A RESEARCH PAPER ON SMART AGRICULTURE SYSTEM USING IOT

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Abstract - *Agriculture has been the primary source of income or primary occupation in our country from ages. But recently due to unpredictable weather conditions and availability of good land there has been hindrance in agriculture. As a result, food security has become a major concern for our country and also most other countries. So, to overcome this we go for Internet of Things (IoT) in Smart Agriculture system to enhance the productivity and operation efficiency in agricultural sector. The feature of this system is developing a system that can monitor moisture, temperature, humidity and even might movement of animals which might annihilate the resources in agriculture field via sensors using microcontroller and in the case of any discrepancy send an alert message using Wi-fi/3G/4G module to the farmers' smartphone. As it has low cost, it allows every farmer to afford it and because of its various features it has a potential to be helpful in water limited areas.*

In this paper we are proposing an efficient and low-cost sensor network technology to get the soil moisture, temperature, humidity and manually operable motor to distribute water in the field as per the need and take the decision accordingly.

***Key Words**: IOT, Smart Agriculture, Moisture, Temperature, Humidity, Sensors, Wi-Fi, Application, Motor.*

1. INTRODUCTION

Agriculture is the base of life for human beings as agriculture is the main important source for food grains and other raw materials. If speaking about the Indian context, the backbone of developing nation's economy is agriculture and it plays a vital role too. It provides huge scale employment opportunities to the people. For the developing the economic condition of the country it is necessary to have growth in agricultural sector. Sadly, many farmers are still using the traditional ancient method which leads to low yielding of crops. But after the advancements had been implemented and human beings had been replaced by automatic technologies, the yields have been improved. Thus, there is a need to use modern technologies in the sector of agriculture for the improvement in yield. In agriculture areas there has been many research and several ways to use new IoT technology. In recent times, it is necessary to increase the yields food grain production. Cloud connected system helps in crop yield maximization, which helps in day-to-day agriculture tasks and even offers real time monitoring. Equipment's that are connected possess various Wi-Fi connections, which helps in monitoring and controlling electronic machines to help farmers in analyzing and for good operation of the crop field. By the usage of sensor devices and other automated electronics devices, now many farmers can efficiently measure moisture level, temperature and even monitor their land.

2. LITERATURE SURVEY

[1] Proposes a system which includes various sensors which are connected to an app via Cloud Network. The system monitors various things like Moisture, Temperature and humidity and even control them. It uses ZigBee which is something that provides standardization of IOT industry which is providing an authoritative standard to the things used in WSN.

[2] The recent time scenario of drying up of tanks and rivers, unpredictable environment shows that there is need of proper use of water. To get over all this use of temperature sensor and Moisture sensor at suitable places for monitoring of crops is done.

[3] Proposes an electronic system which has the applications of IOT. This system can monitor such as moisture and can even based on threshold value control the moisture level. Thus, the proposed model is capable of controlling and monitoring.

[4] A way developed with threshold values of soil moisture and temperature can be programmed into a microcontroller-based gateway for controlling water quantity. By the use of photovoltaic panels, the system is powered and also based on cellular Internet interface can have a communication link that allows irrigation scheduling which is programmed through a web page.

[5] With the development in Wireless Sensor Network (WSN) technologically it is now possible in precision agriculture to use controlling and monitoring of greenhouse parameter.

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[6] This system is applied for a poly-house. It proposes first collecting data from IoT sensors and send it to the server over Wi-Fi module.

[7] Suggests out a method for testing the soil fertility based on the values collected by the sensors. Once the soil fertility is determined is used to select or suggest the best soil fertilizer for the crops.

