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Smart Greenhouse Using Automation

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Abstract- India is a land of agriculture. Agriculture is the main business in India containing about 60% of people but still compared to other countries we are behind. Agriculture sector contributes about 17-18% of the GDP of India. Thus, there is need to do innovations in these field. With the help of latest technology, the crop yield can be increased dynamically. Now, automation is employed in every sector from home to industry. In agriculture, Greenhouse Automation is a modern way in which farmers can monitor as well as control the parameters inside the greenhouse excluding the direct supervision of humans. In greenhouse by taking help of different sensors such as soil moisture sensor, temperature and humidity sensor, CO2 sensor, smoke sensor one can get the readings and accordingly one can control them. This project is easy to implement, it gives accurate results and thus increases fertility and productivity. The result that is achieved concludes that the given system is working efficiently.

Indexed Terms- Agriculture, Greenhouse, Raspberry pi, Sensors

I. INTRODUCTION

The greenhouse is basically a structure where different types of plants and vegetables can be produced [1]. It is generally covered with glass walls and translucent plastic roofs [2]. The main thing that affects production is greenhouse effect which is caused by accumulation of gases such as carbon dioxide, methane which comprises some of the heat that is emitted by the earth's surface. The other parameters are moisture in the soil, light intensity and temperature inside greenhouse [3]. To improve the efficiency of production we need to control these parameters. Thus, we use different sensors.

The sensors used in here replaces the human observations and also measure the environmental parameters and conditions inside the greenhouse for getting more precise measurements [4]. Also, it can allow gathering and processing the collected information for determination of actual status of the greenhouse. The use of IoT in these has contributed a lot to the evolvement in greenhouse [5]. The collected information is analyzed, stored and shown to the end user from any internet enabled device. With continuous checking and controlling of these environmental parameters a farmer can get significant data of how the parameters are affecting the plant growth. This is not limited only upto monitoring and reporting the changes in environmental parameters but also allows controlling the different conditions inside the greenhouse [6]. And from the information coming from these monitoring system decisions are taken of what should be done inside the greenhouse which will ultimately lead to maximum yield of the plants.

II. LITERATURE REVIEW

Several authors have recommended IOT concept in agriculture and greenhouse. K. Ranganand, T. Vigneswaran have described an embedded system approach for monitoring greenhouse-based factors which consist of humidity, pH of water, wetness of soil, temperature and light intensity. Such factors are measured using sensors, processed, controlled and the information is given to the proprietor with the help of Short Message Service technology using GSM modem [7].

Prakash. H. Patil, Chaitali Borse, Snehal Gaikwad and Shilpa Patil have developed a greenhouse monitoring system using GSM, which consist of monitoring of temperature levels, humidity, light and CO2. Their offered system consists of sensors and Short Message Service technology. This system provides a mechanism that alerts the farmer related to the parameter changes inside the greenhouse [8].

However, these both systems shortfall of a real-time

graphical illustration of the actual measured data and the attribute of controlling the greenhouse system remotely. Its main aim is to describe the greenhouse monitoring system which will exhibit the data that is sensed on a webpage and it also offer the facility of controlling and monitoring the system remotely.

Greenhouse monitoring and control system based on wireless Sensor Network by Marwa Mekki which consist of WSN implementation by deployed wireless sensor nodes in the greenhouse with temperature, humidity, moisture, light and CO2 sensors. For controlling the environmental parameters, the microcontroller is programmed for controlling the factors according to preset values or manually through a user interface panel [9].

An energy efficient environmental monitoring, alerting and controlling system based on ZigBee by K. Lokesh Krishnaetal, which is based on paper ZigBee based energy efficient environmental monitoring, alerting and controlling system for agriculture. This system uses an ARM7 processor, various sensors and ZigBee communication module. The sensors that are used to gather various physical data from the field in real time and transmit it to the processor and to the end user through ZigBee communication. Then necessary actions are taken [10].

III. PROPOSED WORK

Green house shells an important part of the agribusiness and agriculture areas in our nation as they are mostly used for development of plants under controlled climatic conditions for ideal produce. Our system is an advanced system which will not only observe but also control the various microclimatic parameters in the greenhouse continuously for farming of plants or vegetables which will increase their production over the complete crop growth season and to completely remove the problems that are involved in the system by decreasing human intervention. The raspberry-pi executes the work as it is connected to various sensors and relay which is further connected to the water pump and exhaust fan. Since we are using raspberry-pi as the heart of system instead of arduino, it creates the set-up low-cost and effective. The system consists of sensors, ADC, microcontroller and actuators. When any of the climatic parameter crosses a predefined threshold value which is to be maintained for safety of the crops, the sensors sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC. The further action is then being carried out by the microcontroller. Thus, this system is useful to farmer to control greenhouse from any remote locations.

