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An IoT based Smart Greenhouse Crop protection, Monitoring and Controlling System using Arduino Uno

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Abstract: Innovation is playing significant and helpful job altogether the fields like agribusiness, mechanical segment, Medical , and so forth. Considering the Agriculture part we have to screen plants constantly. In this way, rather than accomplishing all the work physically we can computerize it so there is less human intercession and time is spared and further more less human exertion. These advantages mean improved employments, and food security for urban ranchers and improved nourishment for their rustic partners in asset obliged zones.

This work is essentially about the improvement of current horticultural practices by utilizing present day advancements for a better yield. This work gives a model of a keen greenhouse which encourages the ranchers to do the work in a homestead automatically without the utilization of much manual review. The propose systems use Arduino Uno, soil moisture sensor, Rain sensor, Pi-camera & LED lights for controlling & monitoring smart greenhouse.

Keywords: Greenhouse, Monitoring system, Arduino, IoT, Sensors.

I. INTRODUCTION

Web of Things (IoT) is an idea and worldview that empowers cooperation among objects inescapably present in a situation. Around 55 percent of Indian population has been occupied with agriculture and unified exercises which comprise just 15 percent of GDP so, it turns out to be a lot of significant for the partners required to emerge from the regular farming practices and modernize the agribusiness utilizing innovation.

The record for the achievement of IOT is its proficiency and makes it a possible innovation easily. There has been a squeezing need to give constant homestead data like soil moisture, temperature, and pH to the farmers. These are fundamental soil boundaries that impact generally crop development, and thus the farmer produce. Observing of soil moisture in various territories of a homestead can help the in generally water system the executives. We have seen mechanization in practically all the divisions. However, agriculture is one such division where computerization has not taken place overall that may be, it has not replaced the human work completely.

Greenhouse can give the required measure of light and warmth yet watering plants, and so forth needs human exertion. So, we have concocted the arrangement of a computerized greenhouse which is an exceptionally modern and dependable framework and is intended to work effectively. This chips away at criticism control i.e, it screens the greenhouse by aligning exact outcomes and changing the conditions dependent on the prerequisite. At the point, when done consistently we can accomplish precise conditions. This is an IoT based system which can be utilized for development of tropical yields or explicit plant species which require explicit ecological conditions. Checking and controlling is utilized in different applications including temperature, humidity, soil dampness, light and CO2 focus. With this system client can distantly screen and control the greenhouse climatic conditions from anyplace which could spare the human costs. Nursery gives ecological atmosphere conditions to develop plants year around, even on cold and rainy days.

This is controlled as follows, set the precise edge conditions for the variable qualities, and in the event that they cross the edge conditions, at that point tell the proprietor of the nursery about the progressions and control it is consequently by the actuators, so that, the rancher comes to think about the states of greenhouse. By utilizing current technologies, we are planning a computerized greenhouse which forestalls waste of harvests because of weighty and uneven rainfall. It comprises rooftop which can close during heavy rainfall and open during the conditions determined by the client. Rooftop can be controlled consequently and physically. This framework can monitor different physical conditions like humidity, moisture, and temperature reasonable or a development of plant indicated by the user.

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II. OBJECTIVE

A. Reviewing on how LED lights can be used as a photosynthesis to store food and energy in a plant
B. About the crop damage due to heavy rains
C. Secure crops utilizing Green house strategy.
D. To control activities with respect to shutting and opening of Roof and different activities physically through IOT innovation.

The above objectives would be completed on a margin of proving the specific hypothesizes through survey analysis, which are:

1) LED lights are very efficient and capable of producing the type of light needed by the plants, because LED Light gives food and energy to plants through photosynthesis and makes everything flourish.
2) A rain sensor is an automated device that shuts off greenhouse irrigation system every time its rains, and because of that rain sensor alertness it will save crops.

III. LITERATURE REVIEW

In[1], Ravi K, K. et al. This author was concluded a smart greenhouse, which causes the farmers to do the work in a homestead consequently without the utilization of much manual investigation. Greenhouse, being a shut structure shields the plants from extraordinary climate conditions in particular: wind, hailstorm, bright radiations, and creepy crawly and bug assaults. In[2], Angal S. et al. The Author was concluded studied plant a shrewd greenhouse checking framework dependent on the internet of things. Took a full thought of cost, practicability and different components, joining the IOT with fluffy controlled technique, utilizing GPRS to controller, structuring a brilliant farming Observing framework with better execution, basic structure and simple extensibility. In[3], Abdullah N. et al.

