Monitoring and Control of Vital Parameters in Greenhouse using Internet of Things

C. Suganthi Evangeline, Ashmiya Lenin, Jaya Keshava Chandra, Jeeva Prasath

Abstract: ***The purpose of this paper is to design a greenhouse monitoring system (GHMS) which helps the cultivator to monitor environment and control the sensor values by means of feedback mechanism. The methodology involves the combination of six sensors which gives the values of the environment such as temperature, humidity, moisture, obstacle entry, pH and light. The sensor values are analyzed and sent to cloud using Wi-Fi module which enables the online monitoring, displays the values of the sensor in liquid crystal display (LCD) and also send alert mail and messages. The results are obtained and the values are updated in cloud and webpages. This design enables the cultivator to protect the greenhouse environment both online and also offline. In addition to it also gives the alert about any intruder or animals crossing the cultivation area. Thereby the soil parameters, environmental conditions and intruder entry are included in the proposed work. The proposed work of GHMS provides the low cost framework to sense the environment parameters such as temperature, humidity, moisture, light and pH. It also protect the environment of greenhouse from animal attacks using an infrared (IR) obstacle sensor. The sensor values are updated in cloud and messages is sent through Global System for Mobile Communication (GSM) module which is a cost effective one. The need of al-time internet connection is overcome by sending messages.***

Key Words: Internet of Things (IoT), Greenhouse, Embedded System, thingSpeak, Wi-Fi, pH

I. INTRODUCTION

Greenhouse is the terminology which provides us the insight about the environment of growing plants and vegetables in a closed environment. With the increase in pollution and global warming there is the possibility of spoiling the natural growth of plants. Agriculture is the major backbone of any developing nation. Hence by growing crops in green house under controlled environment will results in good yield [1]. The parameters inside the greenhouse can be monitored using sensors and controlled using actuators. The crops should be provided with ambient temperature and other environmental conditions which makes the condition favorable for the growth and production of crops [2].

The basic factors affecting plant growth are sunlight, water content in soil, temperature, soil humidity, water source and animal attacks etc. These physical factors are not easy to control manually inside a greenhouse and hence the need for automated design arises. This system receives values from the sensor and activates the actuators if the values are more than the threshold values and also stores the parameter values in the cloud enabling them to be accessed from anywhere. The sensors employed to get the physical parameters by the proposed work are temperature sensor, humidity sensor, light sensor, moisture sensor, pH sensor. In addition to the sensors listed ahead the proposed work includes the IR obstacle sensor in order to provide protection to the crops from animal attacks or some external intruder attacks [3].

The values given by the sensor are sent to cloud using Wi-Fi module and it also sends an alert using mail and message services. To design an efficient and reliable monitoring system for controlled environments which can be accessed externally by storing them in internet database and automatically controls them in the feedback loop. The detailed literature review of greenhouse monitoring is done and summarized in Table 1.

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Table 1. Comparative study of Greenhouse Monitoring Systems

No	Paper ID	Controller	Sensors used	Technique used	Communication Module	Limitations
1	[4]	Arduino	Temperature Sensor Humidity sensor Moisture sensor GAS sensor	Sensor values are analyzed and depicted in graphical user interface (GUI)	Wi-Fi GSM	Monitoring only
2	[5]	Fuzzy control logic	Temperature and Humidity sensor Light dependent resistor (LDR) Actuators	Software unit monitor and manages the system. The hardware unit is used to control the system	RF	Integrating hardware with fuzzy inference engine and IOT is the challenging task
3	[6]	CC2530 with 8051 kernel	Light sensor Temperature sensor Humidity sensor	The illumination, temperature and humidity values are read and sent to server	ZigBee GPRS	Short distance communication only possible. Remote monitoring and controlling is not possible
4	[7]	AT328P	Moisture sensor Light sensor Humidity sensor Temperature sensor	Sensor values are analyzed and updated in cloud	GSM Cloud	Monitoring only
5	[8]	Intel Galileo Gen 2 and Arduino	LDR Moisture sensor Temperature sensor	Green house is monitored and the yield is directly sent to market with proper authorization	Wi-Fi GSM	GSM is 2g technology No remote monitoring is possible
6	[9]	Raspberry Pi Arduino	Temperature and Humidity sensor LDR	Sensor values are sent to Wi-Fi module	Wi-Fi	Internet connection should be available always to monitor and control the environment.
7	[10]	Arduino	Temperature and Humidity sensor Luminosity sensor Barometric sensor	The sensor data are transmitted to gateway via Wi-Fi	Wi-Fi	No warning alert message is sent in case of any abnormal conditions
8	[11]	ARM	Temperature sensor Light sensor Humidity sensor Moisture sensor	The sensed values of any abnormal case will make the relay on to control the deviations	GSM	SMS based technology
9	[12]	ARM	Temperature sensor LDR Humidity sensor Moisture sensor CO_2 sensor	The sensor values are sent to end user via ZigBee module and monitoring is done with camera	ZigBee	Shorter distance communication
10	[13]	STM 32/F4	Temperature sensor Humidity sensor Illuminance sensor CO_2 sensor	The FPGA-based fuzzy logic controller that manages the sensor values. It is monitored through a	GSM GPRS ZigBee	Real time data access is not achieved.

