Smart Agriculture Using IOT

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MAY 2019

CERTIFICATE

This is to certify that work embodied in this project report entitled **"Smart Agriculture Using IOT"** was carried out by **"Mr. Rupesh Kumar"** (201503100610058), at **Chhotubhai Gopalbhai Patel Institute of Technology** for the partial fulfillment of B.Tech. degree to be awarded by **UKA TARSADIA UNIVERSITY**. This research work has been carried out under my supervision and is to our satisfaction.

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I hereby certify that I am the sole author of this report and that neither any part of this report nor the whole of the report has been submitted for a degree to any other University or Institution.

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ABSTRACT

Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network.

The development of Intelligent Smart Agriculture IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage.

The aim of this project work is to propose a Novel Smart IoT based Agriculture this assisting farmers in getting Live Data (Temperature, Soil Moisture, humidity and Rain status) for efficient environment monitoring which will enable them to do smart farming and increase their overall yield and quality of products.

The Smart Agriculture being proposed via this project is integrated with Arduino Technology, Breadboard mixed with various sensors and live data feed can be obtained online from using android application and by SMS and also by e-mail. The project being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds.

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Chapter .1 INTRODUCTION

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater

Production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers.

Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (eg., sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information .

With the advent of open source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the fields or the landscape as an when needed. [1]

Agriculture is considered as the basis of life for us as it is the main source of food and other raw materials. It plays vital role in the growth of country’s economy. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming. In India most of the irrigation system are manually operated one’s. These outdated techniques are replaced with automated techniques. This project focuses primarily on reducing the wastage of water and minimizing the manual labor on field for irrigation. [2]

As the world is trending into new technologies and implementations it is a necessary goal to trend up in agriculture also. Many researches are done in the field of agriculture. Most projects signify the use of wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provide the information about the various environmental factors. Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are number of other factors that decrease the productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems. So, in order to provide solution to all such problems, it is necessary to develop an integrated system which will take care of all factors affecting the productivity in every stage. But complete automation in agriculture is not achieved due to various issues. Though it is implemented in the research level it is not given to the farmers as a product to get benefitted from the resources. Hence this project deals about developing smart agriculture using IoT and given to the farmers. [3]

1.1 Present Scenario of Traditional Agriculture System

Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming.

With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water.

Today, India ranks second in the world in farm output 64% of cultivated land dependent on monsoons. Irrigation accounts for 55-75% of water usage in India. Nearly 60% of the water used in irrigation is wasted. [1]

1.2 Need of Smart Agriculture Using IOT

- Simple and easy to install and configure.

- Saving energy and resources, so that it can be utilized in proper way and amount.

- Farmers would be able to smear the right amount of water at the right time by automating farm or nursery irrigation.

- Avoiding irrigation at the wrong time of day, reduce runoff from overwatering saturated soils which will improve crop performance.

- Automated irrigation system uses valves to turn motor ON and OFF. Motors can be automated easily by using controllers and no need of labor to turn motor ON and OFF

.

- It is precise method for irrigation and a valuable tool for accurate soil moisture control in highly specialized greenhouse vegetable production.

- It is time saving, the human error elimination in adjusting available soil moisture levels.

Chapter .2 LITERATURE SURVEY

[1] Srishti Rawal Department of Computer Science, VIT University "IOT based Smart Irrigation System**"** International Journal of Computer Applications (0975 – 8887) Volume 159 – No 8, February 2017.

This paper present basic information regarding automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. This paper proposes an automated irrigation system which monitors and maintains the desired soil moisture content via automatic watering. Microcontroller ATMEGA328P on arduino uno platform is used to implement the control unit. The setup uses soil moisture sensors which measure the exact moisture level in soil. This value enables the system to use appropriate quantity of water which avoids over/under irrigation. IOT is used to keep the farmers updated about the status of sprinklers. Information from the sensors is regularly updated on a webpage using GSM-GPRS SIM900A modem through which a farmer can check whether the water sprinklers are ON/OFF at any given time. Also, the sensor readings are transmitted to a Thing speak channel to generate graphs for analysis.