The assurance of soil temperature was finished utilizing the ds18b20 sensor taking a shot at the Dallas one wire convention. The framework was coordinated with Bluetooth for the exchange of information to a closed by phone. The whole framework was created on stm32.

Nucleon stage. Future work was underway for integrating 6lowpan for networking. In[4] Shankaraiah. et al.The author was concluded they had executed model of a computerized greenhouse in which we controlled the boundaries like dampness, temperature and soil dampness, utilizing the sensors like STM32 and furthermore we took pictures of plant at specific time frames and send it to mail, so that on the off chance that an individual needs to check the states. In[5], Akkas M. et al. The Author was concluded.

The author proposed a WSN model comprising of MICAZ hubs which were utilized to gauge nurseries temperature, light, weight and mugginess.

Estimation information had been imparted to the assistance of IOT. With this framework ranchers could controlled their nursery from their cell phone and PC from any places. In[6], Shirsath O. et al. Takes out risk of greenhouse not being kept up at explicit natural conditions because of human error. greenhouse. A client ready to characterize explicit greenhouse conditions “Plug and Play” items. In[7], Jennifer et al. This Author was concluded The

Wi-Fi availability in worked in the Netduino empowers a simple data moved to the cloud. The proffered framework utilizing the Netduino guarantees creation increment and a pressure decrease for the farmers giving a competent mechanized framework for green house the executives with a SMS adjusts to the clients. In[8], Shenan Z. et al. The Author was concluded the IoT rely upon the opened web to convey its information, so it could be affected straightforwardly by the web issues such clog additionally, the had been utilized as light power sensor this apparatus may create uncertain outcome and that may impact on the general framework execution for e.g. overshot. In[9], Sreekantha et al.

The Author was concluded the literature survey on the internet of things for the online crop monitoring. He describes that the IOT enables an effective and an easy production of the crop, increasing the profits of the farmers. The Sensors also play a vital role in the monitoring of the crop growth by gathering information about the growth and sending them to the farmer’s mobile devices for implementing the corrective measures In[10], Anjana M. et al. Security of yield during rainy season was significant test for ranchers. By joining farming innovation, a situation condition for a yield to greenhouse assists with securing the yield in any climatic conditions. Utilizing IOT innovation it encourages the ranchers to controlled develop will made along with the different highlights like sensor based thoroughly observing, security, crop safety from unnecessary downpour and programmed rooftop overlaying office.

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IV. COMPONENTS

1) *Arduino Uno:* It is an open-source Arduino Uno board based on the ATmega328P microcontroller. The board is consisting of sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE via a type B USB cable.
2) *GSM900A Module:* It is mostly use in the mobile communication system. It will help to send the message with registered mobile number in sim card which is interested in GSM module. It has capacity of transmitting data from 64 Kbps to 120 Mbps rates
3) *Soil Moisture Sensor:* Measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.
4) *Rain Sensor:* A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall.
5) *LED Lights:* Light emitting diode (LED) lights are often used to encourage plant growth. Plants utilize different wavelengths of light to promote vegetative growth and flowering. LED lights are very efficient and capable of producing the type of light needed by plants
6) *Pi Cam:* Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects.

V. PROPOSED SYSTEM

The propose system is planned by joining different hardware and programming advancements in to it. The proposed system utilizes Arduino Uno as a fundamental control unit and all the controlling activities and executions have been completed by this Arduino. This systems utilizes different sensors to screen and control different parameters like temperature, dampness content in the soil, humidity etc. and so forth GPS, LED lights Pi cam, and the sensors incorporate mugginess sensor, dampness sensor and rain sensor/rain switch as appeared in the Fig. 1. This sensor gives different readings that will help monitor and control the Greenhouse. Whole system works in both automatic mode just as in manual mode. By utilizing IOT innovation proposed system additionally empowers the manual observing of green house from anyplace.

