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IOT BASED SMART CASH CROP CULTIVATION USING RASPBERRY PI

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Abstract— The cash crops refer to items that return far more to farmers than the normal harvests and demands. While, such crops are not often easy to grow in India due to the country's climate obstacles and these plants meticulous attention is needed to provide the finest returns else easy to suffer from pests and illnesses. So ,a minimal expense nursery model which can be managed by the Indian ranchers for the development of money yields like saffron, vanilla, peppers, and so on and they can do the development under this mechanized nursery hence improving their social and monetary condition by an incredible degree. The proposed system had both farm monitoring and automated irrigation control along with the alert message feedback to the user. All the sensors data collected is farm monitoring and the equivalent control constitutes automated irrigation control. This makes the farmer to monitor the green house continuously and necessary actions are taken according to the sensor reading and thus the returns will increase.
Keywords: Raspberry Pi, Feedback, Farm monitoring, Automatic irrigation control, Alert message

I. Introduction

The sense of IoT and its applications is everywhere and it is wide. One application from this can be used in agriculture. In agriculture, the small piece of art is green house where the environment can be controlled such as temperature, humidity etc. The items which return altogether more advantage than the commonplace gathers to the agriculturists are money crops. Peppers, tomatoes, spices are some of the money crops that can be cultivated from the greenhouse. Due to the climatic conditions and considering best yield such crops are hard to yield and a controlled environment should be needed to cultivate such crops to get better yields without being influenced by irritation and illness. All these illnesses, irritations, issues can be overcome by the use of electronic mechanized nurseries by using the modern innovations of the Internet of Things through the use of actuators, sensors, microcontrollers[10][11]. Parameters such as humidity, moisture, Co2 levels can be controlled by the use of motors, fans and pumps. Using all these in the nursery and making it robotized increases the profit of the agriculturists of India. In this project, a cost-efficient nursery innovation is proposed so that it can be managed by the Indian farmers and if not, they can access advances from the government of the country under different plans and schemes. Money crops imply the items which return altogether more advantage to the agriculturists than the commonplace gathers and requests too. Meanwhile, the development of such harvests isn't normally done in India in light of the climatic boundaries of the country and these yields need concentrated consideration for delivering the best yields in any case can be effortlessly influenced by illnesses and irritations.

This issue can be overpowered[12] by the usage of electronic mechanized nursery innovation which can be built utilizing trend setting innovations of the Internet of Things i.e., IoT through different sensors, actuators, micro controllers etc.

II. Literature Survey

This article [1] considers the adoption of IoT-enabled farming, particularly for those who require a smarter approach to agriculture. This study focuses on real-time surveillance using the most cost-effective security solution. This document [2] reflects the broad deployment of wireless sensor networks in the agriculture business with the emergence of the Internet of Things technology. Further agricultural parameters are often recognized via the wireless network of sensor, such as temperature, humidity, soil moisture, soil nitrate content, and groundwater quality. Precision farming employs a range of environmental monitoring and controls methods for the development of many plants. [4] It is quite difficult to meet the needs of farmers to manage water evenly due to the unequal distribution of rain water. This necessitates some irrigation methods that are suited for every weather condition, soil type, and diversity of crops. Finding a strategy that provides flawless analyzing and regulating in order to build a proper atmosphere is more vital. The subject of this lecture is how energy resources in today's world become scarcer and hence more valuable. [3] As the world's population increased in the last century, it has become more necessary for creative, more effective and sustainable agricultural and food practices.

This study demonstrates that traditional agricultural methods have been shown to be incapable of delivering an adequate amount of fertilizer.[5] Similarly, no explicit regulation of climatic factors can be created. During this work, we developed a prototype, comprising a sensor (SN) based node and an embedded system (ES) based on the Raspberry Pi which actively monitors climatic parameters in a greenhouse environment such as air temperature, air humidity, soil moisture, air carbondioxide and the intensity of light. The report finds that the Automated Greenhouse System supports farmers through Internet of Things (IoT) control of environmental factors, including the use of the image analytics to monitor crop health.[8] Two variables influence Greenhouse in general: plant disease and weather conditions that result in a decline in yield. This paper [9] aims to enhance vegetable, fruit and agricultural yields using contemporary technology. The suggested IOT-based, intelligent green house farming system monitors and alerts users via mobile applications to parameters such as heat, wetness, soil moisture or light using sensor components.