				communication module		
11	[14]	CC2530F256	MicaZ node	The wireless sensor network gather the temperature, humidity, light and pressure values	ZigBee	Online control only with PC and smartphone
12	[15]	Arduino	Temperature and Humidity sensor Moisture sensor LDR pH	The sensor values are analyzed and sent as message	GSM	SMS based technology
13	[16]	-	Temperature sensor Humidity sensor Light sensor	All monitored parameters are transmitted through a wireless link to computer	XBee	Distance restriction
14	**GHMS (Proposed work)**	MSP430 as master controller Arduino Nano as slave controller	Humidity sensor Temperature sensor pH sensor Light sensor Moisture sensor IR obstacle sensor	Sensor values are measured and alert is sent in form of mail, message and also to cloud	GSM Wi-Fi Cloud	-

II. METHODOLOGY

This system consists of MSP430 master controller, Arduino Nano as slave controller along with temperature sensor (LM35), Humidity sensor (DHT11), pH sensor (SEN0161), Light sensor (BH1750), Moisture sensor (FC28), IR obstacle sensor (EK1254) and Wi-Fi module (ESP8266) in order to send data to IoT. The master controller collects the data from the sensors connected to its ports. The data collected are from analog as well as digital sensors. The analog sensor values are processed in analog to digital converting (ADC) unit in master controller and analyzed further. The digital sensor values are directly fed to the controller digital input ports. The values sensed by the sensors are displayed in the LCD and also sent to webpage. By using Wi-Fi module the data are transmitted and analyzed for monitoring and controlling the environment of greenhouse. The variations of the values of sensor are continuously plotted at regular intervals in webpage using ThingSpeak cloud [17].

The detailed block diagram is shown in Fig. 1. The temperature sensor is connected inside to the green house environment, humidity sensor and moisture sensor are placed in the soil, pH sensor is placed in the water inlet of the house, light sensor is placed on the transparent covering of the house, IR obstacle sensor is connected to the entry and exit points of the house. Using LCD the values are displayed and monitoring can be done offline and using IoT the online monitoring can be done. If any one of the sensor value deviates from its threshold an alert is sent to the concern person as mail or message using GSM module [18].

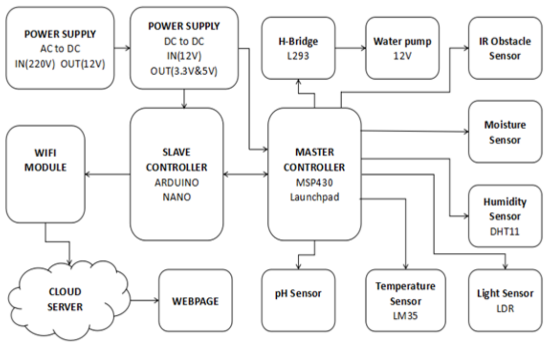

Fig. 1. Block diagram of Green House Monitoring System

III. COMPONENTS USED

The proposed work consists of following hardware components:

- Microcontroller-
  - MSP430- MSP430G2553
  - Arduino- ATMEGA328P
- Humidity sensor-DHT11
- Temperature sensor-LM35
- pH sensor- SEN0161
- Light sensor-BH1750
- Moisture sensor-FC28
- IR obstacle sensor- EK1254
- Wi-Fi module- ESP8266

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- GSM module-SIM900
- Cloud database and End device

The software used are

- Arduino IDE
- Energia IDE
- ThingSpeak Platform
- Matlab 2014a

A. MSP430G2553

The MSP430 belongs to TEXAS Instruments consist of several devices featuring different set of peripherals targeted for various applications is shown in Fig. 2. The controller has 16 bit RISC processor with 16 bit registers. It has 10 bit analog to digital controller (ADC). The ultra-low power controller comes with built in 16 bit timers, 24 input/output pins. The main applications of this controller is to capture the analog signals, convert to digital and then process the data for processing or transmission to host systems. The specification of the master controller is summarized in Table 2.

