International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

AGRICULTURE MONITORING SYSTEM USINGARDUINO AND IoT

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ABSTRACT

Agriculture is the primary source of income for India's largest population and a significant contributor to the country's economy. The Internet of Things (IoT) is a technology that allows a mobile device to monitor a gadget's function. The Internet of Things (IoT) is a network technology that senses data from various sensors and allows anything to connect to the Internet to exchange data. This will be accomplished via a more advanced communication device, such as a Wi-Fi/GSM module. The information gathered by the sensors is transformed into useful information and transmitted to the user. A handheld device, such as a cell phone or a tablet, can be used to see the data.

1. INTRODUCTION

India is a village-based country, and agriculture is critical to the country's prosperity. Agriculture in our country is reliant on the monsoons, which are in short supply. As a result, irrigation is utilised in the agricultural sector. Water is delivered to plants in an irrigation system based on the soil type. In agriculture, two things are critical: first, obtaining information on soil fertility, and second, measuring the humidity content of the air. Different solutions are now available for irrigation, which are utilised to lessen the reliance on rain. Electrical power and on/off scheduling are the primary drivers of this strategy. Temperature and humidity sensors are put near the plant, as well as near the module and gateway unit handles, inthis strategy.

2. PROBLEM STATEMENT

In the present era the greatest problem faced by world is water scarcity. In the case of traditional irrigation system water saving is not considered. The absence of automatic controlling of the systemresult in improper water control system. The majorreason for these limitations is the growth of population which is increasing at a faster rate. And also People are busy with their daily work and do not have enough time for watering activity to maintain a beautiful and healthy plant. Agriculturemonitoring system, or simply smart farming, is a new technological idea in which smart electronic sensors collect data from a variety of agricultural fields ranging from tiny to big scale, as well as their surroundings. Experts and local farmers examine the collected data to form short- and long-term conclusions on whether the pattern, soil fertility, present crop quality, quantity of water necessary for the next week to a month, and so on.

3. OBJECTIVE OF THE PROJECT

The main objective of this project is to develop an automated watering system for plants and to analyse sensors data to take certain precautions on field. Automated systems need fewer manual procedures, are more reliable, flexible, and accurate. We'll build a smart agricultural monitoring system that can collect vital agricultural data and transfer it in real time to an IoT platform called Thingspeak, where it can be documented and analysed. Because the data in Thingspeak is in graphical format, a botanist or a relatively knowledgeable farmer may analyse the data to make appropriate modifications in the given resources in order to achieve high quality yield.

4. PROPOSED MODEL

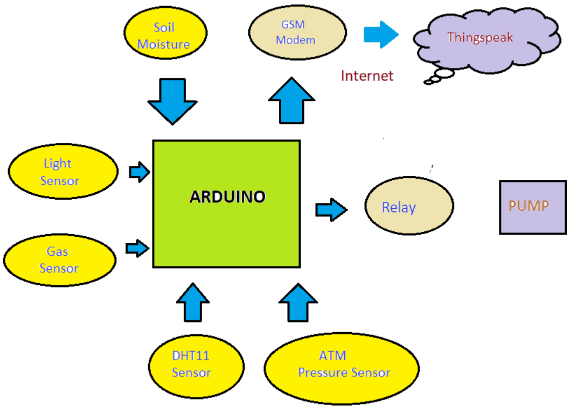

Fig:1 Block diagram of proposed model We'll build a smart agricultural monitoringsystem that can collect vital agricultural datafrom sensors such as temperature and humidity, gas sensors, light sensors, and air pressuresensors, and transfer it in real time to an IoT platform called Thingspeak , where it can be documented and analysed. Because the logged data on Thingspeak is in graphical format, a botanist or a relatively knowledgeable farmer can analyse the data (from anywhere in the globe) to make sensible modifications in the supplied resources (to crops) in order to achievehigh quality yield. In addition, the motor iscontrolled by the moisture level in the soil.When the soil moisture level falls below thethreshold value, the motor will automaticallyturn on, and when the soil moisture level risesabove the threshold value, the motor willautomatically turn off.

