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Self Regulating Monitoring Device using IoT for Greenhouse Agriculture

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Abstract: ***The fundamental idea is to increase the growth of different varieties of crops with good quality in a closed environment usually a Greenhouse. Several parameters contribute to the plant's growth in a commercial greenhouse, namely soil moisture, atmospheric temperature, humidity and light intensity. Maintaining optimal levels of these environmental parameters is essential for healthy growth of the plants and to maximize yields in terms of fruits and vegetables. Monitoring only a few parameters, such as temperature and humidity, while neglecting others, leads to incorrect observations and egregious yields. The Internet of Things is the most encouraging innovation in horticultural applications which comprise of consistency of gadgets associated with screen and control the farming attributes. It can minimize the use of labor and energy and maximize productivity and quality of agricultural products. Because of its low cost and autonomy of energy, the system has the capacity to be useful in water limited geographically isolated areas.***
Keywords: Greenhouse, Temperature, Humidity, Soil Moisture, Light Intensity

I. INTRODUCTION

The scarcity of the agricultural products worldwide is going to increase day by day due to two major factors i.e. overpopulation and urbanization. Basically the rural area is decreasing quite significantly day by day and the amount of farming is also decreasing which may results in decrease in agriculture production. Now to overcome this situation world has only solution is to increase crop productivity by utilizing the resources very judiciously.

Due to inadequate rain and less reliable crops many of them were not able to use automated machines. They were depending on many traditional ways of cultivation. In recent days, many research institutions found greenhouses for growing crops in controlled climatic conditions which will yield more produce with fewer inputs such as water, manures, etc. Green houses are deployed in India at places of higher altitudes where climate is either extremely cold or extremely hot where survival of living organisms is difficult. Because of the high economic returns on fruits, flowers and vegetables, of late, research into greenhouse climate monitoring and control has attracted the attention of several researchers because environmental factors greatly influence the quality and rate of plant growth.

Soil moisture is important for the physical structural strength of plant while temperature (heat), humidity (water molecule) and the light is required for photosynthesis process. Temperature control in greenhouse environment is extremely important because crops grows optimal if we can provide them temperature in specific range for certain amount of time.

II. RELATED WORKS

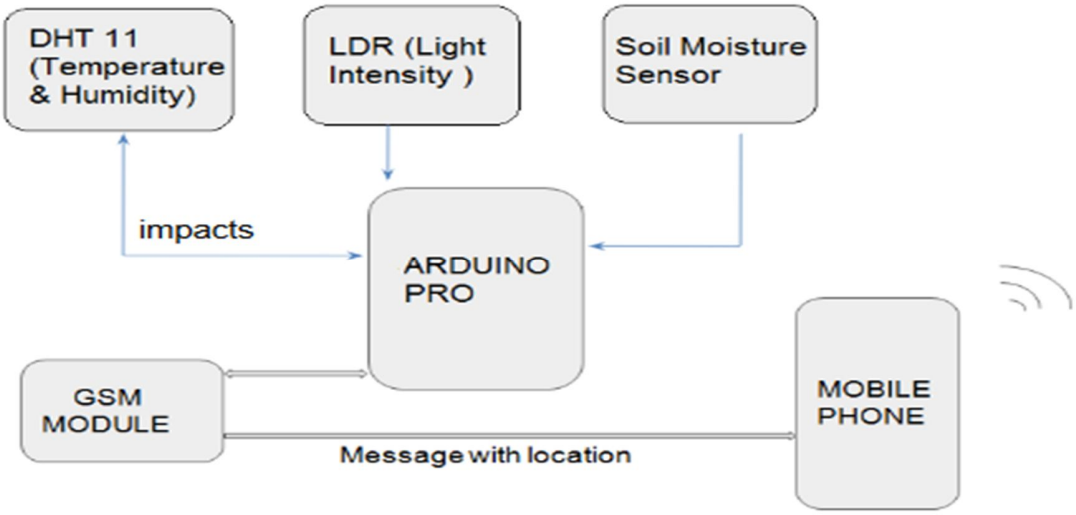
(Yichuan Zhang, Kai Zhou et al,.2014) proposes the implementation of the land circulation system has brought new opportunities for China's agricultural development, and building the smart agricultural demonstrating park is an essential measure to promote the efficient development of modern agriculture. Thus the concept of integrating smart into the agricultural construction demonstration park can promote the sustainable development of the park.

(Han-Sung KOO and Jae Hong, 2015) proposes a framework that adopts RCAS, which is a security system which is dedicated to cable television system, as a cable two-way broadband network, and data protection system as a communication channel among smart agricultural service participants.

(M.K.Gayatri, J.Jayasakthi et al,. 2015) They proposed an approach combining the advantages of the major characteristics of arising technologies such as Web Services and Internet of Things in order to construct an efficient approach to handle the abundant data involved in agrarian output.