Fig. 2. Master controller launch pad

Table 2. Features of MSP430G2553

Features	Range
Low supply voltage range	1.8 V to 3.6 V
Power saving modes	5
CPU	16 bit RISC
Clock frequency	16 MHz
Communication Bus Supported	Synchronous SPI, I^2C

B. ATMEGA328

Arduino Uno is a microcontroller board which has its architecture based on ATmega328P. It has 14 digital input/output pins. It has everything needed to support microcontroller. The controller has 32KB memory with 0.5Kb for bootloader. Fig. 3 presents the picture of Arduino Uno board. It has comes with 2 KB of static RAM and 1 KB of EEPROM. The Uno board is identified with 6 analog pins from A0 to A5 each provides with 10bit of resolution. The pins description are listed in Table 3.

Fig. 3. Slave controller board

The slave controller supports the following communication protocols,

1) Serial communication
2) Serial Peripheral Interface (SPI)
3) Inter integrated circuit (IIC/I2C)

The signals needed to perform serial communication is receiver (RX) and transmitter (TX). The pins supports SPI are slave select (SS), master out slave in (MOSI), master in slave out (MISO), slave clock (SCK). The signals provided for I2C are serial data (SDA) and serial clock (SCL).

Table 3. Pin details of ATmega328P

Pin details	Pin description
0, 1	Serial communication: RX, TX
2,3	External Interrupts
3,5,6,9,10,11	PWM
10,11,12,13	SPI:SS, MOSI,MISO,SCK
13	LED
A0-A5	Analog pins
A4, A5	I2C: SDA, SCL

C. Humidity sensor-DHT11

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor as shown in Fig. 4. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. It has s simple block which is responsible to convert analog to digital and sends out the digital data which has temperature and humidity information. This digital signal can be easily read by any microcontroller.

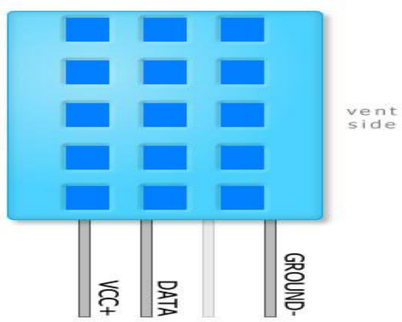

Fig. 4. DHT11-Humidity sensor

i. Getting data from DHT11

The temperature and humidity sensor uses single bus communication with its controller. 40 bit data is transmitted in single line from sensor to the controller.

The format of data is represented as follows
8 bit Integral Humidity + 8 bit decimal data + 8 bit Integral temperature + 8 bit decimal data + 8 bit parity.
The data received using DHT11 is

1 0111	0 0000	1 1000	0 0000	0 1111
t Integral	: decimal	gral	bit t decimal	ty

In order to check the data is received is correct; add first 4 8bit data the result should be as same as parity bits.

0011 0111+0000 0000+0001 1000+0000 0000=0100 1111
Humidity=0011 0111=37H
Temperature=0001 1000=18H=24^{o}C

D. Temperature sensor-LM35

There are a wide variety of temperature sensors IC that are available to simplify the broadest possible range of temperature monitoring challenges. These silicon temperature sensors differ significantly from the above mentioned types in a couple of important ways. A temperature sensor IC can operate over the nominal IC temperature range of -55°C to +150°C. A silicon temperature sensor is an integrated circuit, and can therefore include extensive signal processing circuitry within the same package as the sensor. There is no need to add compensation circuits for temperature sensor ICs. The pin details of LM35 are given in Fig. 5. Some of these are analogue circuits with either voltage or current output. Others combine analogue-sensing circuits with voltage comparators to provide alert functions. Some other sensor ICs combine analogue-sensing circuitry with digital input/output and control registers, making them an ideal solution for microprocessor-based systems.