5. SOFTWARE COMPONENTS AND LIBRARIES

- **Arduino ATmega 328 microcontroller:**

Arduino is a basic single board microcontroller designed to make applications, interactive controls, or environments easily adaptive. Current models feature things like USB interface, analog input and GPIO PIN codes that allow the user to attach additional boards. Introduced in 2005, The Arduino platform was created to make it easier for students and experts to construct applications that play with sensors, actuators, motors, and other essential items in the human interface world.

The Arduino microcontroller is a free and open source microcontroller that does not have any built-in feedback. The I2C bus on these Arduino boards is used to transport data from the Arduino to the output devices. These boards are programmed using the Atmega Arduino microcontroller and RS232 serial interface connection

- **Temperature and Humidity sensor(DHT11library)**

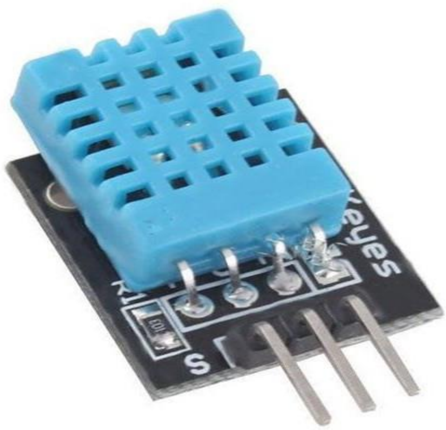

Fig:2 Temperature and Humidity sensor The Temperature and Humidity sensor which is called DHT11. The DHT11 is a widely used temperature and humidity sensor with a dedicated NTC for temperature measurement and an 8-bit microprocessor for serial data output of temperature and humidity values[11]. The DHT11 sensor is available as a standalone sensor or as part of a module. The sensor's performance is the same in either case. The sensor will be packaged in a 4-pinbox with just three pins used, whereas the module will be packaged with three pins as illustrated above.

- **Gas Sensor (MQ135 library)**

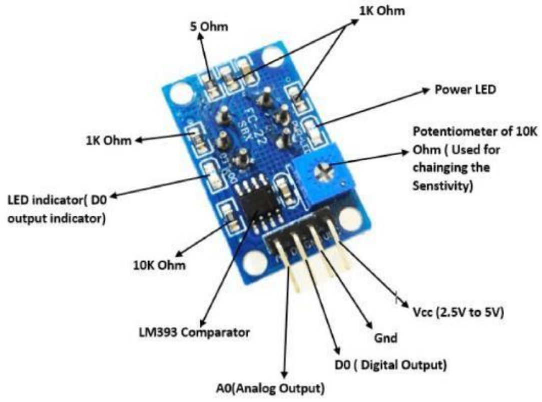

Fig:3 Gas sensor

The MQ-135 Gas Sensor can detect dangerous chemicals and smoke such as ammonia (NH3), sulphur (S), benzene (C6H6), CO2, and others. This sensor features a digital and analogue output pin, much as the other MQseries gas sensors. The digital pin goes high when the level of these gases in the air exceeds a threshold limit. The on-board potentiometer may be used to set the threshold value. The analogueoutput pin generates an analogue signal that may be used to estimate the concentrations of various gases in the environment. The MQ135 air quality sensor module runs on 5 volts and draws roughly 150 milliamps. It needs to be pre-heated before it can produce reliable findings.

- **Soil Sensor(soil sensor library:**

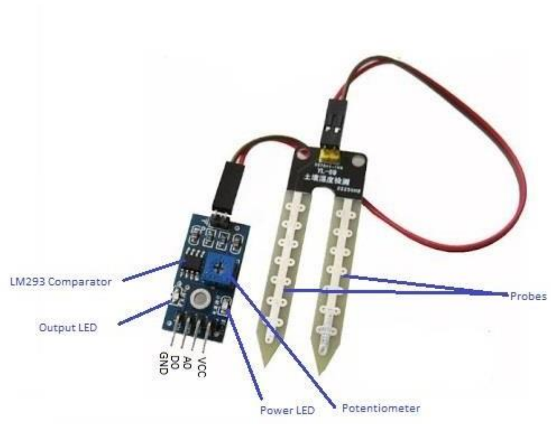

Fig:4 Soil sensor

Two probes are utilised to measure the volumetric content of water in the soil moisturesensor. The two probes enable current to flow through the soil, and the resistance value is utilised to compute themoisture content, and the two probes 14allowcurrent to pass through the soil. The soil conductsbetter electrically when there is more water in it, resulting in less resistance. As a result, the moisture content of the product will rise. Becausedry soil conducts electricity poorly, the soil conducts less electricity when there is less water, resulting in higher resistance. As a result, themoisture content of the product will be reduced. There are two ways to attach this sensor: analogueand digital

