IOT-Based Intelligent Farming Surveillance System

[1]Dr. D. Mohanapriya, [2]Dr. S. Rekha , [3]Dr. S. Selvi

Assistant Professor Department of Computer Science

PSG College of Arts & Science Coimbatore, India

Abstract- Over the previous ten years, monsoon and variations in the climate have been unpredictable. As a result, many Indian farmers have embraced climate-sensitive techniques, sometimes known as "intelligent farming," in recent years. Farmers are now able to check the water reservoir levels in instantaneously, which improves irrigation efficiency by leveraging IoT applications in the farming industry. The application of sensors to every stage of farming, including the number of resources as well as time needed for a seed to develop into a completely mature crop, has been enabled by the use of IoT devices in agricultural activities. Intelligent farming is one of the major uses of IOT. It boosts agricultural output and decreases water as well as fertilizer waste. Intelligent farming is an Internet of Things (IoT)-based computerized system managed by technology that uses information. IOT is expanding quickly and is being used extensively in all without wires contexts. The present investigation has examined and assessed technology for sensors and the incorporation of IOT with wireless communication networks based on the real-world circumstances of farming operations. Actuators that measure the moisture in the soil content, the environment, and saturation in addition to rain. A Sensor technology tracking system (STTS) that combines wlan and internet connection is suggested. The primary goal is to gather contemporaneous information on the production of agricultural commodities ecosystem that optimizes crop cultivation and boosts yields from crops. Deficiencies in nutrients in the ground are found and fixed by employing the IP address to monitor the landscape.

Keywords: *Intelligent farming, Sensor technology tracking system, wireless communication networks, Arduino, GSM Module*

I. Introduction

The Latin words "Ager," which means "the earth or farm," and "Culture," which means "cultivation," are the origin of the word "farming." It refers to the science and art of raising farm animals and crops for commercial gain. Developing vegetarian meals from the land for human use is the art of farming. The development of farming is a turning point in the evolution of civilization as a whole since it allowed people to settle in specific locations. One of the most ancient and important human endeavours is farming. It is still an essential source of land. Despite the world's increasing growth in cities and factories, approximately half of the population that works is still employed in farming. The farming sector has been a significant employer and economic driver in emerging nations. Farming's primary goal is to raise healthier, more productive crops and vegetation and support their growth by replenishing the environment and providing irrigation. An integral part of the Indian economy is agriculture. Approximately 64 percent of India's population depends on farming for their daily food. Physical factors have a strong influence over farming operations worldwide. Indian agriculture is not an exception to this rule; at the moment, India faces two significant challenges related to farming. First, there is the need to feed food to the world's growing inhabitants; second, there is a disparity in the growth of farming and altering trends regarding land usage for farming. India made an effort with five-year strategies to achieve farming sustainable development. Following self-determination, farming gained increasing attention in every five-year strategy and was given the highest level of importance for the continued growth of our nation because of its particular relevance and systematic efforts. After 1950, the location-specific investigation of land and

Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 6 (2023)

farming became increasingly important. India's farming industry saw significant transformation during the start of the 1970s and subsequently with the Green Revolution, which made the country not individual self-supporting in sustenance ounces but similarly able to produce certain high-quality ones.

