the farmers mobile indicating that animals were trying to enter the field. Soil Moisture Sensors used to find the moisture of the soil. By detecting the moisture and if is below the required level then Arduino sends a message to the farmers monile indicating that it is required to water the field. The farmer then sends a message to switch on the motor. Whenever the supplied water is sufficient Arduino sends another message to tell the farmer to switch off the motor. Farmer then switches of the motor by sending a message to the GSM module.

4. Implementation

4.1 Algorithm

The following steps involved in implementation:

- 1. Code for interfacing Wi-Fi module and GSM module to Arduino.
- 2. A message is sent to the GSM module to register the farmer.
- 3. Once the message is sent the program goes into infinite while loop.
- 4. Whenever PIR sensor detects any type of motion around the field, a buzzer sound is played.
- 5. A message is sent to the farmers mobile saying tat animals were trying to enter the fields.
- 6. Whenever the moisture of soil is less than threshold value then a message is sent to the farmers mobile.
- 7. The farmer on receiving the message will send message "on" to turn the motor on.
- 8. When sufficient water is supplied another message is sent to farmers mobile saying to stop motor.
- 9. Farmer will send a message "off" to turn off the motor.
- 10. The values of the sensor are uploaded in Thing Speak platform for every 10 minutes.
- 11. LCD is used to display the functioning of project at any given time. The image of the project is shown in Fig 4.1.

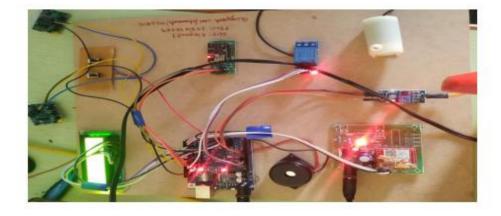


Fig.4.1. Project Image



4.2 Circuit Diagram

The Tx of GSM Module is connected to the Rx of Arduino and Rx of GSM module is connected to Tx of Arduino. Wi-Fi module is also connected in the similar fashion. Adopters were used for supplying power to the Arduino and GSM module. The circuit diagram of the project is shown in Fig 4.2

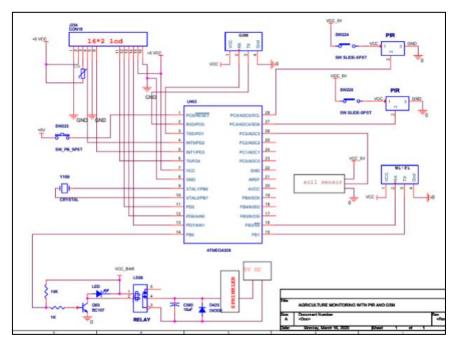


Fig.4.2. Circuit Diagram

4.3 Flow Chart

When the power is supplied to the Arduino board, Wi-Fi module is RESET and the connection is established between the ESP8266 module and local Wi-Fi network.

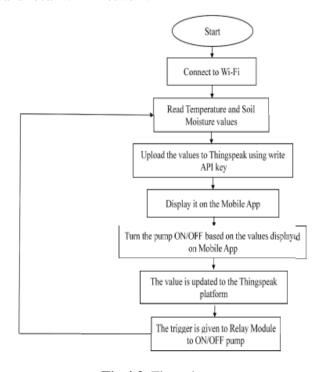


Fig.4.3. Flow chart



The Temperature and Soil Moisture values are read and uploaded to Thingspeak Platform using the Write API key mentioned in the code of Arduino. These values are also updated in the MIT app where the user and see those values. According to the updated sensor values, if in the updated values are below threshold the user turns the Pump ON or turns the pump OFF. These changes are done in App, so they are again updated to Thingspeak platform. The pump status value is returned in the form of a trigger to the Arduino board which is given to the Relay Module to turn the pump ON/OFF. In this way the working continues. The working of the project is explained in the form of flow chart as shown in the figure 4.3.