3. PROPOSED WORK

3.1 SMART AGRICULTURE SYSTEM

In this day to day lives the evolving trend is the Smart Agricultural system. Agriculture has received the latest trends and techniques with the development of technology. One of the major benefits for Smart Agriculture is the connectivity by using existing Wi-fi technology.
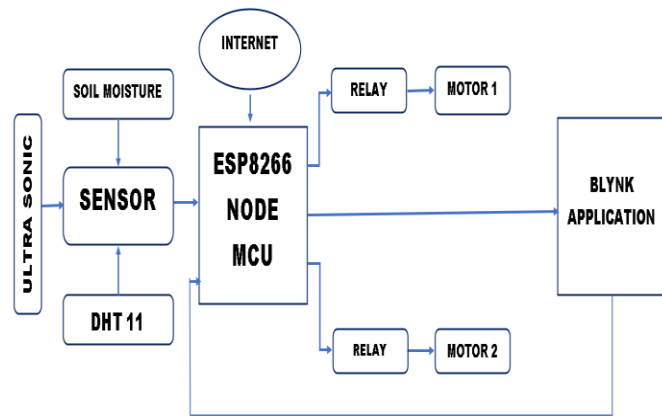

Fig-1: Smart Agriculture System using IOT outline

This system will lead to the successful growth of Internet of Things implementation in the agricultural fields as it helps to save time on hardware setups for Smart Agriculture system. This system which overcomes the existing mobile computing scenario of smart devices and their application (App) and helps in connecting devices in real life.

Here in the Smart Agriculture System, we have three sensors namely soil moisture, DHT 11, and ultrasonic sensor which are connected to the ESP8266 Node MCU which is connected to internet through Wi-fi. Soil moisture sensor senses the moisture level in the soil and send this information to the microcontroller which further displays it in the Blynk app. The DHT 11 senses the temperature and humidity around the field and send data to microcontroller which displays it in Blynk app. And the ultrasonic sensor is fixed in the top of the Supplier tank which measure the water level in the tank and displays it in the Blynk app so like we can send data to Blynk app we can also send data from Blynk app like if the water level is low, we can manually switch on the Motor 1 which will load water from water reservoir like river, shallow, water supply etc. and if we switch on the Motor 2 it

will distribute water over the agriculture if the soil moisture level is low.

3.2 SOIL MOISTURE SENSOR

Soil moisture sensor is a sensor which senses the moisture level in the field. When in the field the water level is low in the Blynk app the LED will glow and if the water level is high the LED won't glow.
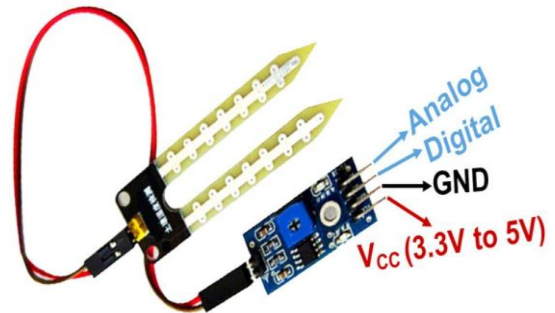

Fig-2: Soil Moisture Sensor

Here we connected the VCC to 5V and GND to GND of the microcontroller and the Digital pin of sensor to GPIO pin of microcontroller. The moisture in the soil is indirectly measuring conductivity in the soil of the field. The more moist the more conductive it is and vice versa.

3.3 DHT 11 (Digital Humidity Temperature Sensor)

Digital Humidity Temperature Sensor (DHT11) is comprised of a thermistor and a humidity sensing component for sensing the temperature. This humidity sensing capacitor has two electrodes with a substrate which contains moisture as a dielectric between them. When the humidity level is change it is seen that the value of capacitance is also changed. The changed resistance value is then change into a digital form with the IC measure process.

A thermistor which is negative temperature coefficient is used for measuring the temperature which causes a decrease in its resistance value with the increase in temperature. This sensor is usually composed of semiconductor materials ceramics or polyceramic to obtain greater resistance value even for the smallest change in temperature.
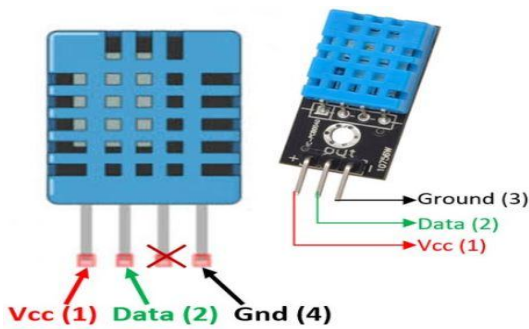
Fig-3: DHT 11 Sensor

The Digital Humidity Temperature Sensor (DHT11) temperature range is from 0 to 50 degree Celsius with 2-degree accuracy. Sensing range of DHT11 is 20-90%RH with an accuracy +\-5%RH. Samplings rate of this sensor is 1Hz i.e., it gives reading for every second. DHT11 is very small in size having operating voltage of 5 volts. 2.5mA is the maximum current used while measuring.