- **Light Sensor (light sensor library):**

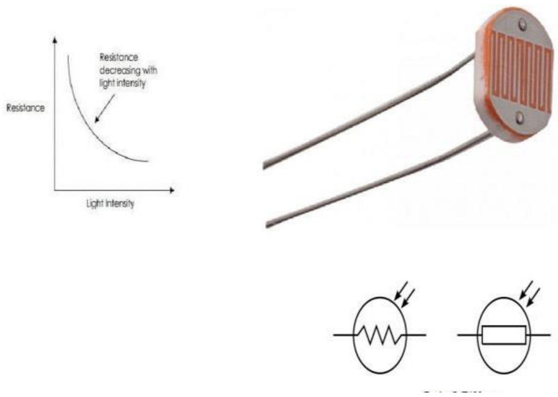

Fig:4 Light sensor

LDRs, also known as Photoresistors or Photocells, are low-cost variable resistors whose resistance varies based on the quantity of light that strikes their surface. The resistivity is higher in dark situations and lower in bright environments. Photoresistors are inadequate for sensing exact amounts of light due to their imperfect nature, but they are capable of detecting changes[6]. They are frequently used to manage street lights and may respond to events such as the shift from day to night (and vice versa) for home automation and gardening applications. The ADC pin and DigitalOutput pin of the Arduino Uno will be used to control it in this project.

- **Pressure Sensor (BMP085 library):**

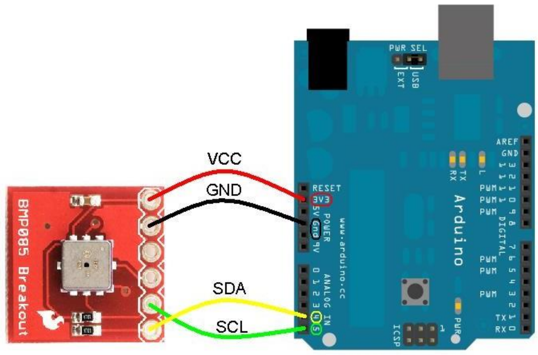

Fig:5 Pressure sensor

The BMP085 barometric pressure sensor is extremely reliable. It has a range of 30,000 to110,000 Pa for monitoring pressure. 'Pa' refers to the Pascal unit, which is commonly transformedto hPa (hectoPascal), which equals 100 Pa, or kPa (kiloPascal), which equals 1000 Pa. The BMP085 also has a temperature sensor that can monitor temperatures from 0 to 65 degrees Celsius.

The BMP085 uses a digital interface, namely I2C. This means that getting it to communicate to your microcontroller may take a little longer, but you'll obtain data that's considerably less vulnerable to noise and other variables that might degrade an analogue signal.I2C is a two-wire synchronous interface in which the first wire, SDA, delivers data and the secondline, SCL, transmits a clock that keeps track of the data. If you're using an Arduino to communicate with the BMP085, the Wire library will take care of the majority of the work for you.

- **Relay:**

Fig:6 Relay

Relays can be used to regulate high-voltage electrical equipment. A relay is a switch that iscontrolled electrically by an electromagnet. A low voltage, such as 5 volts from a microcontroller, activates the electromagnet, which pulls a contact to establish or break a high voltage circuit. A relay, for example, might use a 5V DC battery circuit to switch a 230V AC mains circuit.

- **Motor:**

Fig:7 DC Motor

The term "DC motor" refers to a collection of rotating electrical devices that convert direct current electrical energy into mechanical energy. Magnetic fields are used to produce forces in the most prominent types. Almost all DC motors have an internal mechanism, either electromechanical or electronic, that periodically reverses the direction of current flow in a part of the motor. DC motors were the first to gain widespread usage due to their ability to be powered by existing direct-current lighting power distribution networks.The speed of a DC motor may be varied across a large range by varying the supply voltage or adjusting the current intensity in the field windings. Tools, toys, and appliances all require small DC motors.