Uneven moisture an imbalance in the distribution of resources, and the absence of fundamental construction infrastructure all contribute to the improper channelling of the process of growth in farming. The only places where the movement toward sustainability has been successful are in farming. Despite the best attempts of the government, individual farmers were not able to reap the fruits of their labour. This leads to a discrepancy and a widening disparity between large and tiny landowners, to close this disparity. To do this, methodical planning is needed, and comprehensive knowledge of the area is required. The bulk of people in many nations, like the country of India, depend on growing crops, which also provides the country's national income. A modern and efficient method for conducting farming and producing sustenance in a justifiable manner is termed “intelligent farming”. It is an application of integrating innovative knowledges and plans associated into farming. The IoT plays a vital role in intelligent farming, as it reduces the requirement for cultivators and farmers to do labour-intensive tasks by hand and boosts output in every way. The Internet of Things has greatly benefited farming, especially with regard to efficient use of water and input enhancement, among many other advantages, given the current trends in agriculture. The significant advantages, which have recently changed farming, were what made the distinction. Because intelligent farming based on the Internet of Things monitors the landscape in instantaneous fashion, it enhances the farming industry as a whole. The IoT in Farming has decreased the wasteful use of properties like irrigation as well as power while also saving agriculturalists time thanks to sensors and interconnectivity. It monitors a number of variables, including temperature, humidity, soil, and so on, and provides an incredibly clear current time monitoring.

Despite this, and the fact that contemporary technology is present everywhere, the farming industry still uses antiquated traditional approaches. Our agriculturalists continue to use outdated approaches like hand seeding dissemination, a two-crop rotary motion time frame, and non-scientific systems of cultivation. The erratic nature of the rainstorms and asymmetry of drinking water accessibility year-round provide a significant issue. Insufficient efficiency and inadequate production result from all of this. The application of scientific approaches in agriculture can result in significant changes to the yield of crops because of enhanced cropping technique efficiency. Among the many positive aspects that IOT offers, its capacity to revolutionize the way that farming is done now is truly transformative. The majority of the solutions we see propose a sensor network that is wireless that transmits data to the main centralized server after accumulating data from the many sensors in the field. This approach focuses on analysing ecological concerns in order toward boosting crop productivity. However, as many other factors influence crop output, it turns out that simply keeping an eye on elements of the environment is never adequate.

II. Literature Survey

Using IOT to Create a Sustainable Intelligent farming System

This investigation established an infrastructure that will continuously track the fields used for farming. It also uses a raspberry pi the lens to stream live video of the fields to the server. The farms are continuously tracked for biological conditions such as humidity and temperature at the soil moisture sensor. The suggested system architecture has been created to increase yields by reducing the effort required to observe the fields of information. IOT and wireless sensor node help to decrease the effort required to observe the fields. IOT also prevents the destruction of the farming criteria database and safeguards in the device that stores it or obscure for an extended period of time. Additionally, it offers constant surveillance everywhere, even in the most important regions. Agribusiness products are dependent on various environmental factors, like as temperature, soil pH, then the moisture the soil level. The purpose of developing the suggested system model is to pinpoint the reasons and increase yields. Anandhi Tamilvanan and Ramya Venkatesan describes an IOT-based sustainable farming system.[1]

A Framework for IOT-Based Intelligent farming

Over the past ten years, rainfall and climate change have proven unpredictable. As a result, numerous landowners are implementing climate-sensitive farming practices, also known as intelligent farming. Even though hometown producers have been growing the identical commodity for decades under the current system, climate patterns, conditions of the soil, and insect and infectious disease outbreaks have altered throughout time. Through the use of the suggested system technique, which senses the local farming characteristics, locates the device that senses, transfers data about crop fields, and monitors crops. The farmers can adapt to these changes and perhaps profit from them thanks to the updated knowledge they acquired. It is anticipated that comprehensive immediate time and historic information regarding the environment will make a contribution towards successful administration of resources, surveillance, and consumption. N.R. Kale and Prof. K.A. Patil offer an IOT-based concept for intelligent farming.[2]

Intelligent Farming System Employing Internet of Things

Farmers used to determine the ripeness of the substrate and make assumptions to grow specific types of products under the current system. They failed to consider the water level, moisture content, and weather. The final stages of the production are what determine revenue in the end. They increased the product's efficiency in this suggested system, which evaluates the harvest's characteristics. Providing accurate and cautious cultivation, IOT is employed to meet the obstacles in the field. In precision farming, they also employed sensor networks that were wireless to inspect tens or several square feet by dividing lone plants. Utilized other types of sensors as well, including an ARM processor, an ambient temperature sensor, a sensor to measure humidity, a sensor to measure soil moisture, and an underwater level sensor. IOT technology is used by P. Muna swamy and Muthu Noori Naresh to explain the Intelligent Farming System.[3]