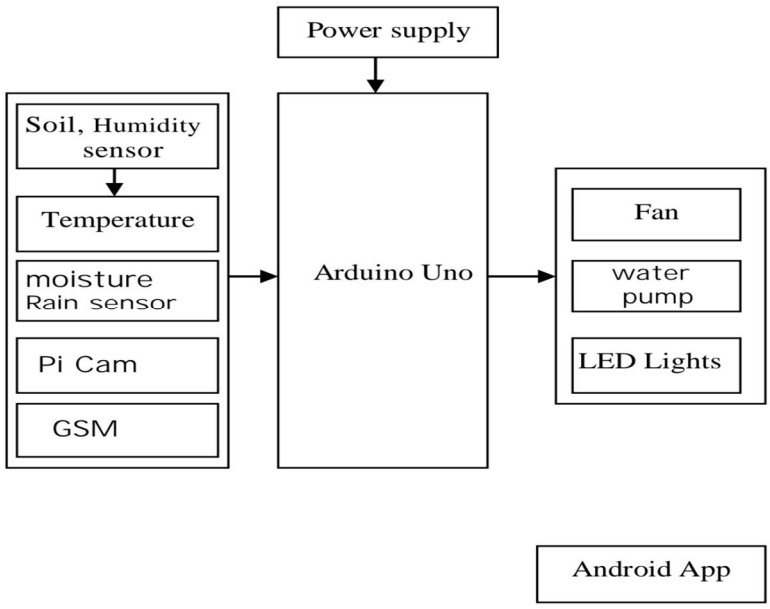


Fig.1 Block diagram of proposed system

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VI. METHODOLOGY

An online survey was taken using the google forms. Link of the form was circulated on social media platforms. The questionnaire was designed in form to test the above proposed hypothesis which verify the certain parameters.

1) *Participants:* To test this hypothesis, this study uses two conditions i.e., first one is helpful and second one not helpful. Total 48 participants data were collected from different states. From this 30% were female and remaining 70% male.
2) *Measures*

Gender	Yes	No	Total
Male	29	3	32
Female	13	3	16
Total	42	6	48

Table 1:- Collected data by online survey

Here is the formula of calculating the expected value.
Formula: - Expected Value = (row total) * (column total)/ (grand total)
E11 = (32*42)/48 =28
E12 = (32*6)/48 =4
E21 = (16*42)/48 = 14
E22 = (16*6)/48 = 2
We have obtained these expected values, now we need to compare this value with what has been observed. To do this, we need to calculate the X2 statistic, which is shown below.

$$X2 = \sum \frac{(\text{Observed value} - \text{Expected value})}{\text{Expected value}}$$

In this formula we have to subtract the expected value from the corresponding observed value. After subtraction has been completed, we have to square them and after squaring result we have divide it by expected value. We have to perform this step for every value and at the end we have to add this answer together.

Calculation table for above example is given below

Obs	Exp	Obs-Exp	$(Obs-Exp)^2$	$(Obs-Exp)^2/Exp$
29	28	1	1	0.0357142857
3	4	-1	1	0.0357142857
13	14	-1	1	0.1
3	2	1	1	1
Total				1.1714285714

Table 2:- Calculation Table

VII. EXPERIMENT

Test value of independent sample where calculated at the significant level 95% using chi-square test. By using this test, we calculated X2 value. With help of participants, we able to test the multiple parameters in test i.e. (Would it be helpful to know if an accident has occurred or not? If an accident occurred, would it be helpful to send a message to the rescue squad, police and to relatives?). The calculated chi value is 1.1714285714, and tabulated chi value at 95% significant level is 3.84 with degree of freedom 1.

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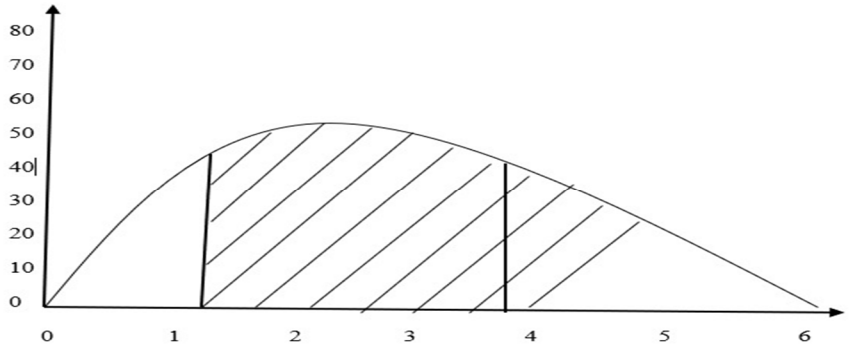


Fig 2:- Statics of Chi square test

VIII. RESULT

The test value of independent sample calculated by chi-square test with help of online survey analysis in that participants have facing at many times paste attack , so therefore this LED lights and Pi cam is helpful to them. Therefore hypothesis 1 is accepted.
The test value of independent sample calculated by chi-square test with help online survey analysis in that participants have been seen that when heavy rainfall happens there is lots of crop damages and because of this had to face the loss in farming business in time; therefore, this Rain sensors sends alertness and close the roof of greenhouse and GSM module sends messages about plant conditions to the greenhouse owner, is this technology helpful to them. Therefore hypothesis 2 is accepted.