- **GSM Shield:**

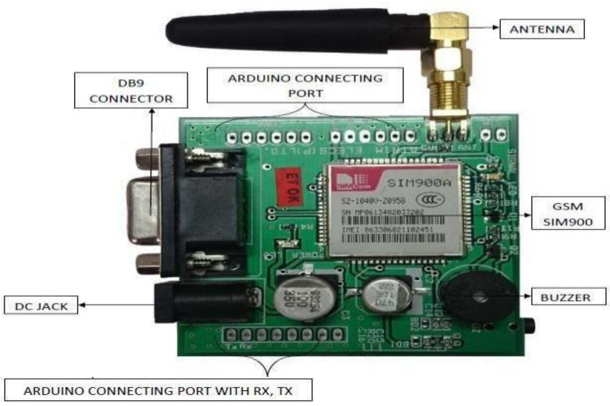

Fig: 8 GSM shield

The GSM standard was initially defined as a digital, circuit-switched network suited for full duplex voice communication, and 2G networks were created as a replacement for first generation (1G) analogue cellular networks. Data communications were added later, initially via circuit-switched transmission, then by packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution, or EGPRS). Following that, the 3GPP produced third-generation (3G) UMTS standards, which were later followed by fourth-generation (4G) LTE Advanced standards, which were not included in the ETSI GSM standard. The GSM Association owns thetrademark "GSM." It might also refer to Full Rate, the (at the time) most popular voice codec.

6. RESULTS AND DISCUSSION

The data from the sensors has been uploaded to the ThingSpeak cloud and it is represented graphically as below:

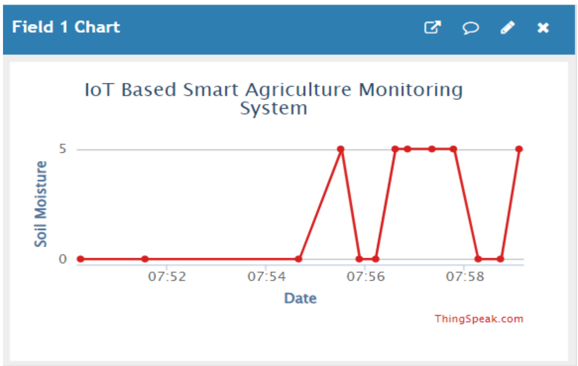

Fig:9 Soil Moisture data

The Soil Moisture data collected from the sensor and has been uploaded to the ThingSpeakCloud. The differences in crop moisture levels may be simply understood and monitored. Before transferring the data to the cloud, the ThingSpeak channel's API key must first becorrectly configured.

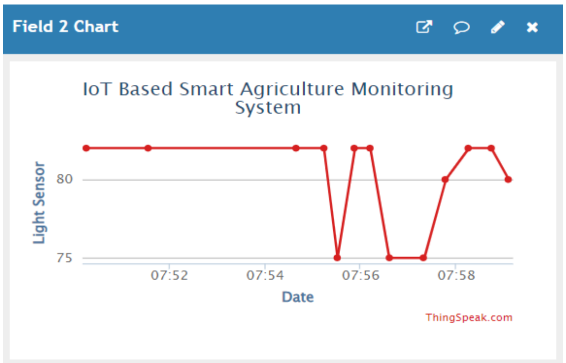

Fig:10 Light Sensor data

The Light Sensor data uploaded to the ThingSpeak cloud. These sensors transform light rays into electrical signals by detecting the amount of light and then converting it into a format that can be read by an instrument, in this instance an IoT device. In agricultural, light sensors offer a wide range of IoT applications. In agricultural contexts, light sensors are used to determine how much light the earth absorbs, allowing plants to thrive.

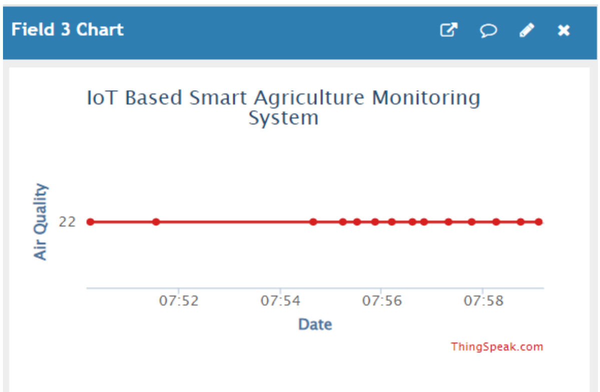

Fig:11 Air quality data

The Air Quality data uploaded to the ThingSpeak cloud. The sensors will collect data on a variety of environmental characteristics and transfer it to the Thingspeak server, which will show it online every 15 seconds. This system may be installed anywhere, and it can also activate some gadgets when pollution levels exceed a certain threshold.