Intelligent Farming Using IOT-Based Monitoring Systems

Because landowners continue to practice farming using outdated techniques, crop and fruit yields are inadequate. By utilizing machinery that is automated, agricultural yields can be increased. On the other hand, by employing IOT to monitor soil efficiency, the outside temperature, and relative humidity, we can anticipate an affordable rise in production. For the agricultural yield in the current system, they exclusively employed conventional methods. However, with the suggested approach, modernizing farming can be achieved by fusing conventional techniques with IOT and wireless sensor networks. The improved system is more helpful to landowners and more economical. Using such a technology in the field can undoubtedly contribute to increasing worldwide farming and the extraction of crops. The IOT-Based Monitoring System in Intelligent Farming is explained by S.R. Prathibha, ANupama Hongal, and M.P. Jhothi.[4]

Utilizing IOT, an Intelligent Farming Monitoring System

Various technology components and sensors make up the operational framework, and they are coupled by ways of modules for distant communications. The connection to the internet, which was at the same time activated in the Node MCU, is employed to transmit and receive client-side sensor data. The open-source IOT platform is called dule. The successful maintenance of the irrigating system's ideal conditions is accomplished by this system. You may access the data on any webpage or within the Thing Speaking app. All information pertaining to the levels, when they've been in operation, if there have been any variations, and whether or not the activities have been finished on schedule is accessible to the landowner. The main goal is to monitor agricultural progress with electronic equipment. This will produce the exact values of the many growth-determining parameters. This method will also help the landowner monitor several plots of land at the same time. Using this approach, fields can be watched over by people with physical restrictions, which lowers the requirement for human resources. IOT-based Intelligent Farming Monitoring System explained by N. Sai Harshith, et al,[5]

IOT-based Intelligent farming

Our goal is to develop a GPS-enabled intelligent remote-controlled car that can do multiple functions, such as surveillance, fields to deter theft, frighten birds and animals, monitor soil moisture levels, apply pesticides and fertilizers, weed, and so forth. Watering crops intelligently means using the right amount of water for each type of crop and the conditions of the soil. Last but not least, we aim to put smart warehouse management into practice. This will include temperature and humidity sensors to safeguard the goods being stored and to spot any trespassers trying to break in. Sensors, ZigBee modules, and microcontrollers will all be integrated to perform these activities, which will all be managed and watched over by a distant smart device that is connected to the Internet. Amandeep, Arshia Bhattacharjee, Paboni Das, et al. make suggestions for using mechanization and Internet of Things technologies to support intelligent farming.[6]

III. Proposed System

In order to establish a real-time monitoring system for parameters of the soil involving relative humidity, temperature, and moisture as well as to identify crop yield using SMS-based alerts, this dissertation presents a proposed model for intelligent farming. Additionally, internet-based and mobile applications will make it feasible to exert control over a range of activities operations compared to any place at any moment. Through the monitoring of various environmental parameters and subsequent detached provision of necessary information to farmers, the Internet of Things (IOT) based agricultural surveillance classification has been utilized to optimize crop productivity. Any kind of farm land with different types of soils can use this particular technique. When IOT is used instead of other technologies, it can be used in any kind of setting to keep track and is more robust and versatile. The intention of the proposed scheme is to benefit farmers. The technology significantly lowers labour costs, interaction between people, and wasteful consumption of water.