[2] Arif Gori 1, Manglesh Singh 2, Ojas Thanawala 3, Anupam Vishwakarma 4, Prof. Ashfaque Shaikh 5 Student, Computer Engineering, Rizvi College of Engineering, Mumbai, India1,2,3,4 Guide, Computer Engineering, Rizvi College of Engineering, Mumbai, India 5. "Smart Irrigation System using IOT" International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 6, Issue 9, September 2017.

This paper presents information regarding as water supply is becoming scarce in today's world there is an urgency of adopting smart ways of irrigation. The project describes how

irrigation can be handled smartly using IOT. This project aims at saving time and avoiding problems like constant vigilance. It also helps in conserving water by automatically providing water to the plants/field depending on the water requirements. This system can also prove to be helpful in agriculture, parks and lawns. The objective of this system is to detect the moisture content of the soil and depending on it sprinkle water .This entire information will be sent to the user's mobile phone.

[3] 1 Dr.N.Suma,2 Sandra Rhea Samson, 3 S.Saranya , 4 G.Shanmugapriya, 5 R.Subhashri

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5 Student, Department of ECE, SNS College of Engineering, Coimbatore, India e-mail:subaranju0708@gmail.com "IOT Based Smart Agriculture Monitoring System" International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 5 Issue: 2 177 – 181

This paper presents information regarding study consists of Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like GPS based remote

controlled monitoring, moisture & temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities. It makes use of wireless sensor networks for noting the soil properties and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any remote device or internet services and the operations are performed by interfacing sensors, Wi-Fi, camera with microcontroller. This concept is created as a product and given to the farmer's welfare.

[4] Karan Kansara1, Vishal Zaveri1, Shreyans Shah1, Sandip Delwadkar2, Kaushal Jani3

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3Teaching Assistant, Babu Madhav Institute of Information Technology, Bardoli, Gujarat, India

"Sensor based Automated Irrigation System with IOT: A Technical Review" (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (6) , 2015, 5331-5333

This paper present information regarding IOT, Sensor based irrigation and GSM, GPRS based mobile system.

Chapter .3 INTERFACING OF SYSTEM

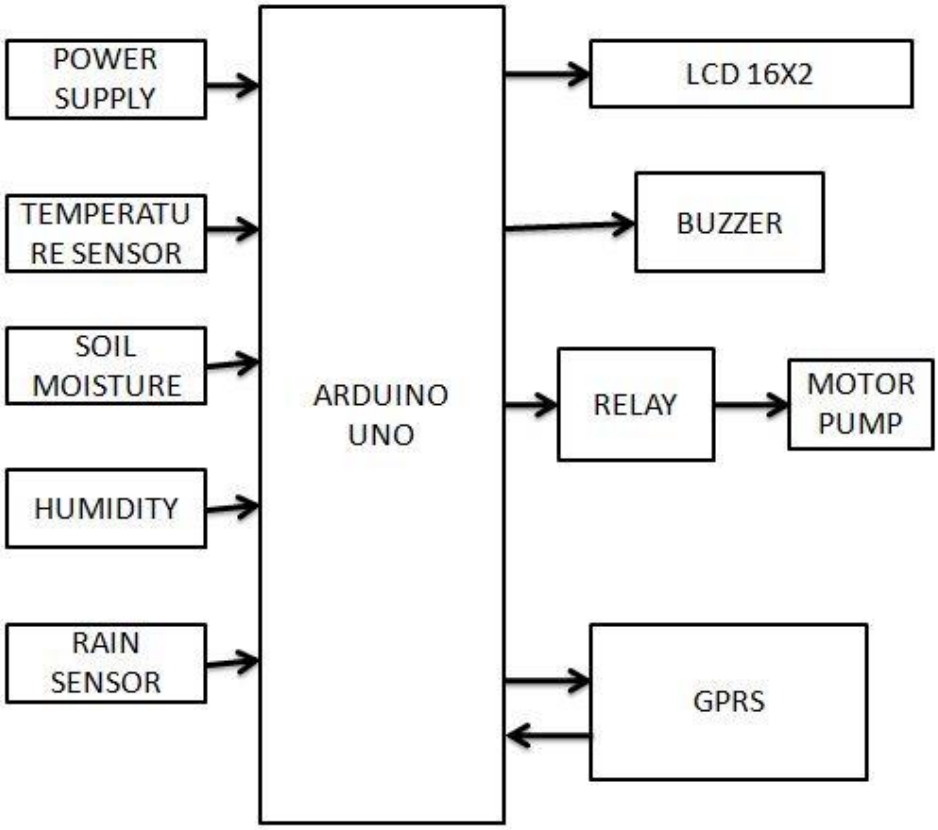

Figure 1 Block Diagram of Smart agriculture Using IOT

3.1 Arduino Controller

- Arduino is an open-source platform used for building electronics projects.
- Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on our computer, used to write and upload computer code to the physical board.

