International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Smart Monitoring System for Agriculture Fields

Md Sadique[1], Parth Kr Singh[2], Prof. Sachin Takale[3]

[1,2]UG Student, Department of ECE, MIT School of Engineering, Pune, Maharashtra, India
[3]Professor, Department of ECE, MIT School of Engineering, Pune, Maharashtra, India

---

Abstract – Smart agriculture monitoring system or just smart farming is an emerging technology concept where data from several agricultural fields starting from small to large scale and its surrounding are collected using smart electronic sensors. The collected data are analyzed by experts and native farmers to draw short term and future conclusion on weather pattern, soil fertility, current quality of crops, amount of water that will be required for the analysis of next week to a month etc.

We can make smart farming a setup further by automating several parts of farming, for example smart irrigation and water management. We can apply predictive algorithms on microcontrollers or soc to calculate the quantity of water which will be required today for a specific field.

Say, if there was rain yesterday and therefore the quantity of water required today goes to be less. Similarly, if humidity was high the evaporation of water at upper ground level goes to be less, so water required are going to be but normal, thus reducing water usage.

Key Words: **Arduino, Soil Moisture Sensor, Temperature & Humidity Sensor, WIFI module, MQ135 Gas Sensor, Ultrasonic Sensor, LDR Sensor Module, LCD, Dc pump**

1. INTRODUCTION

Agriculture is an integral part of Indian economy. Over 60% of Indian population based upon agriculture and one third of the income of nation arises from agricultural practices. Hence it plays an important role within the development of the country. Various issues associated with farming is continuously hampering the event of the country. Possible solution for these problems is to choose modernized agriculture that comprises of recent trends. Hence, agriculture is often made smart using IoT and other technologies. Smart agriculture is use to increases the crop yield, decreases the wastage of water and imbalanced use of fertilizers. The highlighting feature of this project is that it measures the various agricultural parameters affecting the yield.

Various Problems:
1. Small holding lands.
2. Irrigation is inefficient.
3. Excessive fertilizers.
4. Improve supply chain cycle management.
5. Consumer to farmer distribution is weak

2. METHODOLOGY

There are Eight sensors present in the circuit which are used for measuring the ambient temperature, Light intensity, soil moisture level, Harmful Gas in Air, Unknown Visitors in the Field and height of the crop. Based on the monitoring of these sensor values the smart agriculture monitoring system provides heat, light, water, Growth and Protection to the crop. So, whenever the device is started, the distance sensor calibrates itself and set the device distance from ground so that it can calculate the plant growth and use this value for find relative height of plant from the ground The data from the sensors is sent to an Arduino controller which stores and processes this data and then sends it to the IOT platform as well as Thingspeak server. A WIFI module is connected with the Arduino which sends the sensor values to the remote IOT platform using WIFI connection. PIR sensors is used to sense motion, almost always used to detect whether a human or Animal has moved in or out of the sensors range (Field). Plants need good sun shine to prepare its own food and this process called photosynthesis. Plants need optimum amount of light. The amount of light received on a plot of land can be calculated using LDR or photoresistor.

Some devices are also connected to the Arduino outputs. These devices include DC pump, relays, Buzzer and lcd. If any of the sensor values crosses a certain predefined threshold then the value is displayed on lcd and is turned on to notify the user. One relay is connected to the water pump If the soil moisture level is low then the water pump is turned on by the Arduino controller to provide water to the crops. Buzzer is used for Drive away unknown visitors (animals/Humans) by making Loud Noise in the field. The crop status can be monitored remotely by means of this IOT platform.

• IoT Level systems are suitable for solutions supported wireless sensor networks, during which the info involved is big and therefore the analysis requirements are computationally intensive.
•A level-5 type of IoT system has multiple end nodes and one coordinator node.
•The end nodes perform sensing and/or actuation.
• The data from the end nodes is collected by the coordinator nodes and sends it to the cloud.
•Data is stored and analyzed in the cloud and the application is also based on cloud

3. SYSTEM REQUIREMENTS

The basic components required to style the circuit are:

3.1. Atmega328p microcontroller (Arduino UNO)

. It has basically 14 digital input-output pins (of which 6 are often used as PWM outputs), 6 analog inputs, a 16 MHz quartz, a USB connection, a jack, an ICSP header and a push. It contains every feature that is required to support the microcontroller.

