

# IoT Based Greenhouse Monitoring Using Raspberry Pi

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**Abstract:** Green house is a created area in which plants grow artificially under controlled environment. In general, farmers face unseasonal rains, low irrigation system and season changes, so to avoid these problems, introduced green house monitoring using IoT. It basically monitors and controls the requirements, which are essential to grow plants. In this project dht-11, ldr, and Soil moisture sensors are used to detect light intensity, temperature, humidity and soil moisture. In this raspberry pi is used to connect with these sensors and also it controls all the sensors based on inputs given by the user and also send data to the end user via gsm module connected to it. Year –round production and off-season crops are achieved using this technology.

**Keywords:** *Raspberry pi, dht-11 Sensor, ldr sensor, greenhouse monitoring, gsm module and iot.*

## 1. INTRODUCTION

Internet of Things (IoT) is a technology in which sensors, software and other hardware modules are embedded for connecting and exchanging of data over devices via internet. IoT is now everywhere in the world, it evolving day by day in every aspect of life. In this research raspberry pi is used to connect with the devices, which are using in the greenhouse project. Basically raspberry pi is a mini computer without CPU; it performs linux and gpio operations.

In India, major part of the country's economy depends on agriculture sector. To maintain the sustainable development in the economy, agriculture sector must be increased. So one of the new methods to improve or bring development in agriculture is greenhouse technology. By using this new method, farmers can grow imported plants and also able to get the crop throughout the year.

In earlier, there exists this type of technology in greenhouse, but using micro-processors and micro-controllers and sensors. They are also proven successful, but comparing to the efficiency and response time, modern technology using IoT is best. In this modern era, everyone is expecting accuracy and efficiency. By using IoT, it can be achieved. In earlier, micro-processors and micro-controllers are used as controlling devices, but now arduino replaces them, raspberry pi also came into light to replace arduino.

Aim to have a real time monitored greenhouse technology, which works using raspberry pi, it is a low-cost portable linux computer, which has inbuilt wi-fi in it. Using this new technology in greenhouse to obtain better production from the field and to reduce cost of the labour and also to obtain sustainable usage of resources for future generations.

## 2. Motivation

The motivation of this project is due to the increasing population and crisis of the food production and also the problems facing by the problems due to irregular rains and low irrigation system in our country. The main objective of this project is to increase the production and sustainable usage of resources for future generations.

### 3. ORGANISATION

This model is prepared in the following manner such as

By discussing the total connections between the components.

By keeping the main objective of the model which is useful for everyone

Explains the realization of the objective

### 4. CONTRIBUTION

\*The contribution of "IoT based Greenhouse Monitoring using Raspberry Pi " towards society is, agriculture is the backbone of any country, so to improve the technology in agricultural sector and helps the farmers for better production and high income by decreasing cost of labour.

\*With the inclusion of IoT technology in these projects, we can provide a lot of job opportunities to the people who are educated.

\*By using automation in greenhouse, it decreases the cost of labour which eventually increases the economy of the government.

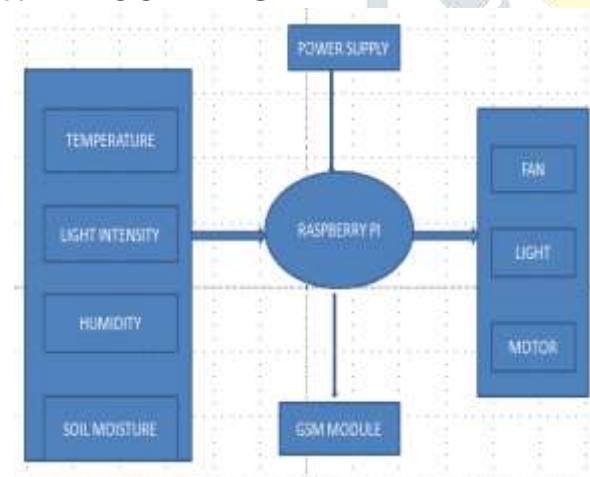
\*With this automation greenhouse using IoT technology, we can step ahead in agriculture sector improvement mission across our country.

\*The main contribution of this project is to increase the production of yield and better usage of resources using automation technology and also to provide lot of job opportunities to educated people. [3].

\*The main contribution of this project is to increase the hygienic conditions in public toilets which eventually decreases the diseases and also it is used to save water and maintain the sustainability of resources[3].