- The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board - you can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.
- The Uno is one of the more popular boards in the Arduino family and a great choice for beginners.
- It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analogue inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

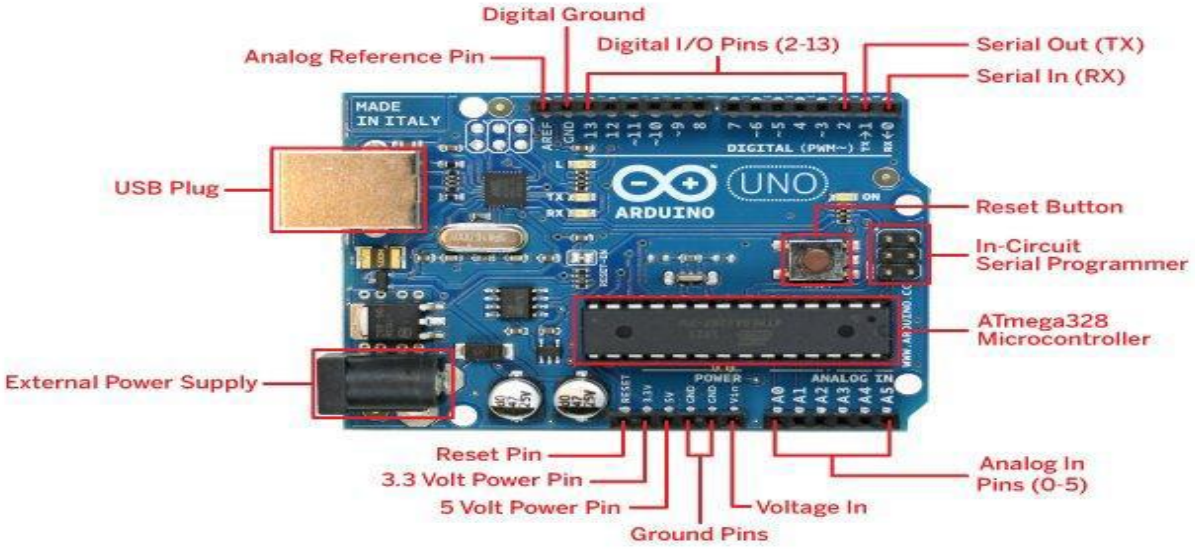

Figure 2 Arduino

Table 1 Arduino Pin Detail

Serial No.	Specification	
1	Microcontroller	UNO R3
2	Operating Voltage	5V
3	Input Voltage (recommended)	7-12V
4	Input Voltage (limits)	6-20V
5	Digital I/O Pins	14 (Including PWM)
6	Analogue Input Pins	6
7	DC Current for 3.3V Pin	50mA
8	Flash Memory	32 KB
9	SRAM	2 KB
10	EEPROM	1KB
11	Clock Speed	16MHz

3.2 Soil moisture sensor

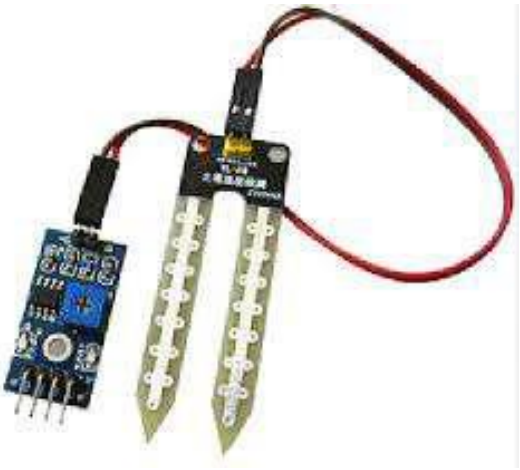

Figure 3 Soil Moisture Sensor

Soil moisture sensor is a sensor which senses the moisture content of the soil. The sensor has both the analog and the digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principle of open and short circuit. The output is high or low indicated by the LED. When the soil is dry, the current will not pass through it and so it will act as open circuit. Hence the output is said to be maximum. When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short and the output will be zero.