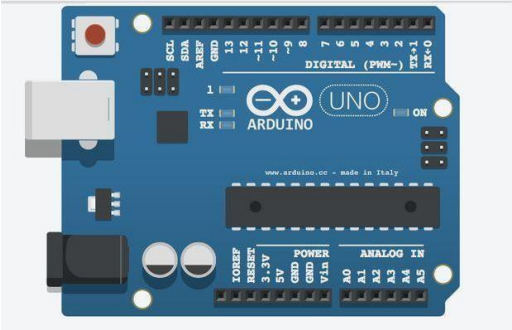

Fig-1: Atmega 328p microcontroller (Arduino uno)

Microcontroller - Atmega328p-8-bit AVR family
Operating voltage -5v
Recommended input voltage-7-12v
Input voltage limits-6-20v
Analog input pins-6(A0-A5)
Digital input pin-14(output of which 6 provides PWM output)
DC current on i/o pins-40mA
Dc current on 3.3v pin-50mA
Flash memory-32KB (0.5KB used for boot loader)
SRAM-2KB
EEPROM-1KB
Frequency-16MHZ [1]

3.2. Soil Moisture sensor (YL 38)

• Plants are of 90% water. The requirement of water varies from plants to plants. The amount of water to be irrigated a day also varies; this relies on how well the soil can hold moisture, current season, temperature and humidity as mentioned in the beginning of this post.

• Many farmers irrigate their crops quite sufficient most of the days just to make certain that each one their crops received adequate water; this may cause inefficient management of water.
• The soil moisture is often measured using the illustrated senor, which has two prongs (electrodes) which are to be inserted on top layer of soil. This is an analog sensor which can output analog values to Arduino.
• The soil moisture sensor composed of two probes that measure the volumetric content of water. The current is skilled the soil while the resistance value is returned that indicates the moisture value present in the soil.
• When there's more water within the soil, the soil will conduct more current which suggests less resistance. Therefore, the moisture level is going to be higher.
• Dry soil will conduct current POORLY when there's less water present within the soil, which returns a lower moisture level.
• The moisture sensor consists of two probes that are wont to detect the moisture of the soil. The moisture sensor probes are coated using immersion gold that protects Nickel from oxidation. These two probes are wont to pass the present through the soil then the sensor reads the resistance to urge the moisture values.
Specifications:
• Model name: YL-38
• Operating Temperature: -40 to +60 deg C
• Sensing Range :0-45%volumetric water content of soil
• Operating Voltage: 5V DC
• Power Consumption :3mA [2]

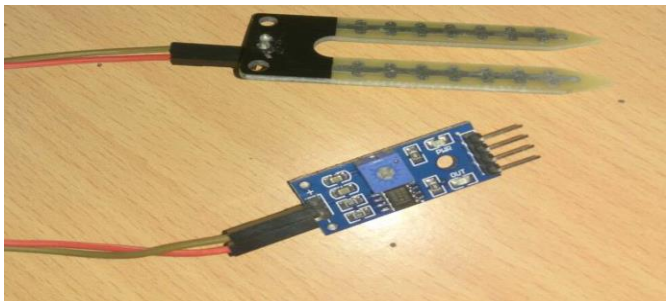

Fig-2: Soil Moisture sensor

3.3. Air Quality Sensor / Gas Sensor

It is mot been considered as an important parameter that plants and trees need fresh air for nourishment and growth. Polluted air will make the plants grow sick and that we might not get highest quality of fruits and vegetables. Polluted air can also make the crops less resistant to disease and bugs.
So air quality may be a vital parameter to gauge the expansion of crops, to try to to this we are using MQ 135 air quality sensor. MQ 135 comes with a breakout board as shown and it's 4 terminals and that we are getting to use just 3 of them Vcc, GND and Aout which is analog output of the sensor, Dout isn't here.
When MQ 135 detects toxic gases in the air analog output value increases and vice-versa . The analog output we receive is converted into 10-bit digital value and converted to percentage out of 100.
100% means lot of air is contaminated and 0% means air is least contaminated, so lower the value better the air quality.
.

Fig-3: MQ135 Gas sensor

3.4. Ultrasonic Sensor

HC-SR04 Ultrasonic sensor is a 4-pin module, whose pin are named as Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications were measuring distance or sensing objects are required. The module has two eyes like structure in their front side which forms the Ultrasonic transmitter and Receiver.

The sensor works with the straightforward high school formula that's

(Distance = Speed × Time).