III. Objective

The main purpose is to build a minimum cost mechanized framework to manage cash crop development in India for all ranchers' collecting in India. The planned development automated nursery innovation may be the finest alternative to assist India transform its traditional growing methods by this new development since it consists both farm monitoring and automated irrigation control and to make people aware of innovation-based farming techniques that can make them more profitable than expected and enable farmers in India to have a better living.

IV. Proposed System

An IoT based smart cash crop cultivation is proposed where the system uses Raspberry Pi, humidity sensor, color sensor, temperature sensor, soil moisture sensors, LDR sensor, LED lights, fan, motor driver and motor. Through Twilio the user will get the alert messages. The system is proposed in such a way that every sensor used had a feedback and is automated according to the threshold considered for the respective cash crop. This helps the user to continuously monitor the green house and get alert messages regarding the status of the green house. Thus, this will make the user aware of the green house environment and the automation makes reduce the human effort of valuating continuously and makes the returns more. The system contains both farm monitoring and automated irrigation system.

V. Methodology

A system of automatic temperature management and irrigation to maintain a suitable environment in the greenhouse and to preserve an adequate humidity content in the soil, utilizing temperature and humidity sensors (DHT11) to monitor temperature, humidity and soil moisture content. The greenhouse's whole interior is split into many sections. The color sensor detects plant health by obtaining the leaf's color and it will detect red, green and yellow. From the plant growing conditions all the data like temperature, humidity, soil moisture, lighting conditions are adjusted in the software and the user get the feedback messages automatically. For example, the experimental plant used is pepper. It requires the soil humidity of 50%, air humidity between 50%- 70% and temperature between 20-26 degree centigrade. The serial DHT11 sensor output is linked to the GPIO pin of Raspberry PI.
The following formula is used to calculate a threshold value.

$$\text{Idx (Threshold value)} = \text{Temperature} + (\text{Humidity} * 0.1)$$
$$= 26 + (14 * 0.1) = 27.4$$

The fan is switched on automatically when the temperature and humidity value exceed the threshold value, so that the closed greenhouse systems moisture and temperature is maintained and if moisture is less pump is activated.. Examples for cash crops includes peppers, colored capsicum, dutch rose, exotic vegetables etc. For all cash crops threshold is calculated and can be used.

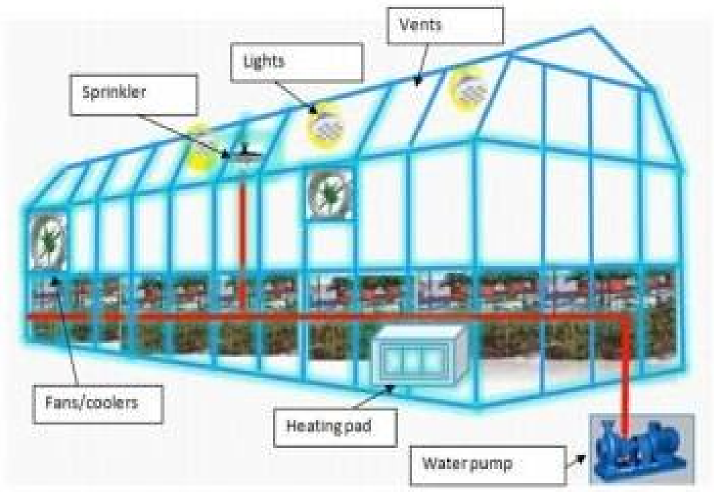


Figure 1: Proposed System

VI. Implementation of Proposed system

Here is Greenhouse automation Raspberry pi Board monitoring for LDR sensing light intensity using and controlling LED light if brightness or darkness using a temperature and humidity sense for measuring temperature and controlling the FAN. Using an earth humidity sensor to check for a dry or a wet soil and controlling a motor pump if soil is dry. The temperature is monitored by the sensor and, by increasing beyond a specific threshold, the system activates the cooler to decrease the heat back down to the target level. To retain moisture inside the allowed limits, a slash device is employed. The sensor DHT11 has moisture and temperature sensors.

