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IOT BASED MONITORING SYSTEM AND SMART AGRICULTURE USING RASPBERRY PI

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Abstract: In India, an important growing sector is an agriculture. The major challenges in agriculture are crop productivity, soil nutrient level, smart irrigation system, crop monitoring, etc. This paper review the internet of things (IoT) based smart agriculture system using ThingSpeak. The main purpose of this work is to improve the efficiency of the existing irrigation system and to reduce the human intervention for the complete automation of the system. The proposed system consists of raspberry pi, various sensors, a pi camera, and a motor driver. Raspberry pi is the main controlling unit that can control the operation of various sensors and actuators. The soil moisture sensor detects the moisture level in the soil and irrigates the crop in a controlled manner. If there is any variation in moisture level then the sensor will update the observed value and store in the cloud. In a smart monitoring system, the pi camera captures the video and transfers it to the cloud through raspberry pi. Here Pi camera is used to provide live video streaming. All this sensor data is stored in a ThingSpeak cloud. So that we can view it from a remote location using ThingView Free mobile android application. All this sensor data we can also view on the telegram application using bot API.

I INTRODUCTION

As the world is trending towards new technologies and implementations it is a necessary goal to trend up in agriculture too.Many researches are done in the field of agriculture and most of them signify the use of wireless sensor network that collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity. Hence, automation must be implemented in agriculture to overcome these problems. In order to provide solution to such problems, it is necessary to develop an integrated system which wills improve productivity in every stage. But, complete automation in agriculture is not achieved due to various issues. Though it is implemented in the research level, it is not given to the farmers as a product to get benefitted from the resources. Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield. Most of the papers signifies the use of wireless sensor network which collects the data from different types of sensors and then send it to main server using wireless protocol. The collected data provides the information about different environmental factors which in turns helps to monitor the system. Monitoring environmental factors is not enough and complete solution to improve the yield of the crops. There are number of other factors that affect the productivity to great extent. These factors include attack of insects and pests which can be controlled by spraying the crop with proper insecticide and pesticides. Secondly, attack of wild animals and birds when the crop grows up. There is also possibility of thefts when crop is at the stage of harvesting. Even after harvesting, farmers also face problems in storage of harvested crop. So, in order to provide solutions to all such problems, it is necessary to develop integrated system which will take care of all factors affecting the productivity in every stages like; cultivation, harvesting and post harvesting storage. This paper therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The paper aims at making agriculture smart using automation and IoT technologies. The highlighting features of this paper includes smart GPS based remote controlled robot to perform tasks like; weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, etc. Secondly, it includes smart irrigation with smart control based on real time field data. In India, most people living in rural areas are dependent on agriculture. Water is a scarce resource in agriculture and its optimal management is emerging as key challenges. The role of various technologies in the agriculture sector is becoming more and more visible. Research has been going on to increase the yield on a farm but if the fields and crops are not monitored properly the results may not be as per expectation. The use of modern techniques can help the farmer to not only remotely

monitor their crops on a farm but also take corrective action in time. They can improve the quality of productivity of crops without much need for large manpower. In this paper, we propose a raspberry pi based smart agriculture system using ThingSpeak to reduce the manpower required in the agriculture field. In this, we can deploy various wireless sensor nodes using IoT for measuring the various variable of interest. Raspberry PI is a main controlling device that can send all the sensed data to ThingSpeak cloud and also receive controlling action from ThingSpeak service. ThingSpeak is an open-source IOT platform which enables a farmer to visualize data instantly and remotely. So they can control various parameters from a remote location. Telegram also enables a farmer to read sensor data from a remote location. A camera module is also used to keep watch continuously on the farm.

II LITERATURE SURVEY:

[1] Developed a fully computerized observation in the space of agriculture that would considerably decrease human efforts and progress the crops quality. The sensors data are responsible to make a relationship among water content, temperature, light etc.

[2] Developed an algorithm for their system. The main improvement of the proposed system is that it has ability to send data of soil to the corresponding users through IoT technology for irrigation. Soil moisture measuring device processes water gratified of soil and produced result is served to the amplifier which is offering to develop the expansion of values.

[3] Experimented with sevral types of sensors such as pH, soil moisture, LM35, PIR and pressure sensors. Detected values of these sensors are shown in LCD screen. If the detected values go elsewhere, the staring values set in the program and corresponding pump will be spontaneously switched ON/OFF by communicating the circuit.

[4] Focused on IOT basedl for agriculture using Raspberry Pi. This is a smart solution to overcome the employment of rigorous work and also controls water supervision system.

[5] The sensor data in order to estimate moistening of soil along with water.

[6] Is to reduce time and energy and makes regular life easier to the farmers. The proposed system is designed especially for the farmers where farmers are able to understand their field status.

[7] Used several types of sensors such as soil moisture sensor and temperature and pH sensor. Atfer receiving the value, the relays whose are integrated to raspberry pi will try to ON or OFF the motors.

[8] Developed an IOT based smart irrigation system which was designed for home based organic garden. This paper also aims at the progress of weather based on irrigation model through an inception.