The transmitter transmits an ultrasonic wave from its transmitting part, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module part of the sensor

ultrasonic distance sensor is used to detect the height of the crops from the ground. So, when the device is set to initiate, the space sensor calibrates itself and set the device distance from ground for plant growth measurements and use this value for finding the relative height of plant from the ground.

HC-SR04 Sensor Features:

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

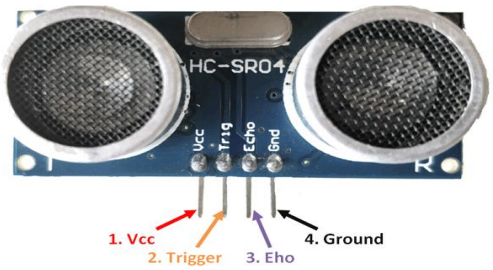

Fig-4: HC-SR04 Ultrasonic Sensor

3.5. PIR Sensor

The PIR sensor stands for Passive Infrared sensor. It is a low-cost sensor which can detect the presence of Human beings or animals. This sensor has three output pins Vcc, Output and Ground as shown in the pin figure [5].

The module is often powered from voltage 4.5V to 20V but, typically 5V is employed. Once the module is supplied with power allow the module to calibrate itself for few minutes, 2 minutes is a well settled time then observe the output on the output pin. There are two important materials present within the sensor one is that the pyroelectric crystal which may detect the warmth signatures from a living organism (humans/animals) and therefore the other is a Fresnel lenses which can widen the range of the sensor .Before we analyse the output we need to know that there are two operating modes in this sensor named as Repeatable(H) and Non- Repeatable(L) and mode. The Repeatable mode is that the default mode.

Repeatable(H) mode:

In Repeatable(H) mode the output pin Dout will go high to (3.3V) when a person is detected within range and goes low after a particular time (time is set by "Off time control" potentiometer). In this mode of module the output pin will go high irrespective of whether the person is still present inside the range or has left the area. The sensitivity are often set using the potentiometer.

Non- Repeatable(L) mode:

The output pin Dout will go high (3.3V) in "I" mode when a person is detected within range and will stay high as long as he/she stays within the limit of the Sensors range. Once the person will left the area the pin will go low after the a fixed time which can be set using the potentiometer. The sensitivity can be set by using the potentiometer.

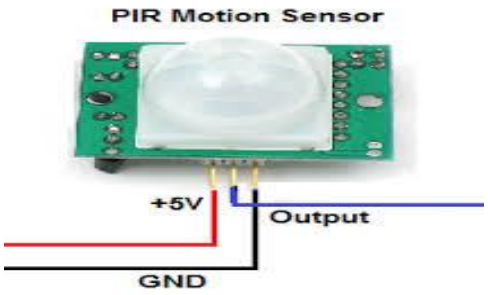

Fig-5: PIR Motion Sensor

3.6. Light Sensor (Ldr)

LDR sensor module is used to measure the intensity of light. It is been caliberated with both the analog output pin and digital output pin labelled as AO and DO respectively on the board. When there is light present the resistance of LDR will become low according to the intensity of light. The greater is the intensity of light, the lower is the resistance of LDR. The sensor is contained with a potentiometer knob that can be adjusted to change the sensitivity of LDR towards light.

It is obvious that plants need good amount of sun shine to prepare its own food and this process called photosynthesis. Plants need optimum amount of light that is not too less or

not too much. The amount of light received on a plot of land can be measured with the help of LDR.

The LDR changes its electrical resistance value depending on the amount of light incident on it. The amount of light falling is converted to 10-bit digital value and further converted to percentage out of 100.

Zero means no light and 100% means a lot of light.

Fig-6: LDR Sensor Module

3.7. LCD (16X2)

LCD is abbreviated as liquid crystal display. It is an alphanumeric display. Thus, LCD is a user-friendly device various unlike seven segment display which can display only numbers and some of the alphabets. The only disadvantage of LCD over seven segments is that seven segments is strong display and be visible from a extended distance as compared to LCD. Here we've used 16 x 2 digital display which suggests on this display we will display two lines with maximum of 16 characters in one line.