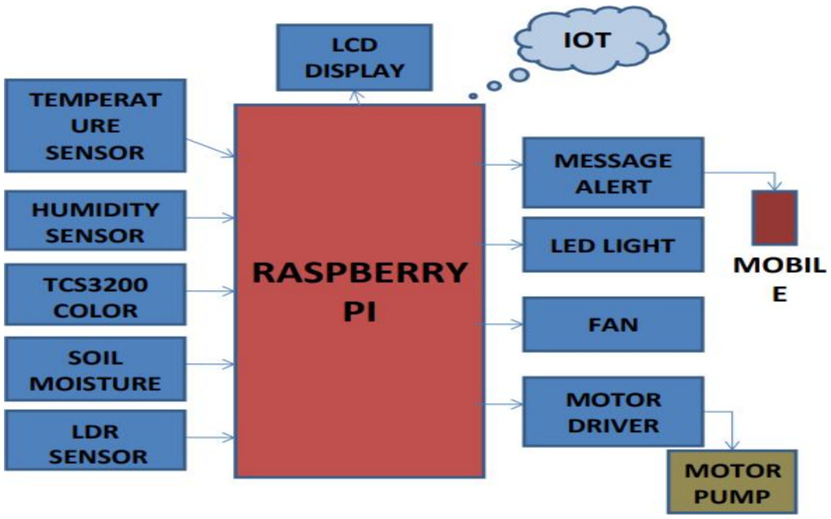
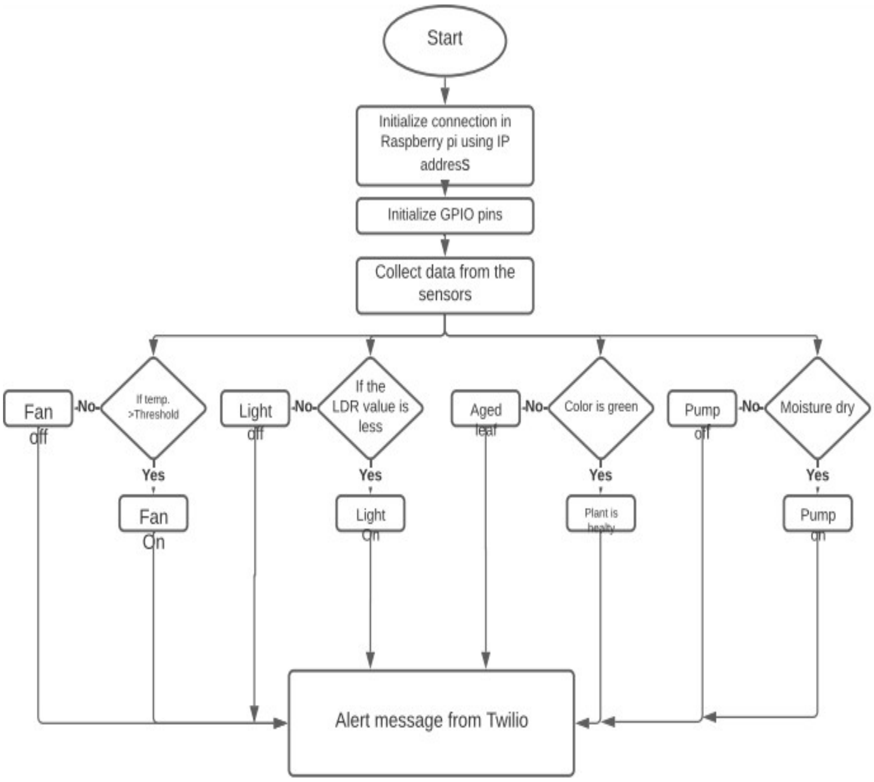