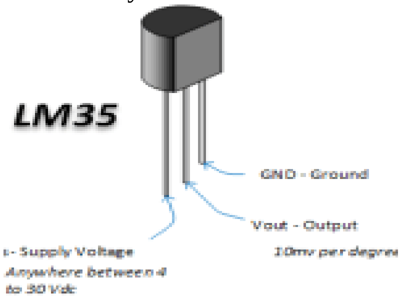

Fig. 5. LM35-Temperature Sensor

i. Getting data from LM35

The output of the sensor value is the voltage. This has to convert to its temperature equivalent. The calibrated LM35 voltage range is given in Table 4. The formulae to convert is

$$Temperature\,(°C) = \frac{V_{out}}{100°C\,/V} \tag{1}$$

Table 4. Analog and its digital value of LM35 [19]

Range	Voltage	ADC	HEX	ADC voltage range
0	0	0	0	
30	0.30	94	5E	0-3.3V
150	1.5	466	1D2	

E. pH sensor-SEN0161

pH is used to measure the acidity content in water. It is generally measured in numeric scale ranging from 0-14. The value 7 denotes neutral. The numbers in the scale will increase with increase in alkalinity and it decreases with increase in acidity. In order to monitor the agriculture environment, it is necessary to analyze the nature of water. By calibrating with the standard solution the accurate solution can be obtained. The best environment temperature is about 25 ℃ which provides reliable value. The pH sensor used for the proposed work is given in Fig. 6. The pin details and its connection with master controller is given in Table 5 and its specification is summarized in Table 6.

Fig. 6. SEN0161-pH Sensor

Table 5. Pin connection with microcontroller

SEN0161	MSP430G2553
VCC	3.3-5.0 V
GND	GND
ADDR	GND
SCL	A5
SDA	A4

Table 6. Specification of SEN0161

Specifications	value
Input voltage	4.5 V
Operating temperature	40-85degree Celsius
Sink Current	7 mA
Tolerance	±20%

i. Getting values from pH sensor

pH is hydrogen-ion concentration in water. The widely accepted pH scale range is presented in Fig. 7. In practical cases, pH is usually defined as the negative algorithm of hydrogen ion concentration.

$$pH = -\log_{10}(H^+) \tag{2}$$

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Fig. 7. pH range

The pH probe measures the potential between the electrodes and potential is converted to equivalent pH value. The conversion value from voltage to pH is given in Table 7.

Table 7. Voltage to pH conversion

Voltage (mV)	pH value
118.32	5
59.16	6
0.00	7
-59.16	8
-118.32	9
-414.12	14

F. Light sensor-BH1750

Light is the essential element in green house environment [20]. The amount of light needed for any plant is depends upon its type. The intensity is too low then artificial lighting should be included. If the intensity is too high then it should be reduced by some external means like shielding, masking etc. BH1750FVI is a digital light sensor as in Fig. 8, which is connected with master controller using I2C bus interface. When light falls on the sensor it gives the value in lux. By sending the value to cloud, anyone can able to visualize the intensity value and necessary actions can be taken. The connection details with master controller is presented in Table 8 and sensor specifications are listed in Table 9.

Fig. 8. BH1750-Light Sensor

Table 8. Pin connection with microcontroller

BH1750	MSP430G2553
VCC	3.3-5.0 V
GND	GND
ADDR	GND
SCL	A5
SDA	A4

Table 9. Specification of BH1750

Specifications	value
Input voltage	4.5 V
Operating temperature	40-85degree Celsius
Sink Current	7 mA
Tolerance	±20%

i. Getting values from Light sensor

By using BH1750 light sensor, the intensity can be directly measured using lux meter, without need of many calculations. The data which is output from the sensor is directly in lux. Table 10 lists out the intensity values for different environmental conditions.

Table 10. Light Intensity values

Environment Conditions	Illuminance in LUX
Night	0.001-0.02
Moonlight night	0.02-0.3
cloudy indoor	5-50
cloudy outdoor	50-500
Sunny indoor	100-1000
under the sunlight in summer afternoon	about 10*6 power
intensity of illumination for reading books	50-60
home video standard	1400

G. Moisture sensor FC-28

Water is a very precious resource and a driving force in irrigation. Optimal use of water is a need of the hour. Efficient irrigation watering helps in saving water, getting better plant yields, reduce dependency on fertilizers and improve crop quality. Various methods, both laboratory and field including remote sensing are available to measure soil moisture content, but the quickest and better one is with the use of soil moisture sensor electronic devices. For successful irrigation, it is necessary to monitor soil moisture content continuously in the irrigation fields. The selection of soil moisture probes is an important criterion in measuring soil moisture as different soil moisture sensors have their own advantages and disadvantages. The soil moisture sensors are used intensively at present because it gives real time readings [21]. For experimental purpose the sensor used is FC-28 as given in Fig. 9. The pin connections and specifications are listed in Table 11 and 12 respectively.