3.4 ULTRASONIC SENSOR

The distance to an object is detected by sending sonic burst in the HC-SR04 ultrasonic sensor is used. It contains of two ultrasonic transducers. The first one acts as a transmitter which is used to send sonic bursts and the other one receiver produces output pulse if it receives.
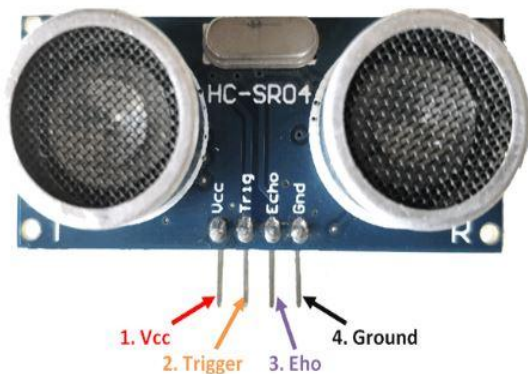

Fig-4: HC-SR04 Ultrasonic Sensor

Here the VCC is connected to 5V power supply in the ESP8266 Node MCU and GND is connected to GND of ESP8266 Node MCU. In order to send ultrasonic waves, the Trigger pin is set to high for 10µs. Then a 8 sonic bursts is send from the module at 40Khz.The ultrasonic sensor although have a detection range of 2cm-400cm but we have set it to 16cm as per our requirement. Then in Echo pin it will be received and the echo pin will output the time in microseconds. Distance is measured by using the following formula-

Distance= Speed of sound × Time / 2

3.5 RELAY

Figure below shows a electronic diagram of relay and it is used as electrical switch. Relay is used here in our project to turn on the water pump if the water level is low in the field.
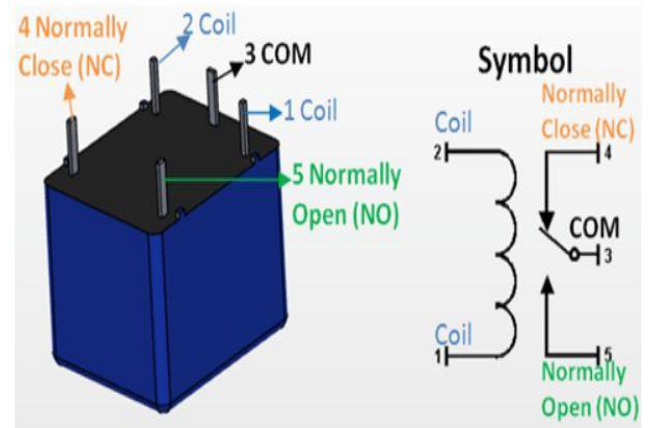

Fig-5: Relay

In the relay the Common is by default is connected to Normally Closed thus our circuit is open and the motor id off. Now when current flows through the coil it attracts the Common connection towards Normally Open thus now the circuit is closed and now the motor will run.

3.6 MOTOR

Figure shows a Mini Micro Submersible Water pump. The motor works on DC 3-6V. It is very low cost; the size of pump is small. 120 liters of water can be pumped per hour with a very low current consumption.

Fig-6: Motor

3.7 ESP8266 Node MCU

It has firmware which runs on the ESP8266 Wi-Fi SoC, and hardware which is based on the ESP-12 module. In our project we have used the pins D1, D2, D3, D4, D5, D6, GND and VIN.
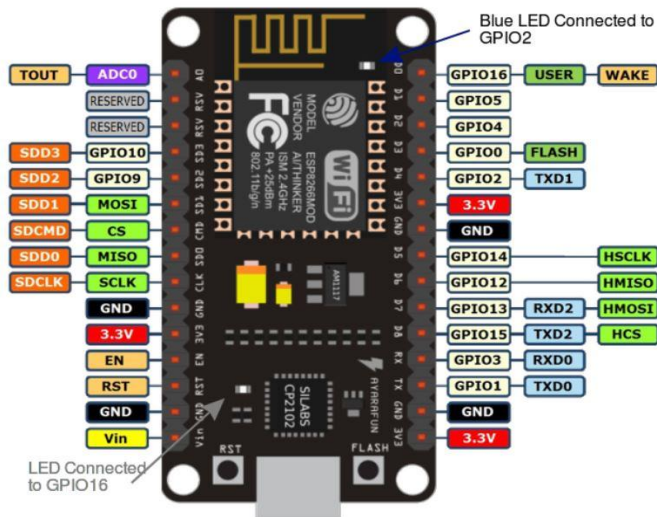