## 5. REALIZATION AND REPRESENTATION OF OBJECTIVES

### 5.1 BLOCK DIAGRAM



**Fig 1:** block diagram of greenhouse monitoring module

Raspberry Pi is a chip card sized mini- computer which runs on its own keyboard and mouse. It performs linux and gpio operations.

GSM stands for global system for mobile communication and it is a digital mobile network. This technique uses combination of time and frequency division for multiple accesses. It is used to communicate and transfer the data; it is a second generation of mobile networks.

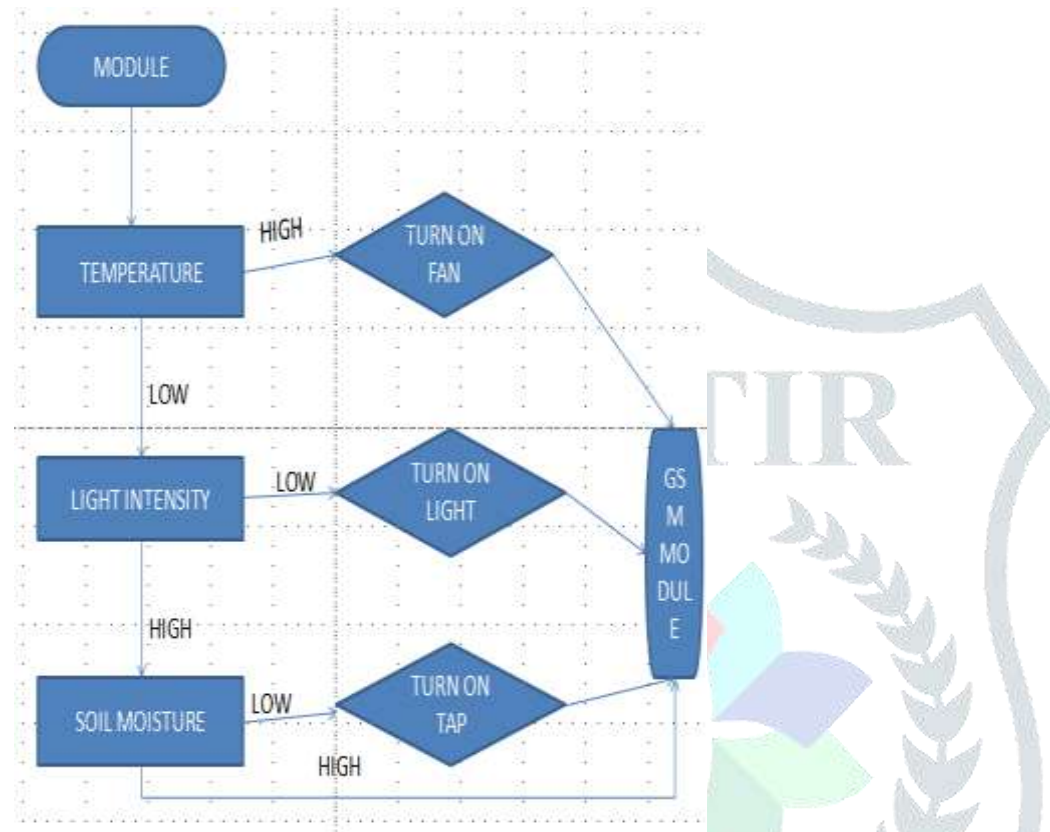
DHT-11 is an ultra low cost temperature and humidity sensor. It uses capacitive resistor and thermistor to measure the surrounding air. It calculates relative humidity by measuring electrical resistance between two electrodes.

LDR sensor also known as photo-resistor. It works on the principle of photo conductivity, is used to measure intensity of light.

Soil moisture sensor is deployed in the soil to measure the moisture in the soil, if the moisture decreases in the soil, the raspberry pi triggers the tap on to release the water to the soil. It is a low cost and high efficiency sensor; it has two metal rods held apart at a fixed distance with insulating material on it.

4-Channel Relay Module, it requires 5v power supply to work, it can be connected with Raspberry pi, AVR, PIC, ARM and MSP430. It consists of 4 relay modules with 'NC' means normally connected to COM and 'NO' means normally open to COM. It consists of 4 leds to show the relay status.

## 5.2 FLOW CHART



• **Fig 2:** flow chart of greenhouse monitoring module.