Figure 2. Proposed System block diagram

DHT11 is a device that is straightforward to use. All sensors submit this information. The data can be transferred in one method or another. Upon request, via the GUI or directly from the mobile phone master. If data beyond the permitted range is detected by sensors, In order tore mind you to decide based on the data provided (e.g. to send an SMS to the mobile master, if Temperature goes over, an SMS will be sent to the mobile master (COOLER should be turned on). If a warning message is answered, the system will obey the order, otherwise the system will ignore the directive. They're going to take care of themselves.

VII. Flow Diagram



VIII. Implementation of Charging Module

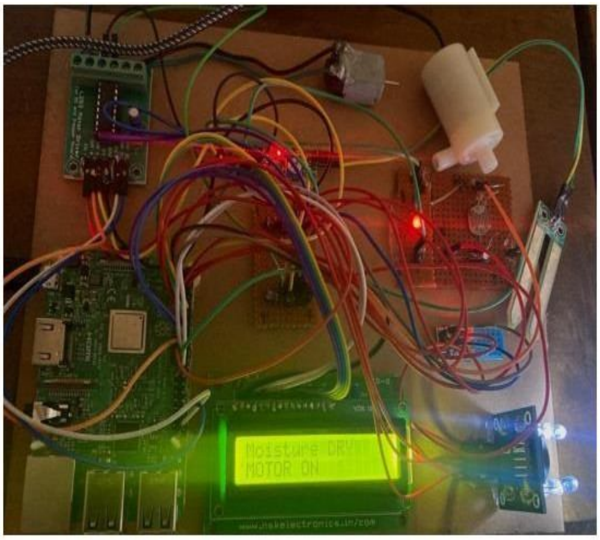


Figure 3: Implemented Prototype Model

IX. Results and Discussions

TEST 1: The test is conducted when the temperature is less than 40° with some moisture environment. The results obtained are as below.

- Read temperature and humidity values from DHT11sensor.
- Temperature and Humidity values are shown on LCD display.
- Temperature is less than 40°C hence system is turning of ffan.
- Soil Moisture is present in soil so system is turning off motor pump.
- Soil moisture's wet message is displayed on LCD display.
- LDR sensor value is high which represents as daytime.
- Daytime message is displayed on LCD displayed.
- System turns off LED light.

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- Colour sensor is facing soil to obtain respective sensory values.
- After processing since red colour value is greater than 10000 and other two-colour values are below 10000, we have obtained red crop as result.

TEST 2: The test is conducted when the temperature is less than 40° without moisture environment. The results obtained areas below along with LCD display and simulation results

- Read temperature and humidity values from DHT11sensor.
- Temperature and Humidity values are shown on LCD display.
- Temperature is less than 40°C hence system is turning off fan.
- Soil Moisture is absent in soil so system is turning motor pump ON.
- Soil moisture's dry message is displayed on LCD display.
- LDR sensor value is low which represents as nighttime.
- Night time message is displayed on LCD displayed.
- System turns LED light ON.
- Colour sensor is facing soil to obtain respective sensory values.

After processing since blue colour value is greater than 10000 and other two-colour values are below 10000, we have obtained blue crop as result. Automated status is shown in the LCD screen from the output received from the sensors and the result is illustrated in figure 4.