IV. BLOCK DIAGRAM

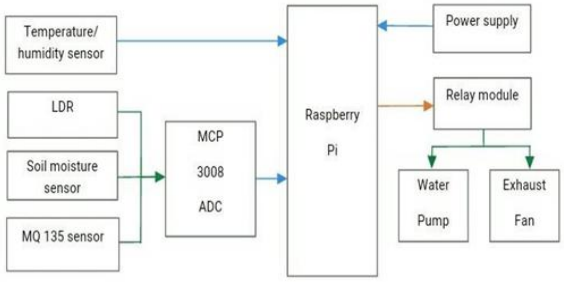
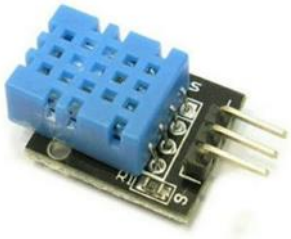


Fig. 1) Block diagram of proposed work

V. HARDWARE COMPONENTS

Temperature/humidity sensor (DHT 11)



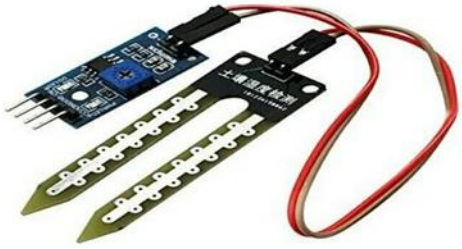
For temperature and humidity sensing, DHT11 sensor is used which is basically a low-cost digital sensor. The interfacing of this sensor is easy, so easily it will be interfaced with any micro-controller such as Arduino, Raspberry Pi etc for measurement of humidity and temperature instantaneously. It helps in getting in digital output. It consists of good stability and is quite reliable. It consists of main three elements such as a resistive type humidity sensor, an NTC thermistor and the an 8-bit microcontroller that helps in converting analog signals from both sensors and it helps in sending out the digital signal. And a critical value of temperature is fixed. When sometimes the temperature inside the green house reaches above the critical temperature level, the cooling fan is provided to cool down the temperature. The range of

temperature of DHT11 is from 0 to 50 degree centigrade with a 2-degree accuracy. Humidity range of this sensor lies between 20 to 80% with accuracy of 5%. The rate of sampling of this sensor is 1Hz i.e., it gives one reading for every second. DHT11 is not large in size and its operating voltage is from 3V to 5V. The maximum current used while measuring is 2.5mA.

- LDR

A Light Dependent Resistor (LDR) also called as a photo resistor is a passive device as they do not have any PN junction. LDR is a light sensitive device. They are also termed as photo conductors. The working principle of an LDR is photo conductivity that is nothing but an optical phenomenon. When the light falls on the LDR then the electrons within the valance band move towards the conduction band. LDR is the light sensor which is usually used for the purpose. The main function of LDR is to closely monitor the intensity of light. It turns off the light when there is a need to save the power and turns on the light when light is necessary within the greenhouse. The maximum power dissipated by LDR is 200MW and the peak wavelength is about 600nm.Its sensitivity is high and they are inexpensive and can be easily used.

- Soil moisture sensor



The 2 copper leads act like the sensor probes. They are dipped into the specimen of soil whose moisture content is to be tested. The status of conductivity of soil is depends on the quantity of moisture present in it. It increases with increase within the water content of the soil that forms a conductive path between two sensor probes resulting in a close path to permit current flowing through.

The specification of this sensor are as follows:

- The voltage required for working is 5 Volt
- The current required for working is less than 20mA.
- Analog type of interface is present.
- For working the required temperature of this sensor is from 10-degree celcius~30 degree Celsius.

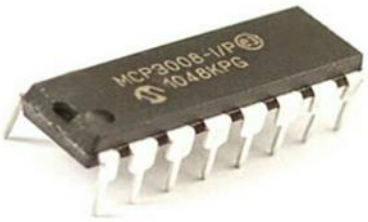
- MQ 135 sensor

This sensor is mainly used for Air quality control and mainly measures NH3, NOx, alcohol, benzene, smoke and CO2. In our project we are using it for detection of Co2 level and smoke it measures PPM of gas it has 4 pins namely Vcc, ground, digital out and analog out the VCC is used for providing power to the sensor and its operating voltages + 5 volt. The ground connects our module to the ground of the system. For getting digital output we use digital output pin. The analog output pin outputs the analog voltage from 0 to 5 volt based on the gas intensity.

Few features of this sensor are as follows:

- It’s detecting scope is wide
- It gives fast response and has high sensitivity
- It's stable and has a very long life
- It has simple drive circuit
- The preheat duration is about 2 second

- MCP 3008 ADC



The MCP3008 is nothing but an 8-Channel 10-bit ADC IC, therefore it will 8 different analog voltage with a resolution of 10-bit. We know that Raspberry pi only takes digital inputs. But the sensors we are using gives us the analog values. Thus, for reading these analog input we use analog to digital converter. In this project we are using MCP3008 ADC which is very popular in ADC. We connect these MCP3008 to our Raspberry pi using the SPI serial connection. To convert analog voltage to digital values it uses successive approximation register (SAR) method

The features of MCP3008 are as follows:

- The Operating voltage is from 2.7 Volt to 5 Volt
- The Sampling Rate is 200 ksps and 75 ksps for 5 Volt and 2.7 Volt
- It is generally offered in 16-pin PDIP, and SOIC packages