(TejasBhosale, MinaksheePatil et al,. 2015) proposed work aims at developing wireless sensor nodes for monitoring soil and atmospheric conditions. The nodes will use the ARM-LPC2148 processor, a low range communication module CC2550 and various application specific sensors. The recorded parameters will be shared over the internet for database creation and for expert advice.
(KiranOtale, SumanPadhi et al,. 2017) proposes smart farming and issues raising in agriculture has overcome by making modern agriculture using automation and IoT technologies. This system comprises of live streaming of crops using automatic water motor on/off system and android phones.
(Manishkumar Dholu, Mrs. K. A. Ghodinde et al,. 2018)suggests the scope of IoT in the domain of agriculture. It also shows the various layers of market for agricultural product and how IoT can be applied at different layer. It also shows all the existing technology which can be handy while thinking of IoT for agriculture.

III. ARCHITECTURE



IV. COMPONENTS

A. Arduino UNO

Arduino UNO is a microcontroller which is similar to ATMega 328P. It is an open source device which was developed by Arduino.cc. The board is furnished with sets of analog and digital I/O pins that may be interfaced to various expansion shields (boards) and other circuits. The board has 6 Analog pins, 14 Digital pins, and is programmable with the Arduino IDE (Integrated Development Environment) through a USB type-B cable. It can be powered by an external supply of 9 Volt battery or a USB cable, though it accepts voltages in the range of 7 to 20 volts.

B. Temperature Sensor

The temperature sensor is utilized for detecting temperature. At the point when temperature surpasses from a characterized level or basic level, the framework consequently turns on the fan and a message is likewise sent to the proprietor or the administrator with data everything being equal. What's more, when the temperature comes in typical range or comes beneath the characterized dimension the fan turns off naturally.

C. Humidity Sensor

Humidity is estimated by utilizing the humidity sensor. In the event that the humidity of nature is beneath the characterized levels, showers are consequently turned on and if the humidity level surpasses from the characterized level splashes are naturally turned off. Here in this task rather than a shower I have utilized CFL to indicate the splash. Due to high humidity, odds of ailment are multiplying. For temperature and moistness same controlling move will be made. A status or warning message is additionally sent to the proprietor by the framework utilizing GSM Module.

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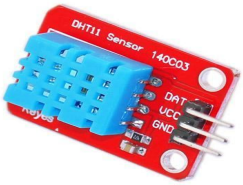

D. Light Intensity Sensor

Light intensity is a vital factor for the plant growth. In the event that the light intensity is low, it influences the growth of the plants. To determine the issue of low light, artificial lights are utilized. Here in this project 100W bulb is used for demonstration. When light intensity is lower than the pre-defined level, the artificial lights turns on, and when the light intensity comes in normal range artificial lights automatically turns off.

E. Soil Moisture Sensor

Water supply for plants is imperative for good development. So here in this demonstration I have used a soil moisture sensor and a water pump, for detecting soil moisture. Two probes of soil-moisture sensors are placed in the soil. When the sensor does not detect moisture in the soil then the system turns on the water pump until it reaches adequate level. A notification is also sent to the owner with status of water pump like Motor On or Motor Off. Transistor is used as a switch for sensing soil moisture.

F. LDR Sensor

Light Dependant Resistors (LDR) also known as photo resistors, are light sensitive devices most often used to indicate the absence or presence of light, or to measure the light intensity. The LDR sensor indicates the variance in light intensity such as increase in resistance upto 1MΩ in the dark and decrease in the resistance down to few ohms when exposed to light. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices.

G. GSM Module

Global Communication for Mobile systems is abbreviated as GSM. It was developed at Bell Laboratories in 1970. It is the widely used mobile communication system in the world. GSM is a digital cellular technology used for transmitting mobile data and voice services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

The SIM900 is a complete Quad-band GSM solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 deliversperformance for voice, SMS and Datawith low power consumption. SIM900 can fit almost all the space requirements in your M2M application, with a tiny configuration of 24mm x 24mm x 3 mm.

Attributes	GSM
Range	35 km
Data Rate	9.6 kbps
Media	Digital Data
Security	Moderate

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V. EXPERIMENTS AND RESULTS

A. Wireless Sensor Network

Nodes of WSN comprise of four key parts. The key segments are a power unit (batteries and/or electric source), a detecting unit (sensors and simple to-computerized converters), a handling unit (along with storage), and a mobile unit(for communication).

B. Watering Module

The water system is performed by controlling the pump using electromagnetic transfers associated with the microcontroller.

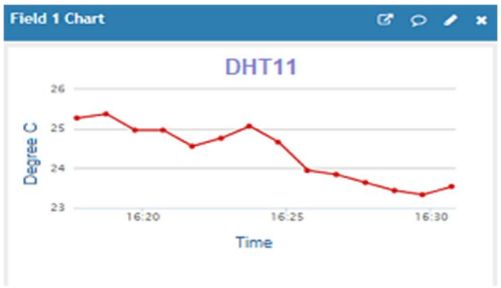

Fig 1. Surrounding Air Temperature

Fig 2. Surrounding Relative Humidity

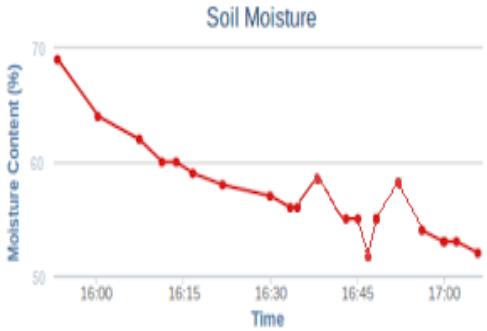

Fig 3. Soil Moisture Monitoring

The graphical representation of the data sense at the greenhouse is given in the charts above. The temperature of the surrounding environment is shown in Fig.1, similarly Relative humidity and the Soil moisture sensor data are as shown in Fig.2 and Fig. 3 respectively.