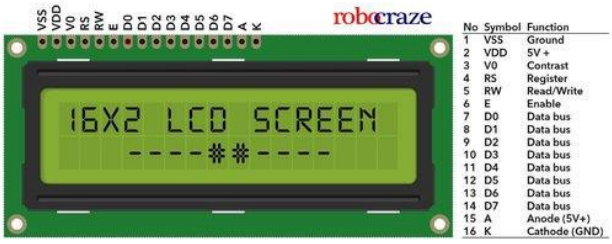

Fig-7: LCD (16X2)

3.8. Temperature & Humidity Sensor (DHT11)

• The DHT11 sensor is a commonly used gor the measurement of Temperature and humidity . The sensor is composed with a fanatical NTC to live temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also been calibrated in factory cand hence easy to interface with other microcontrollers.
• DHT11 sensor is composed with a capacitive humidity detector and a thermistor for sensing temperature. The capacitor present in the module for humidity sensing has two electrodes with a moisture holding substrate as a dielectric between them. Change in the value of capacitance occurs with the change in humidity levels. The IC measure, process this changed resistance values and alter them into digital form.
• For measuring the temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the littlest change in temperature, this sensor is typically made from semiconductor ceramics or polymers.
• The sensor can measure temperature ranging from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.
Specifications:
•Input/output voltage :3V / 5V
•Humidity Range :20-80 percent
•Temperature Range :0-50 deg C
•Sampling Rate: 1Hz
•Response time: 50 ms
•Sensing Range :20-90%RH(Relative humidity)
•Accuracy: +\-5%RH
•Accuracy: +\-2% deg C[4]

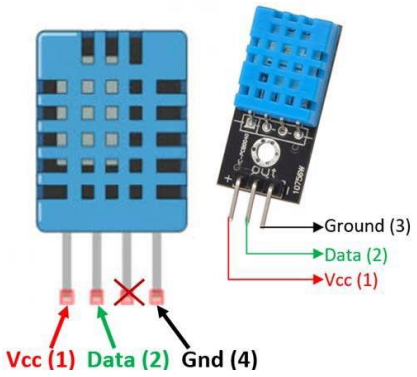

Fig-8: DHT11

3.9. ESP8266 wifi module

The ESP8266 low cost device to provide internet connectivity to your projects. The module can work both as a Access point (can create hotspot) and as a station (can hook up with Wi-Fi), hence it can easily fetch data and upload it .It can also fetch data from internet using API's hence your, thus making it smarter. Additional exciting feature of this module is that it can be programmed using the Arduino IDE. However this particular version of the ESP8266 module has only 2 GPIO pins (you can hack it to use upto 4) so you have to use it along with another microcontroller like Arduino.

• 3V3: – 3.3 V Power Pin.
• GND: – Ground Pin.
• RST: – Active Low Reset Pin.
• EN: – Active High Enable Pin.
• TX: – Serial Transmitter Pin of UART.
• RX: – Serial Receiver Pin of UART.
• GPIO0 & GPIO2: – General Purpose Input/Output Pins. It also referred to as TX/RX pins are used for Programming the

module or for serial I/O purpose. To program the module using UART,we need to connect GPIO0 to ground and GPIO2 to VCC or leave it open.
To use UART for normal Serial Input/Output leave both the pins open (neither VCC nor Ground.

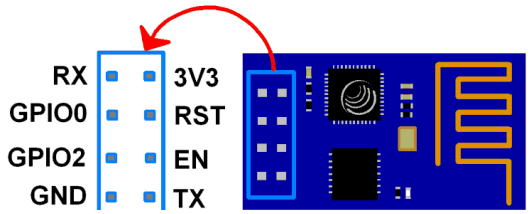

Fig-9: ESP8266 WiFi module

3.10. Submersible DC Pump

DC pump(3-6V)or Micro Submersible Pump or Mini water pump For Fountain Garden Mini water circulation System DIY project. This is a small size Submersible Pump Motor available at low cost, which can be operated from a 3 ~ 6V power supply. It can take up to 120 ltrs of water per hour with very low current consumption of about 220mA. You just need to connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the level of water is always higher than the motor. Dry run may cause damage to the motor due to heating and it will also produce noise.

Specifications-
- Operating Voltage : 3 ~ 9V
- Operating Current : 130 ~ 350mA
- Rate of flow : 80 ~ 120 L/H
- Continuous Working Life : 500 hours
- Driving Mode : DC, Magnetic Driving
- Material : Engineering Plastic
- Outlet Outside Diameter : 7.5 mm
- Outlet Inside Diameter : 5 mm [6].