Fig-7: ESP8266 Node MCU

It has 30 pins. We give 5V power supply to it through the USB port. It has 16 Digital I/O pins and 1 Analog I/O pin. A flash memory of 128Kb. Clock Speed of 80MHz-160MHz.The microcontroller name is Tensilica 32-bit RISC CPU Xtensa LX106.

3.8 ARDUINO IDE

The software in which we are going to write program will be Arduino IDE. The Arduino IDE is an open-source platform for programming which is generally used by programmers to write then compile code using Arduino which is the module. Compiling of code simple and easier so a normal man can understand the learning procedure without any prior coding knowledge because this is the official programming software. For all operating systems like MAC, windows, Linux the Arduino IDE software is readily available.

3.9 BLYNK APPLICATION

The Mobile App that we will going use for controlling hardware will be BLYNK App. It has the capacity to remotely control hardware and also shows sensor information. To visualize and store data this app also helps. This application has 3 main elements:

1] Blynk app- Different widgets and good interfaces for the projects can be created with the help of this app.

2] Blynk Server- The network between smartphone and hardware is established using this.

3] Blynk Libraries- All commands are processed here whether it be incoming or outgoing.

4. RESULT

The main objective of our project is to connect the modern used technology in required fields like agriculture. This system makes agriculture monitoring easy using IoT technology in agriculture. The advantages as mentioned like water saving, labour saving and most importantly saving the crops from bad weathers are required to maximise in current agricultural state of affairs.

Fig-8: Smart Agriculture System using IoT

Thus, using the sensors in agriculture field makes things easier. The information from sensor is sent to the user using cloud. Thus, any changes inside the field may be identified effortlessly and early action is achieved as such. The developed hardware kit of our proposed work is shown in Figure 8.

In Blynk Application we can see the Temperature and Humidity levels. We will also be able to see that the Soil is Dry or Wet. If the Soil contains no water the LED will glow and if the LED doesn't glow it means the soil contains Water.

We will also be able to see the water level in the Tank and accordingly refill it. We also two motors the supplier motor is distribute water in the agriculture field if the water level is less in field. And the Tank Motor is to refill the Supplier tank if the water level is low and vice versa.
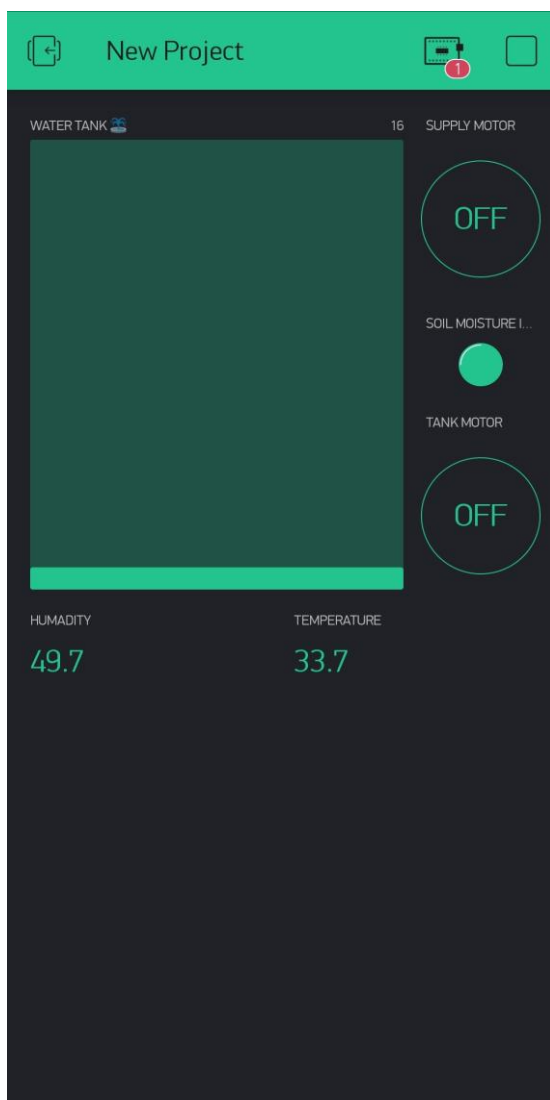
Fig-9: Blynk Application Interface