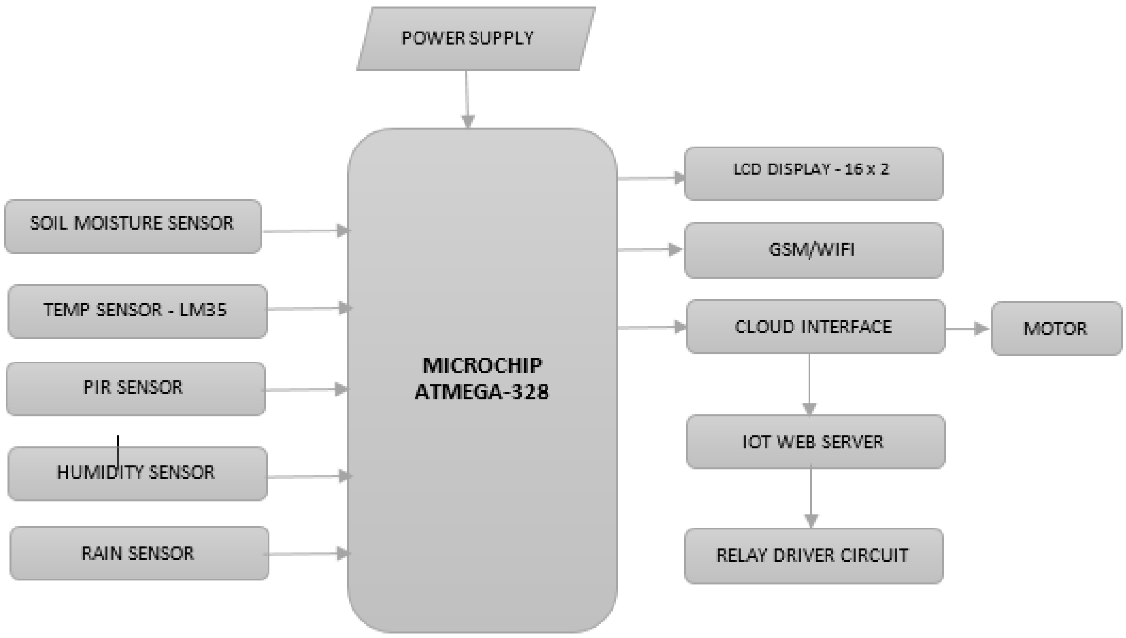

Figure 1: Frame Layout diagram

Arduino

A circuit with a microcontroller created on the ATmega328 is named as Arduino Uno (datasheet). It features an ICSP-compatible header, an electrical outlet, a USB connector, 6 analogue indicator contributions, 14 numerical both input and output functions pins (six of which are capable of producing PWM output), a porcelain resonating oscillation at 16 MHz, and a reorganise switch. Everything required to operate the microcontroller is encompassed, all we need to power it using an external battery, an AC to DC power converter, or a USB connection to a computer. The FTDI Uno does not use an application driver chipset to convert USB to serial, setting it apart from all earlier boards. Rather, a USB-to-serial translation application has been installed on the Atmega16U2. Arduino is a freely available platform used to build electrical projects. The Arduino system is

Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 6 (2023)

made up of two separate parts: an IDE which is a computer program, and a microcontroller (a chip that functions as a board for customizable electronic components). The IDE is used to create and upload PC software to the real board that needs to be programmed.[7] For a number of reasons, the Arduino platform has grown in popularity among novice programmers. In contrast to other electronics customizable boards in the past, the Arduino may have its programme reorganised simply by plugging in a USB restraint slightly than a dispersed hardware component known as a programmer. In toting, the Arduino IDE uses a simplified variety of C++, which makes erudition to software package calmer. Finally, and maybe most importantly, Arduino affords a conventional procedure influence that condenses the capabilities of the microcontroller into a more manageable compact.