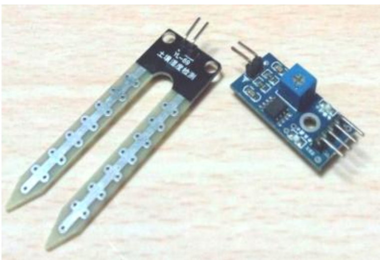

Fig. 9. FC28- Moisture Sensor

Table 11. Pin connection with microcontroller

FC-28	MSP430G2553
VCC	5V
GND	GND
A0	A0

Table 12. Specification of FC-28

Specifications	value

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Input voltage	3.3-5V
Output voltage	0-4.2V
Input current	35mA
Output signal	Analog and digital

i. i. Getting data from Moisture sensor

FC-28 sensor can give output both in analog and digital. The analog output from soil moisture sensor gives the value in the range of 0-1023. The moisture value is presented in percentage by map the values to the range of 0-100. The water pump can be opened depending on the need and controlled according to the value set in the program. The formula used for the conversion is given as

$$Moisture\ value = sensor\ value * \left(\frac{100}{1023}\right) \quad (3)$$

H. IR obstacle sensor- EK1254

The IR sensor is used to detect any suspicious entry of animals or intruders is given in Fig. 10. The heat emitted from the obstacle is recognized by the sensor and that information to passed on the farmer or concerned authority. The connection details with master controller is presented in Table 13 and the specification of sensor is listed in Table 14.

Fig. 10. EK1254- IR obstacle sensor

Table 13. Pin connection with microcontroller

EK1254	MSP430G2553
VCC	5V
GND	GND
OUT	7

Table 14. Specification of FC-28

Specifications	value
Input voltage	3.3-5.0 V
Detection range	2cm-30 cm
Input Current	23mA at 3.3V, 43mA at 5.0V
Output signal	Low logic level when obstacle is detected

i. Getting values from FC-28

The obstacle sensor detects the object present within the range of 2-30m. The sensitivity calibration can be done using potentiometer. The voltage comparator IC LM393 provides an output if there is a pull up resistor between the output of the IC and V_{cc}. The output D0 is

$$D0 = \begin{cases} 1, & no\ object\ is\ detected \\ 0, & object\ is\ detected \end{cases} \quad (4)$$

I. Wi-Fi module- ESP8266

ESP8266 is the 3V Wi-Fi module for IoT based applications. It is self-contained system on chip with integrated transmission control protocol/internet protocol (TCP/IP). It can perform the hosting of an application or offloading all Wi-Fi networking functions from other application processor. This module has on board 80 MHz low power 32 bit processor for performing custom firmware. It means with this module it is possible to host small webpages without any external controller. It can support voice over internet protocol (VoIP) and Bluetooth interfaces. Because of its low cost and high features it makes it an ideal module for internet based applications and also for prototype development. The connection details with master and Wi-Fi module is given in Table 15 and Wi-Fi module specification is listed in Table 16.

J. Cloud database and End device

Cloud database is used to store the parameters in the internet enabling them to be accessed from anywhere and End device is used to monitor those parameters. Here the cloud database used is “Thinkspeak.com” and End device can be anything from a PC to mobile phone given it has internet connection.

Table 15. Pin connection with microcontroller

ESP8266	MSP430G2553
RX	RX
TX	TX
VCC	3.3v
GND	GND

Table 16. Specification of FC-28

Specifications	value
Input voltage	3.3V
Standard	IEEE 802.11 b/g/n Wi-Fi
GPIO	16
ADC	1-10bit
Instruction RAM	64kb
Data RAM	96kb
CPU	32 bit RISC

IV. FLOWCHART

Figure 11, clearly depicts the process flow of the GHMS. The master controller gathers all the sensor values and print those values in LCD. The Regular updates of the value takes place and sent to cloud. When there is any abnormality happen the controlling mechanism is taken up by the master controller.