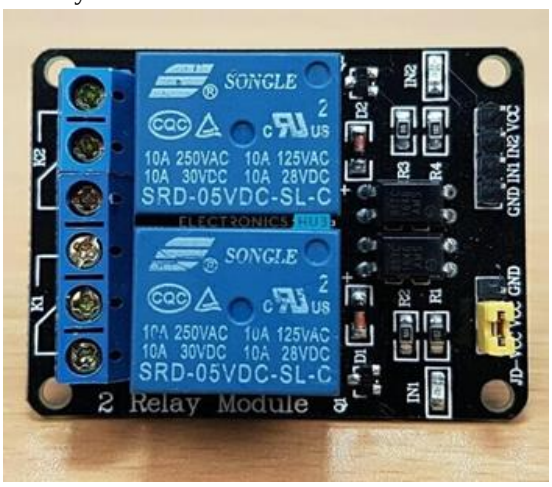
- Raspberry pi Zero WH

Raspberry pi zero WH is an advanced vision of Raspberry Pi zero W (Wireless) which was launched in 2017 and gained huge popularity. In Raspberry Pi zero W we need to solder the 40 pin headers which is quite time consuming. Thus raspberry Pi zero WH came into market which is pre-soldered with 40 header pins. It generally helps in hardware prototyping. It is a low cost single board computer. It is a lot more cheaper than the arduino controller board having 32 bit processor. But that is not the only advantage this WH version of raspberry Pi also comes being Wi-Fi and Bluetooth ready. We can control the pi zero remotely using SSH and VNC by installing the Raspberry Pi OS.

Some features of raspberry Pi zero WH are as follows:

1) The processor used is BCM 2835 SOC
2) Its clock speed is about 1 gigahertz
3) It has a Ram of 512 MB
4) It has mini-HDMI for display and audio
5) For camera interface it has CSI camera connector
6) It has pre-soldered 40 pin GPIO connector
7) GPIO is compatible with existing HAT add-ons

- Relay module



Raspberry Pi generally works on a supply of 3.3 volt. For controlling the devices like submersible water pump and exhaust fan we cannot connect it to the Raspberry pi as it works on ac supply while raspberry pi works on 3.3-volt dc. In such cases we can use the relay which is an electromechanical device having a coil and some electrical contacts. When this coil energizes it closes the switch and when it is deenergized it releases the switch. Raspberry pi is used to control the coil of the relay as small current is needed to energize the coil.

VI. RESULTS

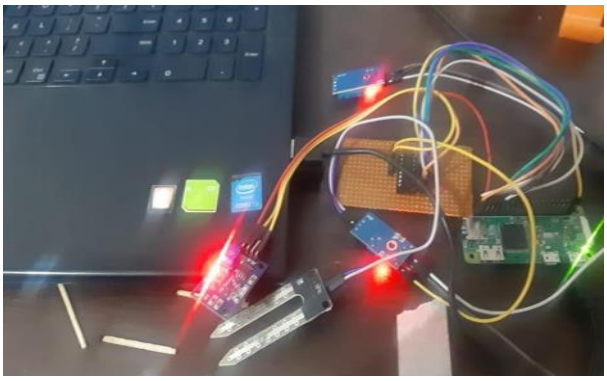
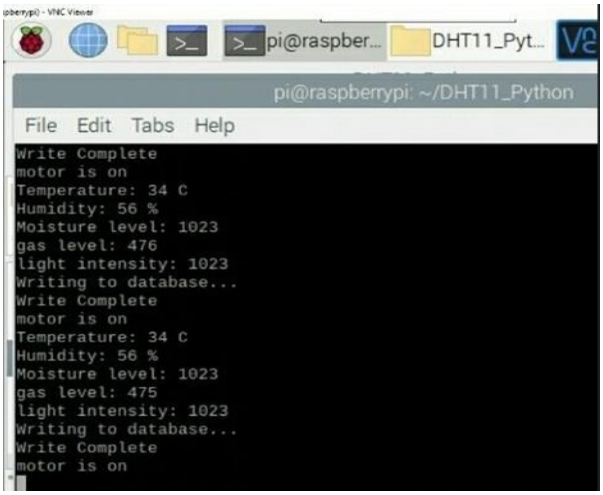


Fig. 2) Result of proposed work



CONCLUSION

In this paper we have seen how a greenhouse automated system works. Here we have implemented raspberry pi platform for monitoring and controlling of various greenhouse parameters. It changes the traditional way of monitoring and controlling the greenhouse by making the use of real time monitoring system thus saving a lot of time and human efforts. This increases the production of crops or plants inside the greenhouse which gives profit to the farmers. The farmers won't have to worry about their plants all the time as they would know that the plants are taken care of even if they are having a vacation.

FUTURE SCOPE

- Speaking voice control can be used.
- With the help of renewable source by providing the power, better performance of device can be achieved.
- The given system's performance is further enhanced which consist of operating speed and memory capacity.
- With the help of advanced version of controllers, the number of channels can be increased to interface a greater number of sensors.
- Time bound supervision of fertilizers, pesticides can be introduced.

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