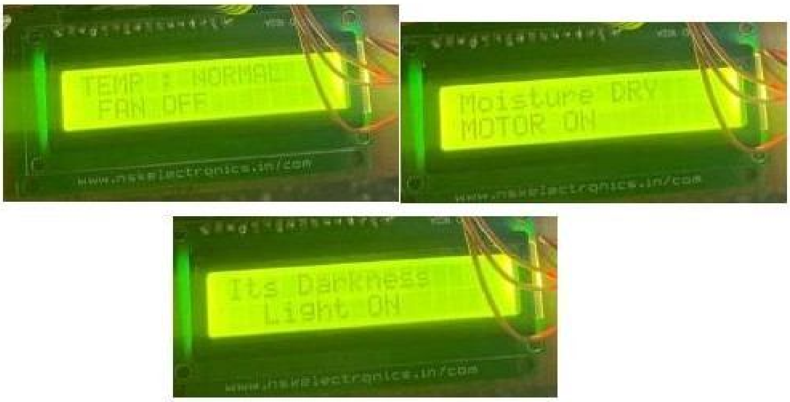

Figure 4. Different Outputs on LCD display

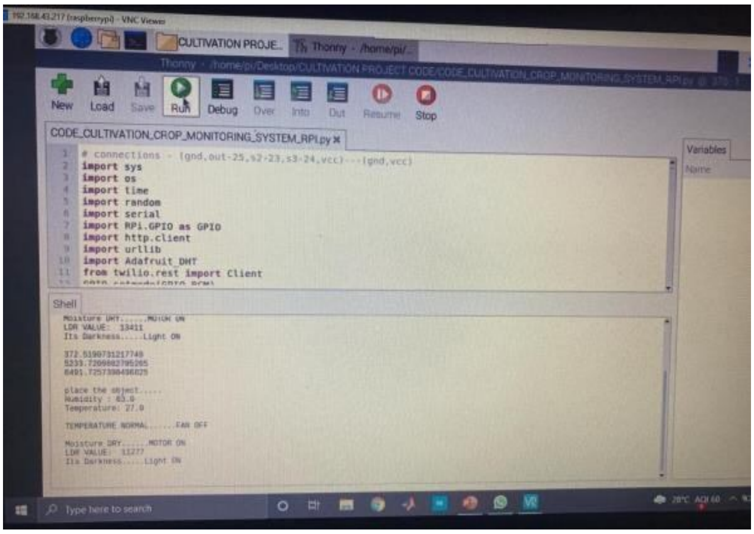

Figure 5. Simulated result

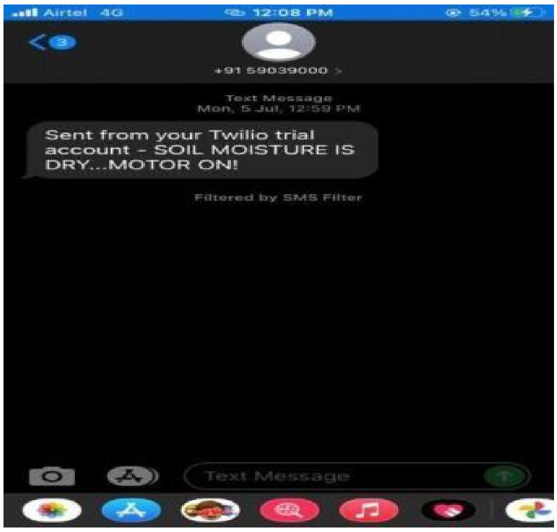

Fig 6 Alert message to the user through Twilio

The simulated result obtained from the monitor is showed on Figure 5 where it includes the data collected from the sensors. The feedback alarm message is sent to the owner or the cell phone number that had been included in the program through Twilio. The simulated text message sent is as shown in the below Figure 6.

X. Conclusion & Future Work

In an agricultural nation like India, where compensation is the norm in most of the areas, people should think about new developments, with the goal of achieving it in their development, and of enhancing it generously. Individuals really need to be aware of the growth of money and the use of arobotic plan and innovation and may help them to enhance the nation by both socially, monetizing by doing so in their daily lives. A less expensive IoT greenhouse system was established to monitor the environment of greenhouses, such temperature and humidity, and also to examine the health of plants. Many input devices and actuators have been utilized. Farmers will profit from the technology since the greenhouse climate can be readily regulated and monitored. The concept is flexible, cheaper and more compact for the agricultural sector. In order to capture all areas of the green house in future, multiple cameras can be constructed. This configuration permits monitoring of the overall health of green house.

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