V. RESULTS

In order to access wide range of embedded devices and web services, IoT plays a major part in it. ThingSpeak is an IOT platform which helps to accumulate, save and gives the graphical presentation of data. In the proposed work the sensed data are collected from ESP8266 and put in the webpage and also for data analysis using ThingSpeak.

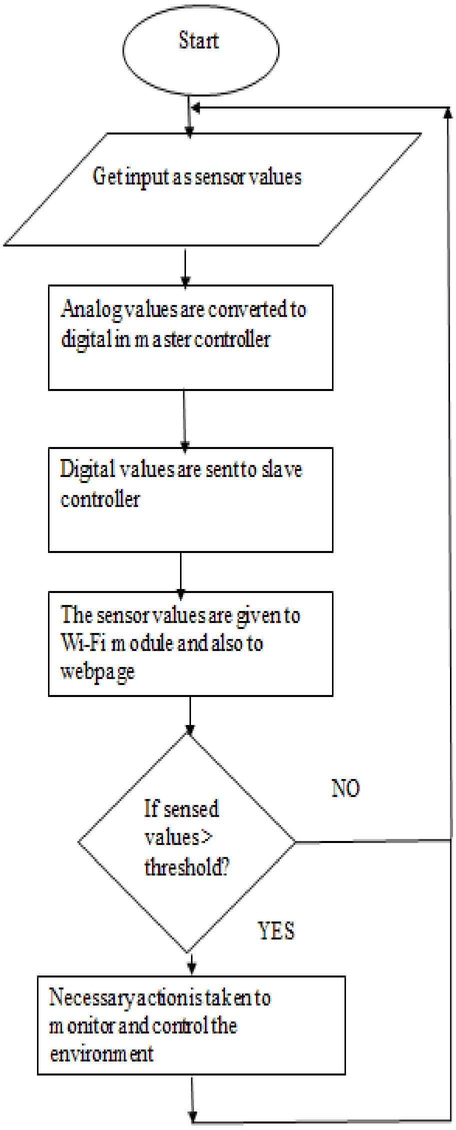

Figure 11. Flow Chart of the proposed system

A. ThingSpeak

The primary element of ThingSpeak activity is the *channel*, which contains data fields, location fields, and a status field. After you create a ThingSpeak channel, you can write data to the channel, process and view the data with MATLAB code, and react to the data with tweets and other alerts. The channel window is presented in Figure 12.The typical ThingSpeak workflow lets you:

1. Create a Channel and collect data
2. Analyze and Visualize the data
3. Act on the data using any of several Apps

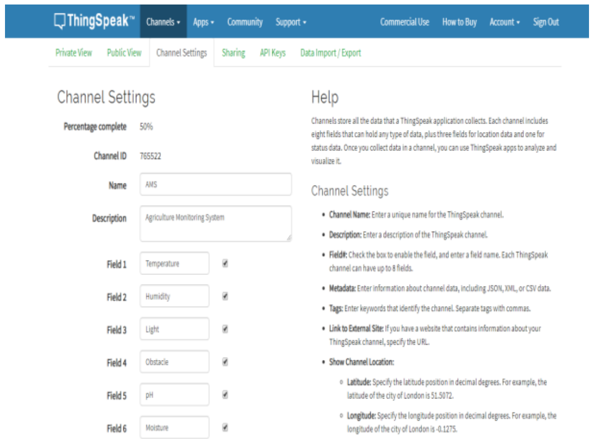

Fig. 12. ThingSpeak Window

The sensors connected to monitor the greenhouse are temperature, humidity, light, moisture, pH and IR obstacle sensor. The values are analysed for the period of time and sent to cloud via Wi-Fi module. The deviations are controlled and brought back to normal by enhancing the controlling mechanism by the master controller. The actions executed can be opening of water pump to increase the moisture content, put on the lights to increase the intensity artificially, switching on the fan for reducing the temperature, in charge person can visit the farm in case of intruder entry. Figure 13 depicts the analysis of temperature value of green house for a certain period of time.