The sensor is platinum coated to make the efficiency high. The range of sensing is also high. It is anti-rust and so the sensor has long life which will afford the farmer at a minimum cost.

3.2.1 Features

- Sensitivity adjustable.
- Has fixed bolt hole, convenient installation.
- Threshold level can be configured.

- Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

3.2.2 Specifications

Table 2 Sensor Specification

Parameter	**Value**
Operating Voltage	+5v dc regulated
Soil moisture	Digital value is indicated by out pin

3.2.3 Pin Details

Table 3 Sensor Pin Detail

Pin	Definition
GND	GND
Vcc	5V
A0	Analog output interface
D0	Digital output

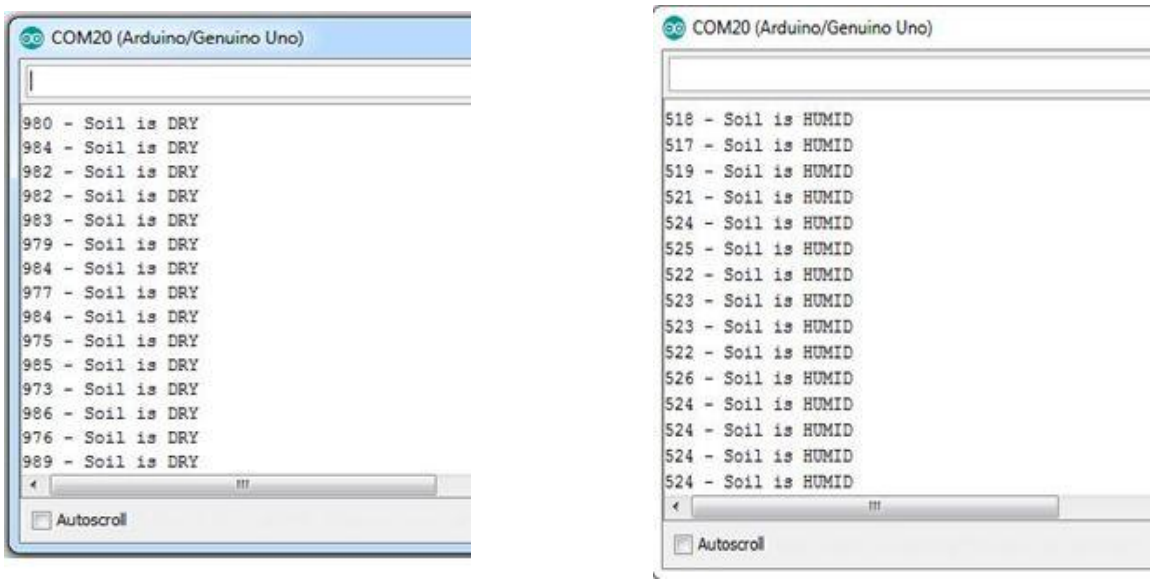

Figure 4 Output of soil moisture sensor Field

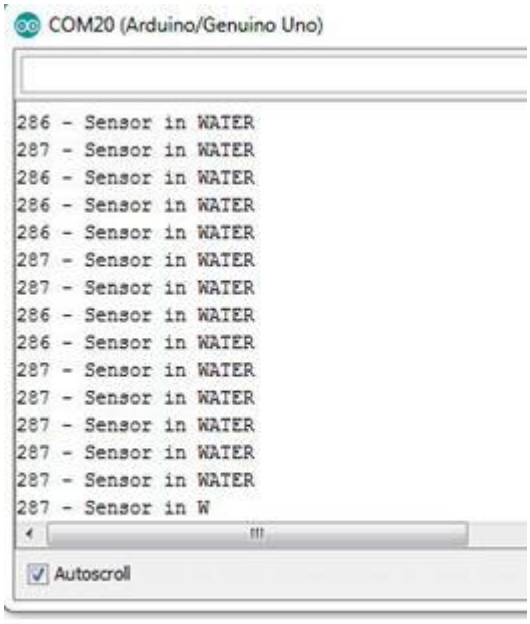

Figure 5 Output of soil moisture in field at wet

3.3 Temperature sensor

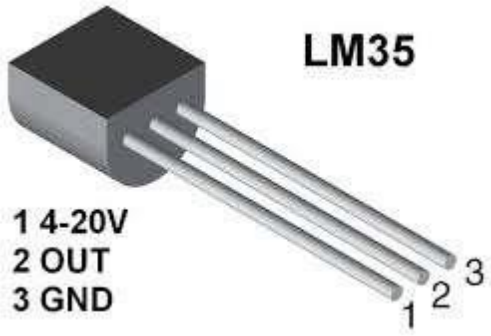

Figure 6 LM 35

The LM 35 sensor is highly used because its output voltage is linear with the Celsius scaling of temperature. It does not provide any external trimming. It has a wide operating range. The maximum output is 5V. The output will increase 10mV for every one degree rise in temperature. The range is from -55 degrees to +150 degrees. There are three terminals as Vcc, Ground and the analog sensor. It consumes minimum amount of electricity. Thus, it is energy efficient. It is very efficient in horticulture. It is user friendly to use.

3.3.1 Working Principle of LM35