Scope of the Survey:

In this paper, the existing literature on IOT based smart systems is analyzed with the suggested requirements. In addition, an investigation of the current state of technologies with respect to the enablers of the Smart farming is presented. To the best of the author's knowledge, no paper has surveyed and suggested comprehensive requirements for the Iot Based smart monitoring systems and analyzed existing research on these requirements.

III SYSTEM DEVELOPMENT:

A) Algorithm:

Proposed irrigation system Generally, water requirement for paddy cultivation is not uniform throughout the life span. It is noted that only 50% and 25% of water were utilized during the mid and early stage of cultivation when it is compared to the fully grown stage.

Efficient irrigation not only depends on the water requirement of crop cultivation, but also the environmental factors of the agriculture field. The environmental conditions need to be continuously monitored because the factors such as temperature, humidity, rainfall and moisture content of the soil will decide the amount of water required for the effective irrigation system. of proposed methodology The proposed irrigation system based on smart sensor which consists of ARM microcontroller, smart phones, GSM module, sensor unit and motor control unit is shown in Fig. 3. The sensor unit comprises of temperature sensor, humidity sensor, light sensor and rain sensor which is used to monitor the environmental conditions by collecting the physical parameters such as temperature, humidity, light intensity and rainfall of the agricultural field. An irrigation application is developed for determining the wetness of the soil from the captured image and it is installed in the smart phone which is kept in a closed chamber having Transparent Anti - Reflective Glass (TARG) medium on one side of the chamber. The Global System for Mobile communication (GSM) module in the proposed irrigation system is used for sending and receiving the messages between the microcontroller and smartphone. Based on the data received from various sensors, the ARM microcontroller manages the irrigation by controlling the motor unit and periodically updates the information to the farmer.

Block diagram of the project

The temperature sensor measures the ambient temperature of the crop.

•The water level sensor measures the water level of the crop.

•Soil moisture sensor measures the level of moisture in the soil.

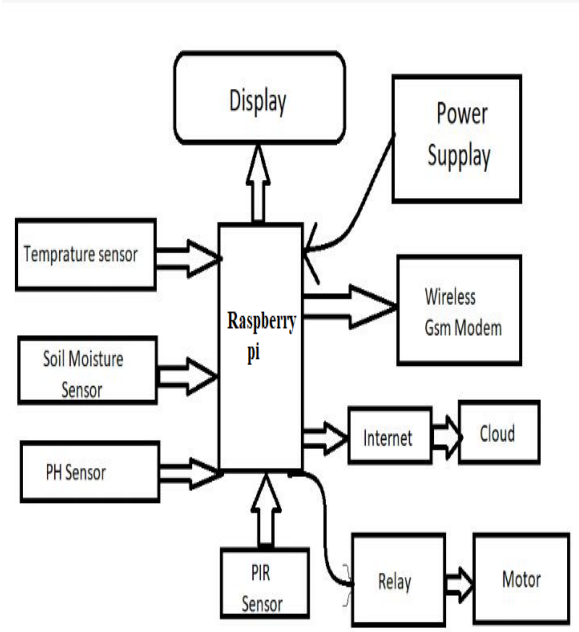
•GSM modem is used to send SMS notifications to the user at an interval of 5 minutes.

•The WiFi module is used to send the sensor values to the remote server via a WiFi connection and IOT protocols.

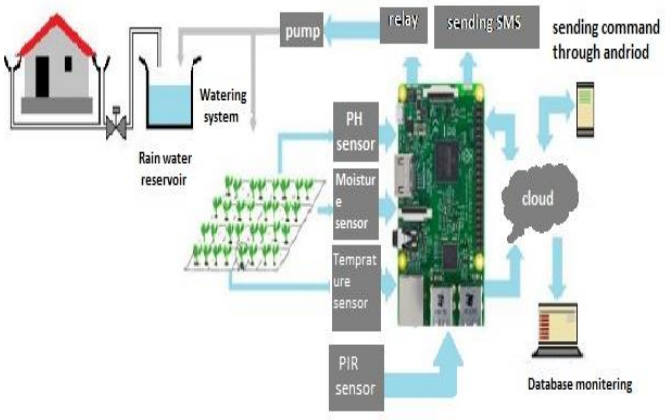
•Arduino controller communicates with the GSM modem and WiFi module, gathers data from the sensors and activates the output devices.

•Relays are used to turn on the fan as well as the water pump in order to maintain the temperature and moisture level of the crop.

•The buzzer is turned on when any of the sensor values crosses a certain threshold.



Block Diagram



Advantages:- •Increased Production.

•Water Conservation.

•Real-Time Data and Production Insight.

•Lowered Operation Costs.

•Increased Quality of Production.

•Accurate Farm and Field Evaluation.

•Improved Livestock Farming.

Disadvantage:- • The potential for disease transmission if proper food and environmental safety precautions are not in place.

•Exposure to pesticides and herbicides.

•Contamination from animal waste.