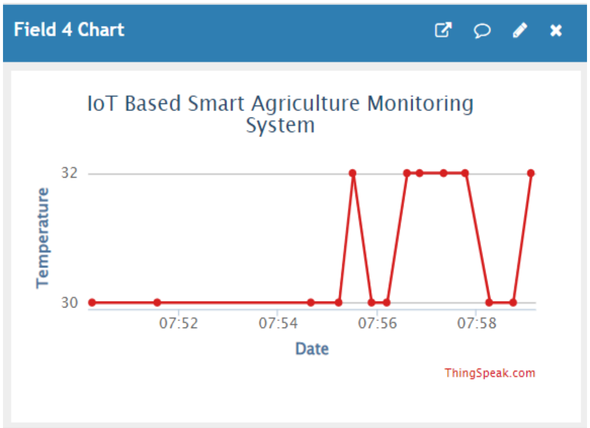

Fig:12 Temperature sensor data

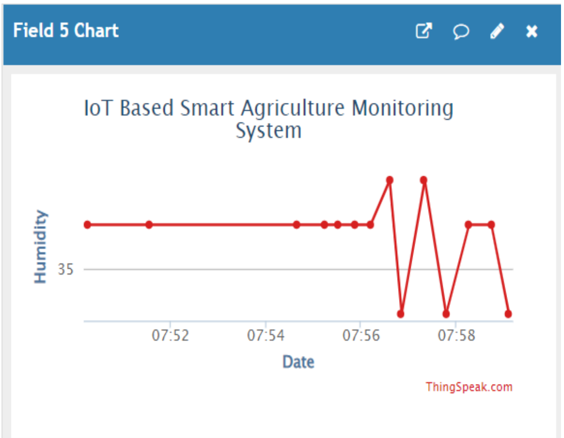

Fig:13 Humidity sensor data

The temperature and humidity datauploaded to the Thinspeak cloud. Temperature and humidity are crucial in determining when crops and fruits are ready to develop or begin producing. A digital sensor called the DHT11 is used to measure this parameter, which can monitor both temperature and humidity. We cananalyse temperature and humidity fluctuations around the field using the graph.

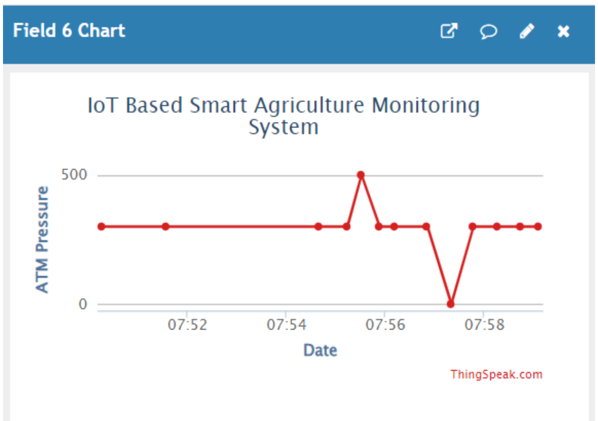

Fig: 14 ATM Pressure data

The ATM pressure data uploaded to the Thing Speak cloud. Using atmospheric pressure data you can predict weather for short term and also can be used for studying how plants behavein different atmospheric pressure conditions.

7. CONCLUSION

This project describes automated irrigation system using IOT. The combination of the internet of things and cloud computing creates a system that effectively controls the agriculture industry.

This system will detect all environmental characteristics and transmit the information to theuser through the cloud. The user will perform control actions based on the information providedby the actuator. This asset enables the farmer to enhance the cultivation in the manner required bythe plant. It results in a larger crop output, a longer production period, better quality, and the use of fewer pesticides. The system uses information from the soil moisture sensor to irrigate soil whichhelps to prevent over irrigation or under irrigationof soil thereby avoiding crop damage. The farm owner can monitor the process and can take the control over the process.

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