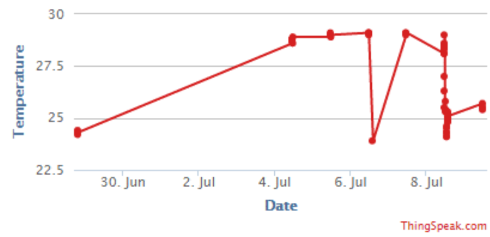

Fig. 13. Temperature Analysis in ThingSpeak cloud

Figure 14 and 15 presents the humidity and intensity analysis of proposed method in thingSpeak cloud. The data can be viewed anywhere in the world which makes the proposed method as successful and cost effective using IOT.

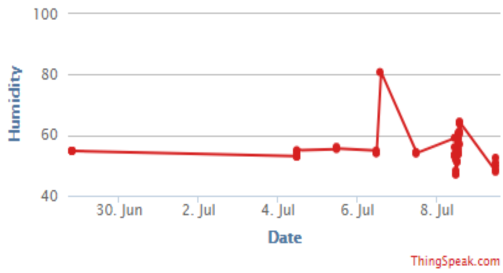

Fig. 14. Humidity Analysis in ThingSpeak cloud

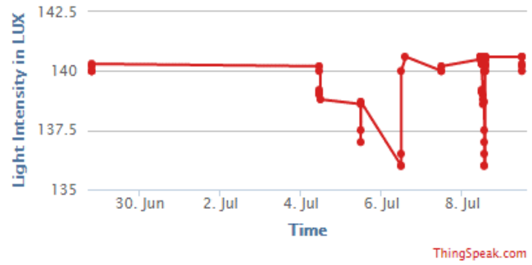

Fig. 15. Illuminance Analysis in ThingSpeak cloud

Figure 16 depicts the intruder entry over period of time. This proposed method is quite gives the protection of the greenhouse environment from animal attacks or entry of any foreign objects. If there is any entry the IR sensor detects the object and send the values to master controller.

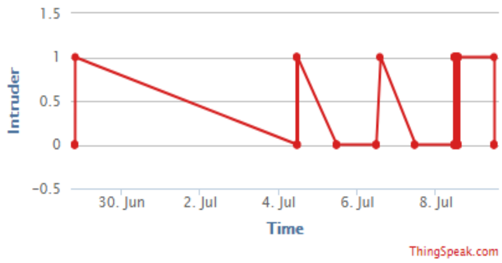

Fig. 16. Intruder entry Analysis in ThingSpeak cloud

Figure 17 and 18 depicts the pH value and Moisture value of the water and soil of greenhouse.

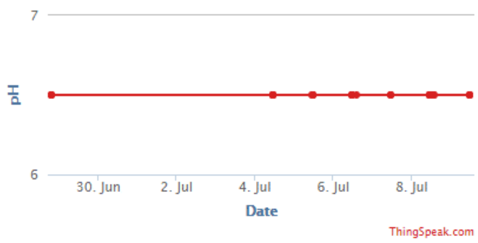

Fig. 17. pH Analysis in ThingSpeak cloud

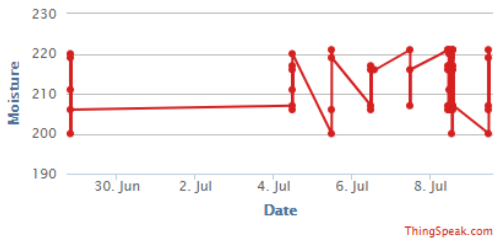

Fig. 18. Soil Moisture Analysis in ThingSpeak cloud

The proposed method is tested in Karunya Institute of Technology and Sciences-Coimbatore and channel location is updated in the cloud is presented in Figure 19.

Fig. 19. Channel Location -Coimbatore in ThingSpeak cloud

B. **Mail Alert**

It is used to send an automatic mail if the monitored parameters have crossed the threshold values. It works with help of thing http extension of thingspeak.com

i. Configuration

1. Configure a pushingbox.com scenario
- Subject: Humidor 2.0 Daily Update - hum
- Body: Humidity: hum Temperature: $temp$

2. configure a ThingHttp - action on thingspeak.com
- Name: Humidor 2.0 Daily Update
- Url: http://api.pushingbox.com/pushingbox
- Method: POST
- Content Type: application/x-www-form-urlencoded
- HTTP Version: 1.1
- Body: devid=[deviceIDfrompushingbox]&hum=%%channel_24484_field_2%%&temp=%%channel_24484_field_1%%

3. Configure a TimeControl - trigger on thingspeak.com
- Configure the time/interval needed
- Action: ThingHTTP
- Select profile: Humidor 2.0 Daily Update