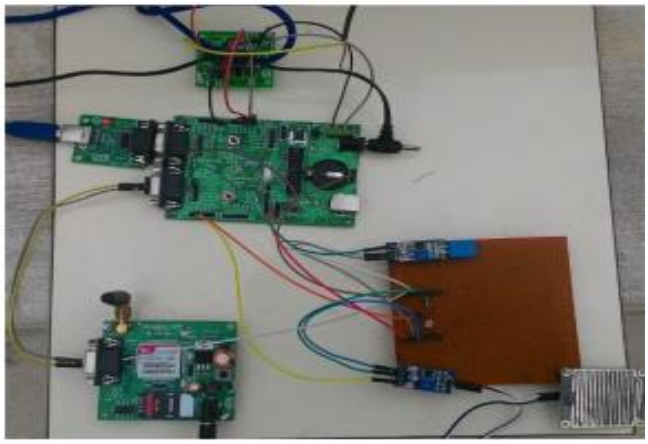
•Urban soils may be contaminated and unsuitable for food production.

Applications:- • IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors. •In terms of environmental issues, IoT-based smart farming can provide great benefits including more efficient water usage, or optimization of inputs and treatments.

IV RESULTS:

The proposed irrigation system consists of ARM microcontroller, sensors, smartphone, motor and GSM module. At a predefined time interval, the smartphone captures the image and sends the wetness of the soil to the microcontroller through a GSM module. Then the microcontroller decides the necessity of water to the field using the soil wetness along with the sensor values and transmits the information to the farmer through SMS. The control module of the proposed irrigation system is shown in The environmental conditions such as soil wetness, temperature, humidity level, light intensity, rain status and motor condition are shown in and the information sent to the farmer mobile phone via SMS is shown in The prevailing climatic conditions of the agricultural field were observed using proposed irrigation system continuously for a period of 15 days in the month of March 2016 and its maximum and minimum values are plotted in the form of graph as shown in. The proposed irrigation system is tested in the paddy field of area one acre and the amount of water required for different stages of paddy growth is calculated. The estimated amount of water for the proposed irrigation is compared with the existing irrigation systems and the values are tabulated in Table 1. From the Table 1, it is noticeable that all the three irrigation methods utilize the same amount of water for the field preparation, and the proposed smart drip irrigation system saves a considerable amount of water for the remaining stages of paddy cultivation compared to the existing irrigation methods. The proposed system utilizes only 58.57% of water and saves 41.43% of

water compared to the manual flood irrigation method, and also utilizes only 86.97% of water and saves 13.03% of water compared to drip irrigation method.



In proposed smart sensor based irrigation system, the percentage of water saving is increased because it utilizes the environmental factors for switching ON and OFF the irrigation motor. The average amount of water utilized for one acre of paddy cultivated land is shown in and the percentile comparison of water used for manual flood irrigation, drip irrigation and the proposed irrigation methods are shown in , it is evident that in all the categories of utilization, the proposed shows best among the remaining methods. With respect to the Flood irrigation, if it requires 100% of water level, then the drip and proposed smart system need only 67.35 and 58.57% respectively. Similarly, if the Drip irrigation requires 100% of water level, then with the proposed, it can be said that it is enough to have 86.97% to grow the paddy. When the proposed utilizes 100% of water level, then the remaining systems require higher percentage, i.e., 70% and 14.98% higher for the flood and the drip correspondingly. Then, the average percentage of water needed for cultivating the crop for one acre of land for the proposed smart system in comparison with the traditional flood and drip irrigation system is represented in Fig. 22 as a pie chart. From the figure, it is clearly stated that the proposed system comparatively requires a lesser amount of water and it outperforms than the existing systems.

V CONCLUSION:

For the effective utilization of the water in agriculture, it is mandatory to have a system which can support the farmer and act as a guide to irrigate their fields. It is obvious that rainwater and the groundwater levels are decreasing day-byday, thereby increasing the requirement of new systems to utilize the water resources effectively for agriculture. And it is a known fact that the economy and growth of a country purely depends on the agricultural income. Tamilnadu is found to be a major paddy growing state in India due to its favourable climatic conditions and it is a major source of food for the people. By considering all these factors, a smart sensor based system for drip irrigation is designed, implemented and tested particularly for the paddy. The smart sensor based automatic drip irrigation system is implemented in an acre of paddy field and it is observed that the experimental results are very much encouraging compared to the other state-of-art methods. The proposed android application of the smartphone captures the soil image, computes the wetness of the soil, and transmits the data onto the microcontroller through the GSM module present in it. The system decides the necessity of irrigation according to the values received by the microcontroller such as sensor outputs and the images captured by the smartphone. From the test results, it is observed that the proposed smart sensor based irrigation system consumes only 58.57% and 86.97% of water compared to the flood and drip irrigation respectively. It is seen that the proposed saves water nearly 41.43% when compared to the flood irrigation and 13.03% when compared to drip irrigation. Due to the non-contact and non-invasive setup, it is sure that the system will increase the productivity of crop and also it can aid the farmers in making decisions for the irrigation to improve the cultivation of the crops. By using the cutting-edge technologies in agriculture, the overall production cost of the crop will be reduced and the time can also be saved by reducing the human interventions in the irrigation. In future, the work can be extended to a large scale by incorporating the wireless sensor networks in the agricultural fields.

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