IX. CONCLUSION

In this paper proposed system is use to provide the information about heavy rainfall happens or not and getting the message. In this system Rain sensor is used to getting the alertness of whether conditions and closing the roof of greenhouse, and LED Lights is used to flourish the plants photosynthesis for plants , and GSM module is used to send the message to the owner of greenhouse on theirs registered numbers. The results of proposed system it satisfying the participants according to survey analysis

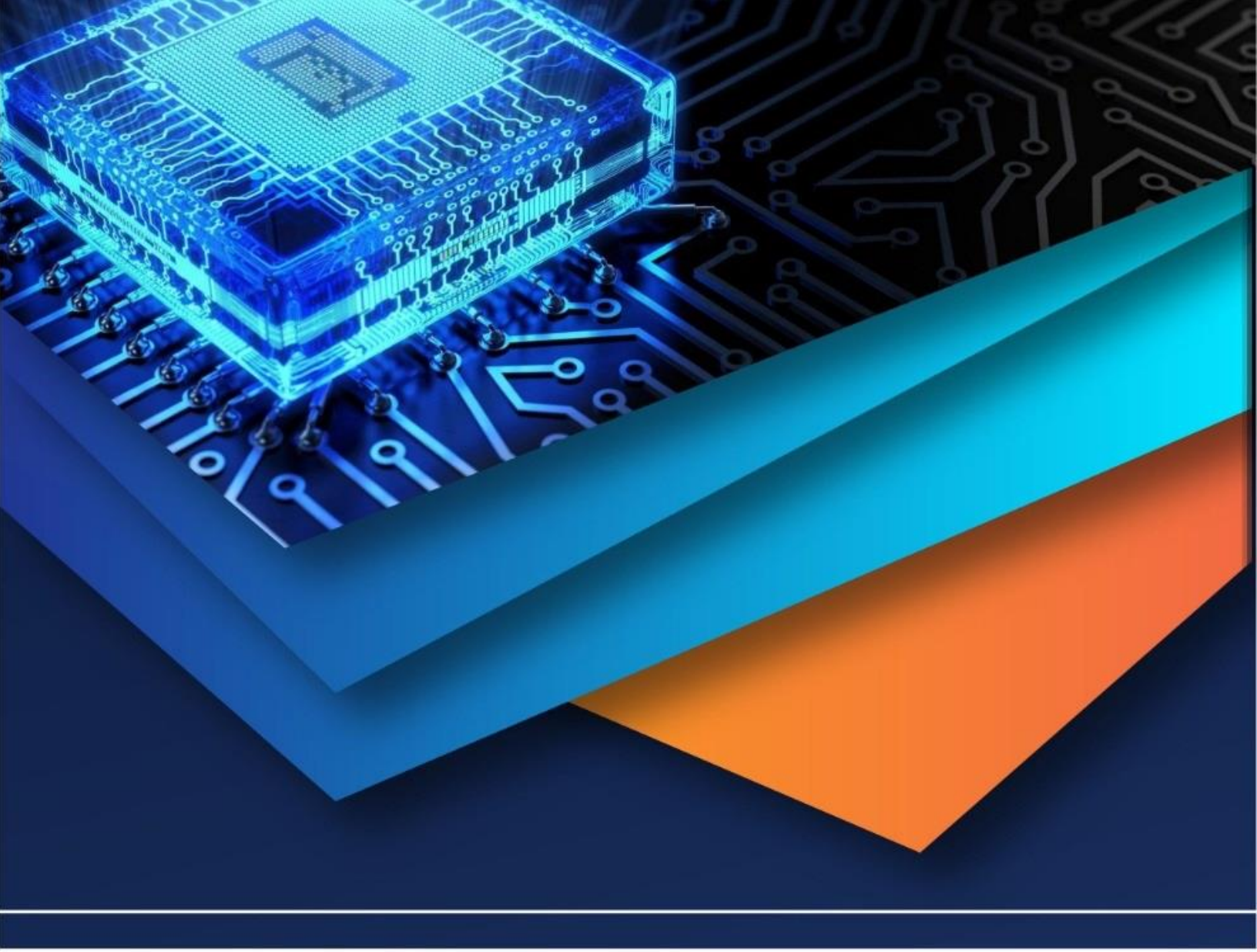
X. ACKNOWLEDGMENT

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