There are two transistors in the center of the drawing. One has ten times the emitter area of the other. This means it has one tenth of the current density, since the same current is going through both transistors. This causes a voltage across the resistor R1 that is proportional to the absolute temperature, and is almost linear across the range. The "almost" part is taken care of by a special circuit that straightens out the slightly curved graph of voltage versus temperature.

The amplifier at the top ensures that the voltage at the base of the left transistor (Q1) is proportional to absolute temperature (PTAT) by comparing the output of the two transistors.

The amplifier at the right converts absolute temperature (measured in Kelvin) into either Fahrenheit or Celsius, depending on the part (LM35).

3.3.2 Features

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Low-Cost Due to Wafer-Level Trimming
- Operates From 4 V to 30 V
- Less Than 60-µA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

3.3.3 Applications

- Measuring temperature of a particular environment
- Providing thermal shutdown for a circuit/component
- Monitoring Battery Temperature
- Measuring Temperatures for HVAC applications.

Table 4 Temperatue Sensor Pin Detail

Pin Number	Pin Name	Description
1	Vcc	Input voltage is +5V for typical applications
2	Analog Out	There will be increase in 10mV for raise of every 1°C. Can range from -1V(-55°C) to 6V(150°C)
3	Ground	Connected to ground of circuit

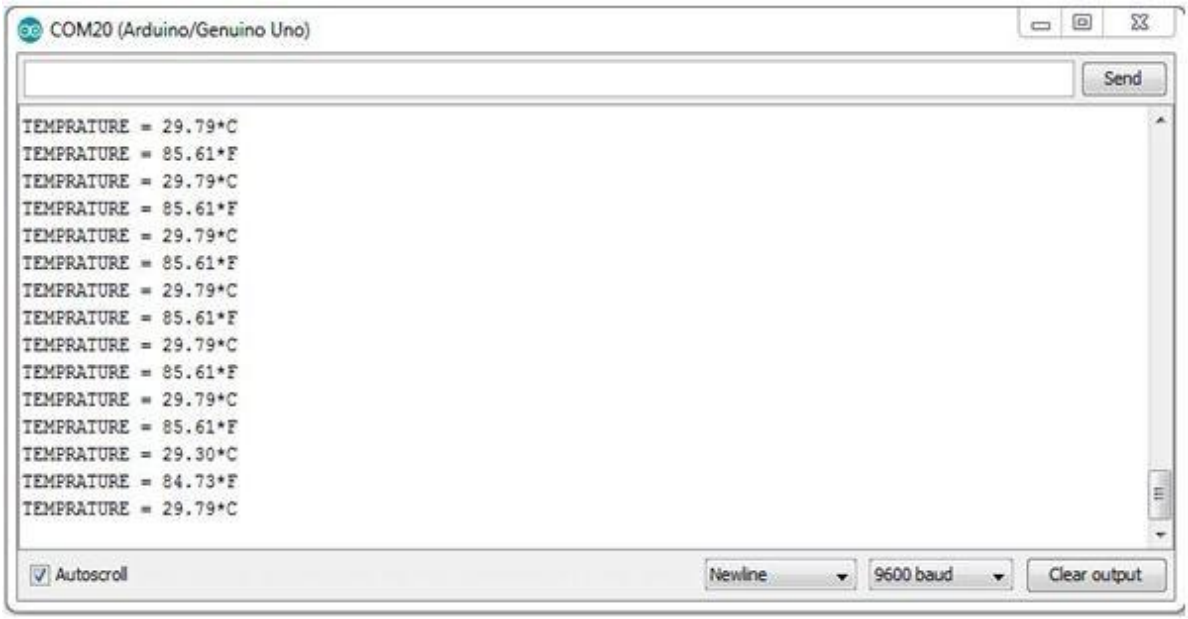

Figure 7 Output of Temperature sensor (LM35)