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VI. CONCLUSION & FUTURE WORKS

An electronics system has been proposed that includes a sensor node along with the IOT application in the domain of agriculture. Greenhouses require proper environmental conditions for optimal plant growth and health. If the mixture of temperature, humidity, and soil moisture are incorrect, crops can be lost. We have to monitor and maintain the proper mix of all the above for achieving more productivity in greenhouses. Internet of things based Greenhouse can monitor and control from office, trip or anywhere so that plants are always with us.

In future this work can be carried out by improving the usage of mobile app like adding alarms if particular parameter is not controlled properly. In the proposed system set point for relative humidity, soil moisture and surrounding temperature is mention during coding of the MCU now to make this prototype more practical these control of setting the set point can be given to the mobile app itself.

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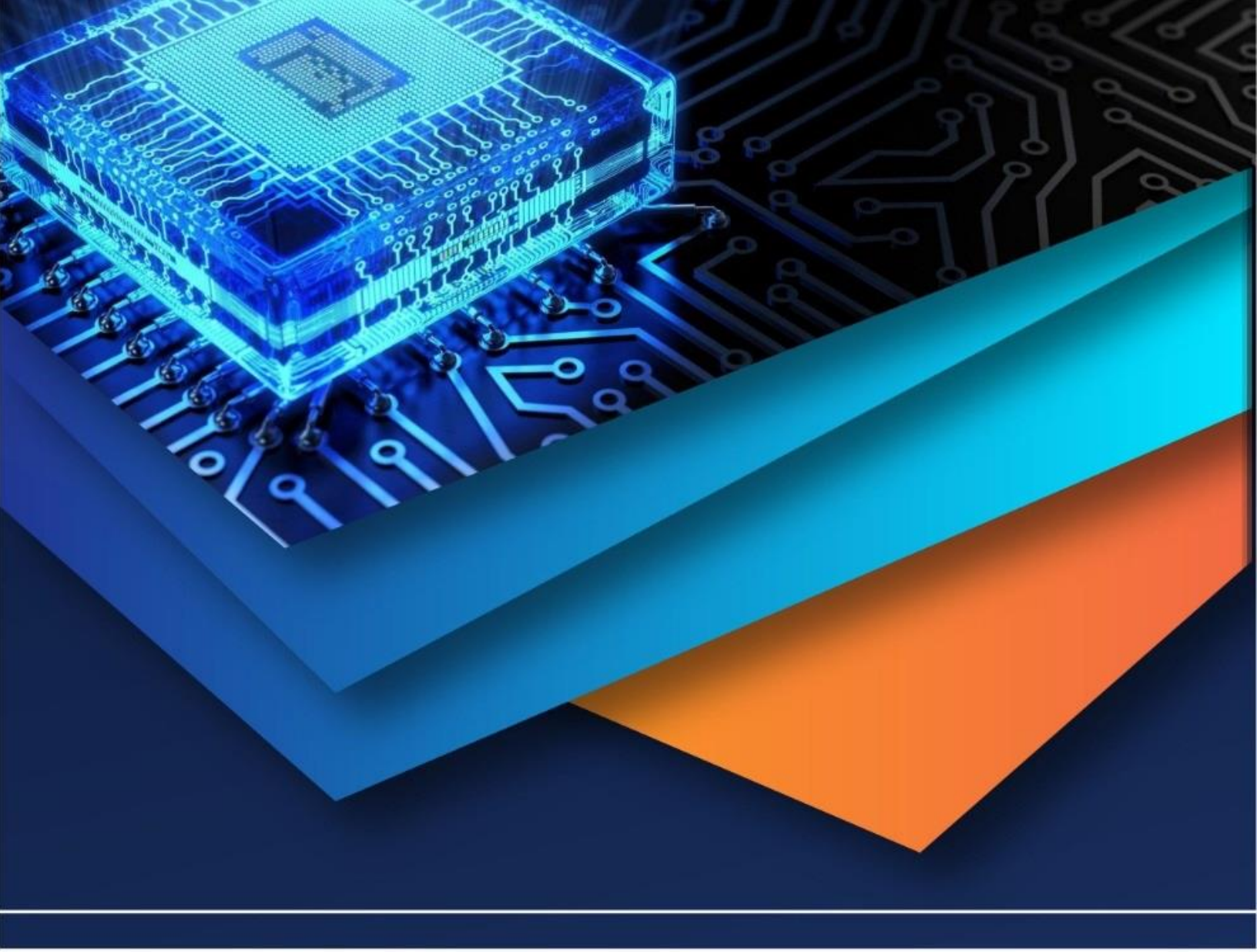

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