Explanation:
- Pushingbox.com -> hum and $temp$ are the variables, that we submit via HTTP POST from thingspeak
- Thingspeak.com -> [deviceIDfrompushingbox] the id identifies the configured scenario on pushingbox
- Thingspeak.com -> %%channel_24484_field_2%% - variable from channel
- Thingspeak.com -> %%channel_24484_field_1%% - variable from channel

ii. Working modes
- Daily status update, also serving as a "watchdog" to show me the service is still running smoothly
- WARNING - below threshold the warnings are not configured as a thingspeak "TimeControl" but as a "React" scenario, the scenario reacts on certain values in the channel on thingspeak.com, in this case the notification is triggered when the humidity value falls below a configured threshold. The notification is only triggered once when the value falls below, so I don´t get the warning every 25 minutes as long

as the value stays below the threshold.

- WARNING - above threshold

The proposed method regularly updates the sensor values to the cloud. In addition to this I also send alert messages in terms of mobile messages using GSM module and also using mail services. The message format is shown in Figure 20 and 21 respectively.

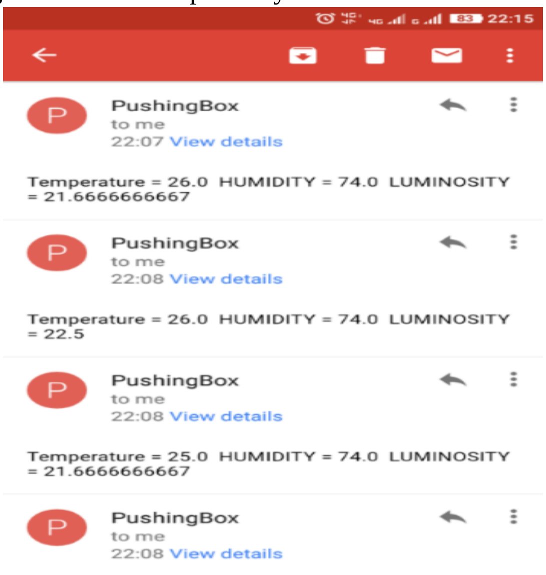

Figure 20. Mail alert system

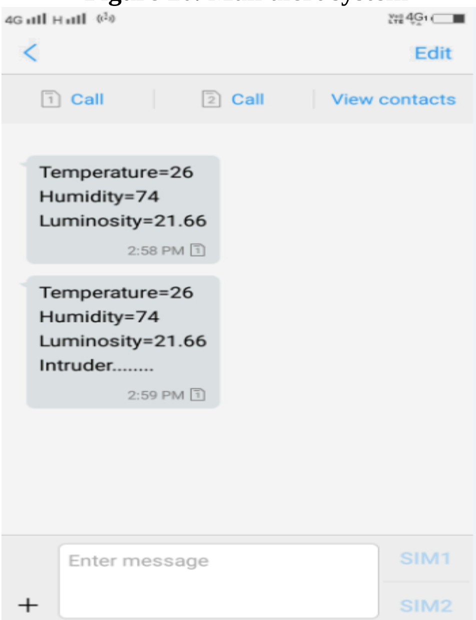

Figure 21. Message Alert system

The information is sent to cloud via Wi-Fi module and alert is sent using mail services and also in message using GSM module. The cultivator can see the status both online and offline. It limits the availability of internet facility in the user end. There by providing the cost effective greenhouse monitoring and controlling is designed using IoT.

VI. CONCLUSION

The proposed work of greenhouse monitoring aims to fulfill the measurement of environmental parameters and also perform necessary remedial measure in case of any deviation of the sensed values. The sensors are available inside the greenhouse to monitor the temperature, humidity, moisture, light intensity, pH value and also detects any obstacle or irrelevant movements.

With the help of IoT enabled feature in the prototype it is possible to perform continuous monitoring of the parameters and the results can be viewed in the webpage of the given website and can be monitored from everywhere or anywhere in the world. In this work the basic parameters of soil and water are considered. To develop it further live streaming of video can be incorporated. The proposed work deals with the general monitoring of greenhouse parameters and in future enhancement the individual crops and its yield based monitoring inside and outside of the greenhouse can be done. By using Artificial Intelligence (AI) advancements the greenhouse monitoring can be made to improve in near future.

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