Description: It shows that the result of temperature using LM35 sensor and the temperature is shown in Celsius at constant temperature.

3.4 Rain Sensor

Figure 8 Rain Sensor

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the rain sensor.

The analog output is used in detection of drops in the amount of rainfall. With the help of rain sensor we stop the motor running condition during raining or when rain comes.

3.4.1 Specification of Rain sensor

- Adopts high quality of RF-04 double sided material.
- Area: 5cm x 4cm nickel plate on side
- Anti – oxidation, anti – conductivity, with long use time.
- Comparator output signal clean waveform is good, driving ability, over 15mA Potentiometers adjust the sensitivity, Working voltage 5V
- Output format: Digital switching output (0 and 1) and analog voltage output AO

3.5 Humidity Sensor

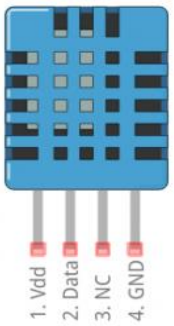

Figure 9 Humidity Sensor

- The DHT11 detects water vapor by measuring the electrical resistance between two electrodes.
- The humidity sensing component is a moisture holding substrate with electrodes applied to the surface.
- When water vapor is absorbed by the substrate, ions are released by the substrate which increases the conductivity between the electrodes.
- The change in resistance between the two electrodes is proportional to the relative humidity.

3.5.1 Features of Humidity Sensor

- Humidity Range : 29-90%
- Humidity Accuracy : ±5%
- Operating Voltage: 3v to 5.5v

3.6 LCD (Liquid Crystal Display)

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid 13 crystal. This combination of colored light with the gray scale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

LCDs Connection:

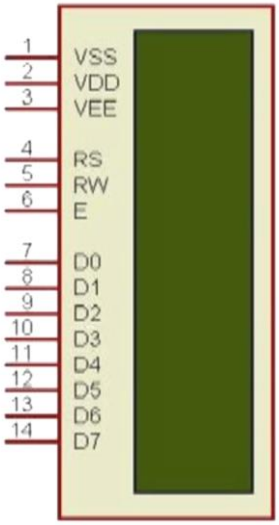

Figure 10 LCD(16x2) Pin Diagram

Advantages of an LCD's:

- LCD's consumes less amount of power
- LCDs are of low cost
- Provides excellent contrast
- Use for display purpose

Disadvantages of an LCD's:

- Require additional power sources
- Range of temperature is limited for operation
- Low reliability
- Speed is very low

Table 5 LCD (16x2) Pin Description

Pin No.	Symbol	Function
1	Vss	Signal ground
2	Vcc	Power Supply for logic
3	Vo	Contrast adjust
4	RS	Register select signal
5	R/W	Read/write select signal
6	E	Operation enable signal
7-10	DB0- DB3	Data transfer pin
11-14	DB4- DB7	Bi directional data transfer between the computer
15	LED+	Power Supply
16	LED-	Power Supply

3.7 General Packet Radio Service (GPRS)

Figure 11 GPRS Module

General Packet Radio Service (GPRS) is a packet oriented mobile data standard on the 2Gand 3G cellular communication network's global system for mobile communications (GSM).