## 7. Analysis

In India, the major concern in agricultural sector is climatic conditions i.e, unseasonal rains, tropical weather and mainly India faces floods and droughts, which eventually creates poor irrigation system for farming, all these fall under climatic conditions. To overcome this issue, we came up with this new age technology called greenhouse monitoring using raspberry pi, which works automatically once setup is done. This technology not only helps farmers to overcome climatic conditions, which also helps farmers to reduce cost of labor. In a developing country like India, where population are gradually increasing day by day, and in contrast to that people, who can do farming are decreasing. By using this new age technology, we can overcome all these hurdles and we can achieve sustainable usage of resources.

**Advantages:** By using this method we can overcome climatic hurdles, we can decrease cost of labor, sustainable usage of resources and we can grow imported plants.

**Disadvantages:** Initial cost of setup is high, wear and tear of machines happens.

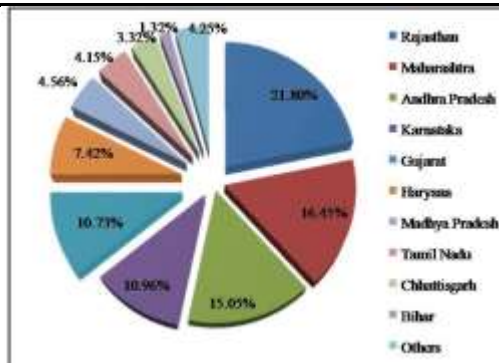


Fig.3: Irrigation system of different states



Fig.4: Greenhouse climatic conditions.

By using this method, we can able to bring ideal conditions in the greenhouse as shown in the above figure , as we can see in the above plot , we can understand that the temperature, humidity and light intensity is at moderate level , these conditions are required to grow plants.

## 6. RESULT

This proposed model basically focuses on resources utilization for future references. In this model, raspberry pi is used to control the sensors connected to it using IoT technology. Earlier arduino is used in this method, but now raspberry pi replaces it with its efficiency and accuracy. The rate of speed or response time is more accurate with raspberry pi than arduino.

Working of this model is, dht-11 sensor is connected to raspberry pi to detect temperature in the surroundings, if it finds that the temperature is increasing , it sends data to raspberry pi to turn on dc fan connected to it, soil moisture is connected to raspberry and deployed in soil to detect soil moisture and if it is decreasing , raspberry pi automatically turn on motor supply to provide water, in this ldr sensor is also connected to detect light intensity and if it's less, automatically light will turn on , these are all works on IoT technology and gsm module is connected to raspberry pi to send notifications to the user. Python platform is used to import code to the

NAME OF THE CROPS	CONVENTIONAL GROWTH	GROWTH USING GREENHOUSE MONITORING
TOMATO	12-15%	15-20%
ROSE	10-12%	16-20%
BRINJAL	10-15%	18-23%
JASMINE	12-16%	15-22%

Raspberry pi. It continues the process as instructed by the user, so manual input is not required and cost of labour is less compared to conventional fields.

Fig.5: comparison of growth of different crops over period of one month.

#### FUTURE SCOPE:

As agriculture sector is one of the major sectors in india, it accounts the sum of 18% of total gross domestic product (GDP) of the country. In this covid-19 outbreak also, it records the 3% growth in the economy. So we can understand the importance of agriculture in everyone's life, despite of the situations.

When we consider the resources like water, electricity, agricultural power use is about 20% of the total country's consumption.

RESOURCES USED IN AGRICULTURE SECTOR	CONSUMPTION PERCENTAGE
WATER RESOURCES	80% OF TOTAL
ELECTRICITY	18% OF TOTAL

Fig.6: comparison of different resources used in agriculture sector.

So by considering the above stats, this technology can save energy resources using non-conventional resources like solar and wind mills. By using automatic control of resources in greenhouse, it can able to reduce the usage of water resources also. In the future, greenhouse technology becomes as a trendsetter in agricultural sector.

## 7. CONCLUSION

The benefits of smart greenhouse over conventional crops is that it can be auto-monitored by its own technology, which includes the benefits of better yield, insectless, pestless, less resource consumption and less cost of labor. As proposed by some researchers that using greenhouse, more production, year-round

production and off-season crops also can be achieved. It can bring down any climatic conditions in the greenhouse using this technology, so it can able to grow imported crops also, which are not suitable for our climatic conditions. Initial setup cost is more, but high span. In future, by using non-conventional energy resources like solar and wind mills, it can be more efficient. It can be believed that this project helps to improve technology in agricultural sector and helps to increase the economy of the country.

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