5. CONCLUSION

Thus, this paper explains an existential model of how in Indian agriculture Internet of Things (IoT) is applied. We have proposed a system of how Internet of things concept is used with respect to our traditional agricultural practices. Later we have explained different types of sensors like Temperature sensor, moisture sensor which will be required for our agriculture practices. Types of software that we have for communication is also explained. Thus, for the son of soil-farmers and for their benefits we propose this idea.

6. FUTURE SCOPES

Indian agriculture has large potential and is yet to be discovered and we yet have a long way to go in this field of research as we have soil textures different in different regions of our country. With the implementation of this project farmer will be benefited on a large scale. Inter-

connection of the sensors in the agriculture field and in designing a user-friendly application that can be easily understood by the farmers are the real challenges and yet to be overcome.

Smart agriculture system using IoT has vast scope in future making it more user friendly by adding more features for farmers-

1. We can add motion sensor in the system to detect any animal movement in farm.

2. Voice command features with different languages present in different regions can be implemented in the system to make it more user friendly for farmers to use the system.

3. GPS (Global positioning system) can be implemented in the system to get accurate location of farmer and the accurate weather report of farm land.

4. We can rain detector sensor which will make it more beneficial.

5. We can also add webcam to the system, the photos that will be captured can be displayed over the app.

REFERENCES

[1] M.K.Gayatri, J.Jayasakthi, Dr.G.S.Anandha Mala, "Providing Smart Agricultural Solutions to Farmers for better yielding using IoT", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015), 2015

[2] S.R.Nandurkar, V.R.Thool, C.Thool, "Design and Development of Precision Agriculture System Using Wireless Sensor Network", IEEE International Conference on Automation, Control, Energy and Systems (ACES), 2014

[3] Manishkumar Dholu, Mrs. K.A Ghodinde, "Internet of Things (IoT) for Precision Agriculture Application", Proceedings of the 2nd International Conference on Trends in Electronics and Informatics (ICISC), New Jersey, pp. 478-483, 201.

[4] JoaquínGutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta-Gándara, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, 0018-9456,2013

[5] Dr. V. Vidya Devi, G. Meena Kumari, "Real- Time Automation and Monitoring System for Modernized Agriculture", International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE) Vol3 No.1. PP 7-12, 2013

[6]   Rahul Dagar, Subhranil Som, Sunil Kumar Khatri, "Smart Farming-IoT in Agriculture", Proceedings of the International Conference on Inventive Research in Computing Applications (ICIRCA), Chennai, pp. 1052-1056, 2018

[7]   P.S.Vijaybaskar, Sreemathi R., Keertanaa E., "Crop Prediction using Predictive Analytics", International Conference on Computation of Power, Energy, Information and Communication (ICCPEIC), pp. 370-373, 2017.

[8]   Harika Pendyal1, Ganesh Kumar Rodda, Anooja Mamidi, Madhavi Vangala, Sathyam Bonala, Keerti Kumar Korlapati, "IoT Based Smart Agriculture Monitoring System" International Journal of Scientific Engineering and Research (IJSER), Volume 9 Issue 7, July 2021

[9]   https://components101.com/modules/soil-moisture-sensor-module

[10]   https://components101.com/sensors/dht11-temperature-sensor

[11]   https://components101.com/sensors/ultrasonic-sensor-working-pinout-datasheet

[12]   https://components101.com/switches/5v-relay-pinout-working-datasheet

[13]   https://www.amazon.in/Stookin-Double-Micro-Submersible-Project/dp/B0839J68QZ

[14]   https://circuits4you.com/2017/12/31/nodemcu-pinout/

[15]   https://www.elprocus.com/a-brief-on-dht11-sensor/