Services offered

- SMS messaging and broadcasting
- "Always on" internet access Multimedia messaging service (MMS)
- Push-to-talk over cellular (PoC)
- Instant messaging and presence—wireless village
- Internet applications for smart devices through wireless application protocol (WAP)
- Point-to-point (P2P) service: inter-networking with the Internet (IP)

Chapter .4 PROJECT HARDWARE

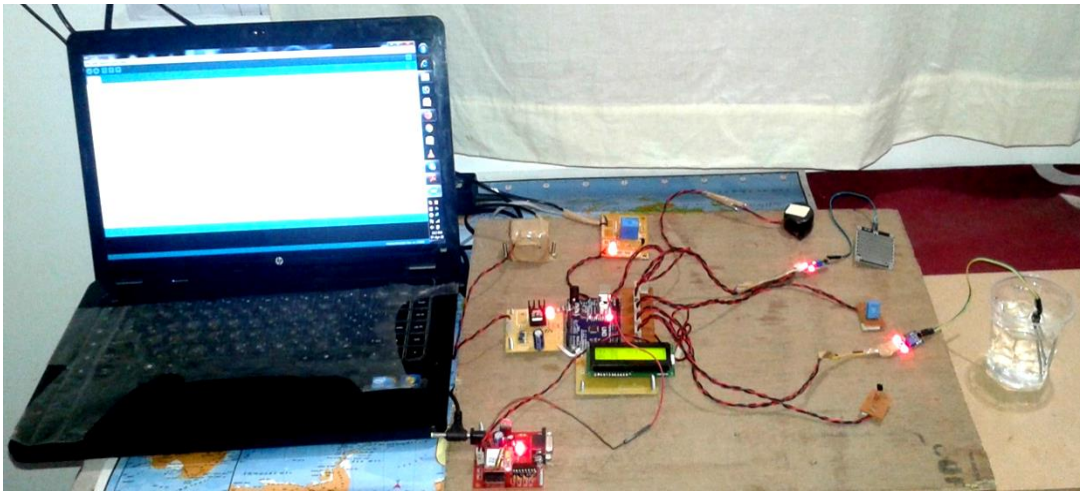

Figure 12 Project Hardware

Description: Connected all the sensors to the Arduino board (like Rain sensor, LM35, Humidity sensor and Soil moisture sensor) all this give individual signal to Relay board to operate water pump.

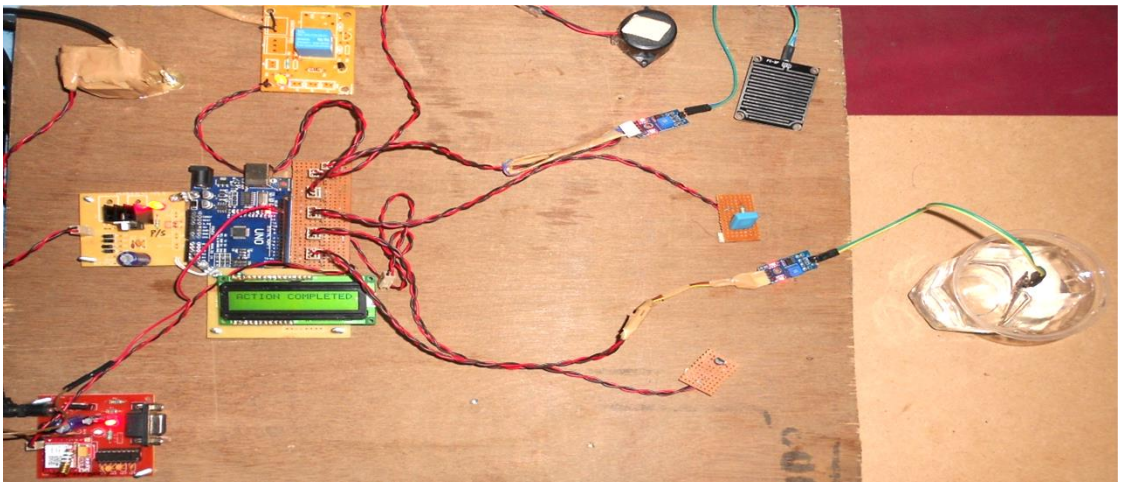

Figure 13 Hardware with Arduino, GPRS, Relay Board, Sensors and LCD

Results:

Figure 14 Results by SMS

Figure 15 show that the operation of iot agriculture through SMS and its results. Operating of each individual sensor.