5. Results and Discussions

In this smart agriculture farming designed and implemented by using IOT. Thing Speak platform is used in here to display the values of sensors and implemented in interactive way by knowing about the functioning of the project through SMS with the help of GSM module

5.1 Registering Mobile

When power is supplied to the Arduino and GSM module a welcome message is shown on the LCD. Then the GSM module connects with SIM instered in SIM connecting port. The welcome message is shown in Figure 5.1 and 5.2



Fig.5.1. Welcome message



Fig.5.2. Project name

Once the SIM instated in the GSM module get connected with the Arduino, a message is displayed on the LCD saying to the farmer to register his mobile with SIM inserted in the GSM module which is shown in Fig 5.3.





Fig.5.3. Confirmation message

5.2 Connecting to Network

Once the project successfully registers with the users, then it starts connecting with the WI-Fi using Wi-Fi module. The WI-Fi module searches with network having SSID as "Elegant1" and password as "123456789" which is given in the program. Once it finds the network with those credidentials it connects with the network. module. Fig 5.4 shows details of SSID and password in the code. Whenever there is a need to change the network the SSID and password details need to be updated in the program



Fig.5.4. Confirmation for N/W

5.3 Water Supply Monitoring

One of the important task of the project is to monitor water supply. This can be done using Soil Moisture sensor and DC Motor.



Fig.5.5. Less Moisture

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Whenever the moisture level is below 50, a message is sent to 26 the registered mobile as shown in Fig 5.5.

After receiving the message the user sends a return message as 'MOTOR ON' to turn on the motor for supplying water. When the motor is turned on it is shown on LCD screen as shown in Fig 5.6.

When the motor is turned on a message is sent in return as 'USER REQUEST MOTOR ON'

When the soil moisture value becomes more than 50, a message is sent to farmers mobile which is shown in Fig 5.6



Fig.5.6. Sufficient Moisture

5.4 Movement Detection

Two PIR sensors are used in this project to detect entry of animals and other living organisms during night time. One of the them is named as 'WEST PIR' and other is named as 'EAST PIR'. Whenever the PIR sensor detects any motion around it sends a message to the users mobile with the name of PIR sensor. The values of PIR sensors are displayed on the LCD.

Whenever PIR sensor detects any obstacle the PIR value is sent to the server which is shown in Fig 5.16. A message is sent to the mobile saying that sensor has detected movement which is shown in Fig 5. 7. Similarly when EAST PIR detects any movements a messages is sent to user as shown in Fig 5. 8.



Fig.5.7. West PIR

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Fig.5.8. East PIR

5.5 Sensor Values

The values of sensors are timely updated on the server. These values are displayed in the form of a graph. We will be having four fields in which one filed is for WEST PIR, one for EAST PIR, one for Soil Moisture Sensor and one for DC motor. The filed graphs are shown in Fig 5.9(a), 5.9 (b), 5.9 (c), 5.9 (d).



Fig. 5.9(a) West PIR graph



Fig. 5.9(c) Moisture graph

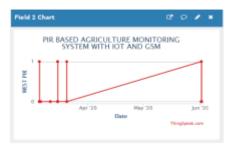


Fig. 5.9(b) East PIR graph

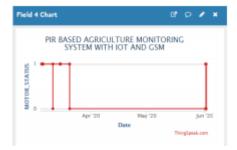
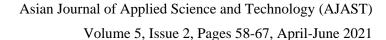


Fig. 5.9(d) Motor status graph

6. Conclusions

In this work, a design and implementation of Smart Faring using IOT has been proposed. This system is able to collect the information about the main environmental parameters such as; Temperature, Humidity and soil. The whole system is advanced, reliable and convenient. This design improves the real-time performance of the user to the agricultural environment change, and is conducive to the realization of the unattended goal, and promotes the





development of the intelligent Agriculture system. In future, this scheme can be used as a part of the development of remote monitoring of the Internet of things and can be applied on other areas of modern facilities agriculture, In future, instead of the ARDUINO UNO microcontroller, we will use the Raspberry Pi 3 microprocessor. It has the in-built Wi-Fi module. So that there is no need of the external Wi-Fi module so that we can reduce the hardware complexity.

Declarations

Source of Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent to participate

Not Applicable.

Consent for publication

We declare that we consented for the publication of this research work.

Availability of data and material

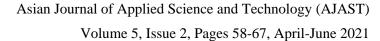
Authors are willing to share data and material according to the relevant needs.

Author's contribution

All authors participated in overseeing laboratory work, data analysis, and manuscript writing and review.

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