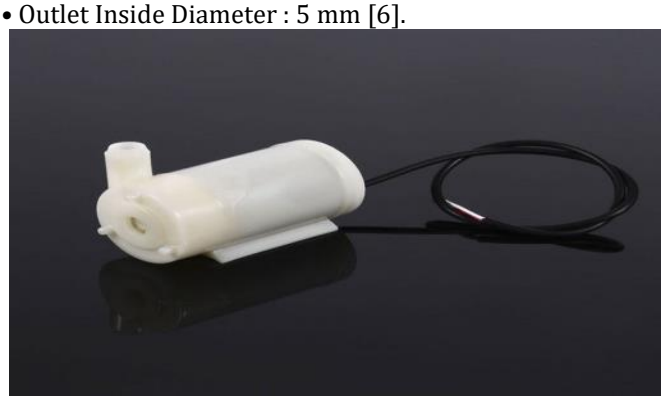

Fig-10: Dc Pump

3.11. Buzzer

A 5V Active Alarm Buzzer Module compatible with Arduino Uno is an audio based device , which can be mechanical, electromechanical, or piezoelectric. it's 5V DC Buzzer Module. Using high quality material, it's durable in use.
An active buzzer rings out as long because it is inspired . Compared with a passive buzzer, it's a touch expensive but easier to regulate . Typical uses of buzzers include alarm devices, timers, and confirmation of user input like a click or keystroke.
Features:
•An active buzzer with a concussion internal source-goodbye because it are going to be called an energized
•Program is easy to control
•sound- while passive buzzer didn't
•Operating voltage 3.3V - 5V
•Module interface specification (3-wire) :
+ External 3.3V-5V voltage (can be directly connected with the 5v and three .3v MCU MCU)

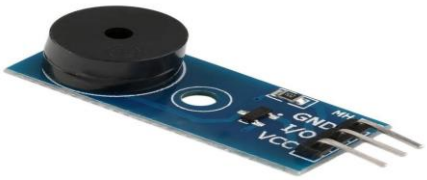

Fig-11: Buzzer

3.12. Relay

Relays are simple switches thst is being operated both electrically and mechanically. Relays are consisted with of an electromagnet and also a set of contacts. The switching mechanism in the module is carried out with the help of the electromagnet. The major operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used at places where only one signal can be used to control a lot of circuits. The application of relays started during the invention time of telephones. They played a very important role in switching calls in telephone exchanges. They were also been used in long distance telegraphy. They were used in switching the signal coming from one source to another destination. The high end applications of relays involves the requirement of high power to be driven by electric motors and so on. Such relays are called contactors .

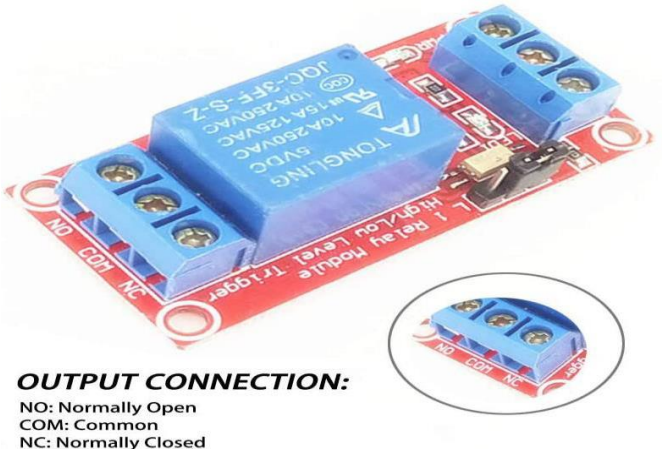

Fig-12: Relay

4. IMPLEMENTATION

Real time circuit is developed to verify the existence of the circuitory in real life, it is important to implement it on the general-purpose PCB board which is used to connect all the electronic components using pathways drawn using the software named proteus and complete itching process is completed on PCB board and therefore the components are further soldered properly in order that the circuit would be fixed and ready to be used. As of now it is done with zero PCB and working model of circuit is shown in figure [13].