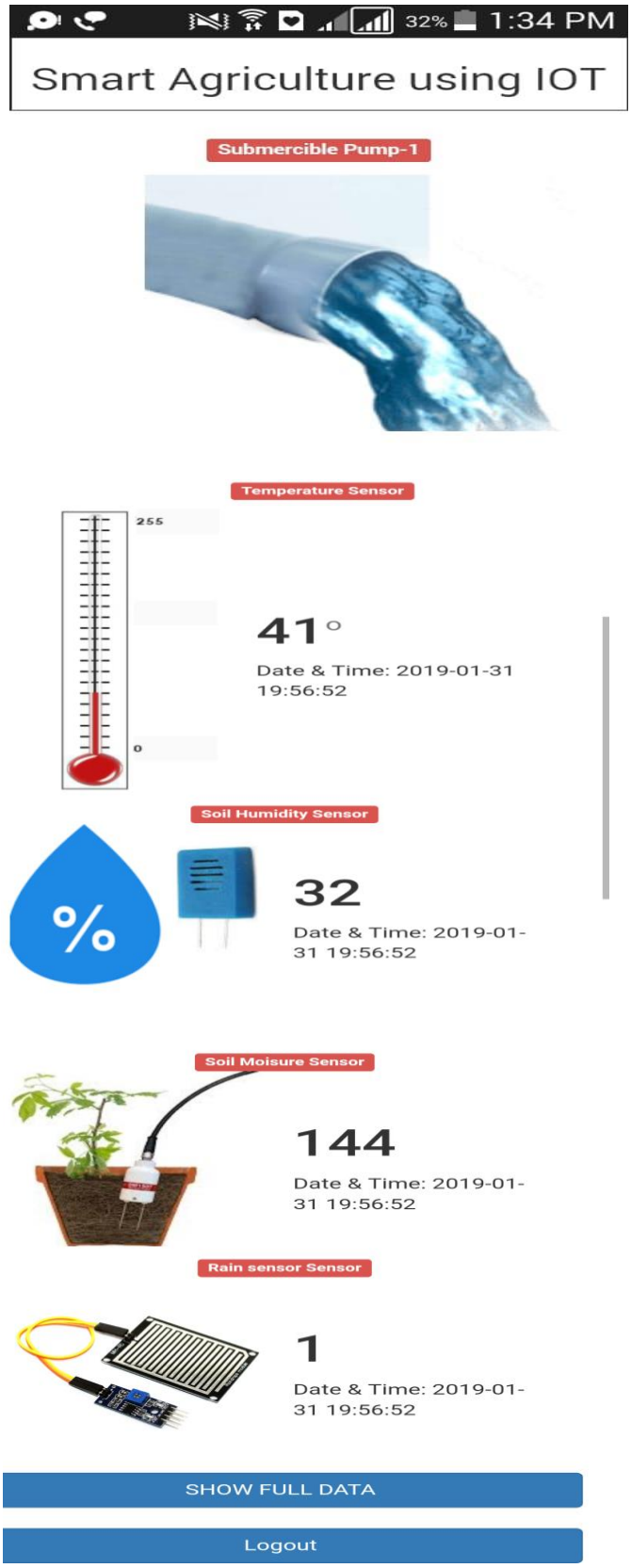

Figure 15 Results by Mobile Application

Chapter .5 CONCLUSION

The smart irrigation system implemented is cost effective for optimizing water resources for agricultural production. The proposed system can be used to switch on/off the water sprinkler depending on the soil moisture level sensor, temperature sensor and by rain sensor also thereby making the process simpler to use. Through this project it can be concluded that there can be considerable development in irrigation with those of IOT and automation. Thus this system is a solution to the problems faced in the existing process of irrigation.

Interfacing all the sensors with iot system like Soil moisture sensor, Temperature sensor, Humidity sensor and Rain sensor for Smart agriculture.

FUTURE SCOPE

- This system can be expanded in future by adding more sensors to make agriculture system more efficient.
- The sensors like health monitoring of soil and plant.
- To determine soil fertility etc.

Chapter .6 REFERENCES

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[2] Arif Gori 1, Manglesh Singh 2, Ojas Thanawala 3, Anupam Vishwakarma 4, Prof. Ashfaque Shaikh 5 Student, Computer Engineering, Rizvi College of Engineering, Mumbai, India1,2,3,4 Guide, Computer Engineering, Rizvi College of Engineering, Mumbai, India 5. "Smart Irrigation System using IOT" International Journal of Advanced Research in Computer and Communication Engineering ISO 3297:2007 Certified Vol. 6, Issue 9, September 2017.

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