5. RESULT

This IOT based Agriculture monitoring system makes use of wireless sensors creating a networks that collects data from different sensors deployed at various nodes and sends it through the wireless protocol. This smart agriculture using IOT system is powered by Arduino, it consists of Temperature sensor, Moisture sensor, water level sensor, Gas Sensor, Ultrasonic Sensor, PIR Sensor, LDR, DC motor and GPRS module. When the IOT based agriculture monitoring system starts it checks the Light Intensity, Harmful Gas Level, water level, humidity and moisture level. It sends the SMS alert on the phone about the levels. Sensors sense the level of water if it goes below a certain limit, it automatically starts the water pump. If the temperature goes above the level, fan get started. A LDR is placed in Project so to measure light Intensity and we all know plants need good light intensity to make food so if there is minimum light then there is external light source so plants can make food and leads to good growth in plants. If we proceed to Next step then there is PIR sensor which sense whenever an unknown person/Animal enter in our field to harm the crop and it is connected to alarm buzzer. whenever someone tries to enter in the field then it gives alert in my mobile and an alarm is triggered so that Loud voice will come out, which they all ran away. One more sensor used is Ultrasonic Sensor which gives the information about Height of my crop So that I can Take proper care of each plant. Lastly Mq135 Gas Sensor which detects toxic gases the analog output value increases and vice versa.

This is displayed on the LCD display module. This all is also seen in IOT where it shows information of Humidity, Moisture, Height and water level with date and time, based on per minute.

Temperature can be set on certain level; it is based on the type crops cultivated. If we want to close the water forcefully on IOT it is done by using button given from where water pump can be forcefully stopped.

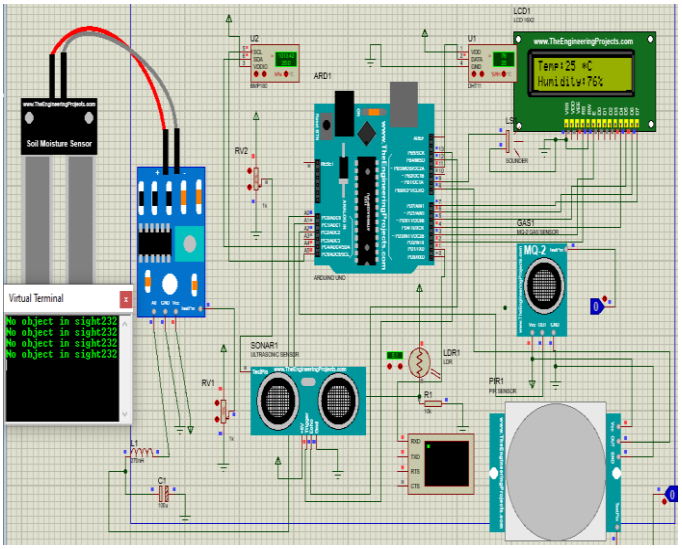

Fig-13: Simulation Model

6. CONCLUSION

IoT based smart agriculture monitoring system has been proposed using Arduino and Cloud Computing. The System has high efficiency and quite accurate in fetching the live data of temperature and soil moisture and Height of crop in field. The IoT based System being proposed will assist farmers in increasing the agriculture yield and take efficient care of food production .This developed System will always provide an additional help to farmers for getting accurate environmental temperature and soil moisture with more than 99% accurate results.

ACKNOWLEDGEMENT

The satisfaction that accompanies with the successful completion of the model would be put incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crown all the efforts with success.

I whole heartedly thank my project guide **Prof. Sachin Takale** for their consistent guidance, expert academic and

support throughout the project, without their great concepts & inspiration it would have not been possible.

I thank my parents for their emotional and financial support which they provided me during this project.

We show our gratitude to our honorable Principal **Dr. Kishore Ravande,** for providing all facilities and support.

I thank all faculties who directly or indirectly helped us in the completion of this project.

REFERENCES

[1.] Keerthana B, Nivetha P, Boomika M, Mathivatahni M, Niranjanaa-"IOT Based Smart Security and Monitoring Devices for Agriculture" in IRJET journal

[2.] Rubeena M M, ASIET, Jincy Denny, ASIET, Kerala, M Gokilavani Asst. Professor, ASIET, Kerala, - "IOT APPLICATION: SMART AGRICULTURE"- International Journal of Innovative Research in Advanced Engineering (IJIRAE) ,Issue 05, Volume 6 (May 2019)

[3.] Chetan N Kulkarni, Dr. Ajay U Surwade-"THE FUTURE OF FARMING THROUGH IoT PERSPECTIVE"- International Research Journal of Engineering and Technology (IRJET) ,Volume: 06 Issue: 02 | Feb 2019

BIOGRAPHIES

Parth Kr Singh
UG student, Dept. of ECE,
MIT School of Engineering Pune,
Maharashtra, India

MD Sadique
UG student, Dept. of ECE,
MIT School of Engineering Pune,
Maharashtra, India