• Six of the 14 digital I/O pins have the potential to generate PWM.
• Pins #3, #5, #6, #9, #10, and #11 are the six PWM pins.
• UART: 1 • I2C: 1
• Six pins for analog input and one for SPI
• DC current per I/O pin (20 mA).
• DC Current of 50 mA for 3.3V Pin
• Microcontroller: Microchip's ATmega328P
• 2 KB of SRAM, 1 KB of EEPROM, and 32 KB of flash memory, of which the boot loader occupies 0.5 KB. • Voltage of operation: 5 volts
• Voltage input: 7–20 V, 117–12

Figure 2: uno Arduino

Sensor of humidity

A device known as a sensor for humidity perceives, procedures, and results the air's relative humidity (RH) or the concentration of water vapour in either a single gas (gas) or a mixture of gases (air). The processes of water adsorption and desorption are connected to humidity sensing. The temperature and moisture sensor DHT11 generates a digital output that can be measured. You can boundary with any micro - controller, like an Arduino, Raspberry Pi, etc., to receive instantaneous results with the DHT11. The DHT11 is a reasonably priced hotness and clamminess sensor that offers good dependability and constancy over time. Evaluates the air quality using a thermistor to measure the hotness and a clamminess sensor that is capacitive before outputting an electronic signal on the measurement information port (no pins for analogue inputs are necessary) [8]. It's quite informal to usage, and there are Raspberry Pi and Arduino frameworks and demonstration scripts available. Because it comes with the pull-up resistor needed to operate the sensor, this module simplifies the process of connecting the DHT11 sensor to an Arduino or microcontroller. The sensor only needs the following three electrical connections to function: Vcc, Gnd, and Final Product. Because to the unique digital signal harvesting method and accurate temperature and moisture detecting technological devices, it has great reliability over time and high dependability.

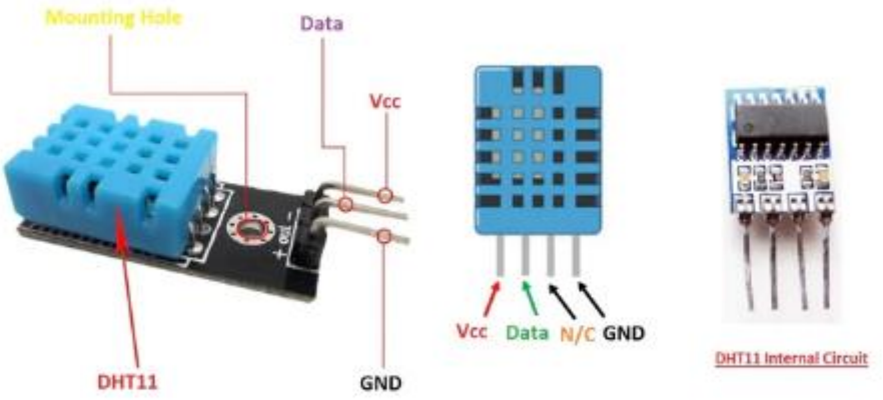

Figure 3: GSM Module

SIM800 GSM Module

A compact GSM modem, the SIM800L GSM/GPRS module is suitable for a wide range of Internet of Things applications. Almost everything a typical cell phone can do can be done with this module: to and from SMS texts, make and take calls, connect to the web via GPRS or TCP/IP, and much more. This GSM modem's RS232 interface and SIM800A chip allow linking to a computer system, their laptops, or microcontroller using the USB to Sequential connection or the RS232 to TTL conversion [9]. You must identify the USB to Serial Adapter's Device Manager's proper COM port after connecting the SIM800 modem via the USB to RS232 connector. Next, apply Latex or any other final solution, establish an association to that COM port at the modem's standard baud rate of 9600. Transferring AT-command0 can begin as soon as the computer or your microcontroller establishes a serial link with the computer. The SIM800 modem should respond to AT instructions, such as "AT\r," with a message indicating "OK" or another answer based on the instruction being sent.

Figure 4: GSM Module

Features of SIM800A

- Class 2/10 GPS
- Commands via AT (3GPP TS 27.007, 27.005, and expanded AT command set via SIMCOM)
- Bands: DCS 1800MHz, PCS 1900MHz, EGSM 900MHz, GSM 850MHz
- Compact size: 23 * 23 * 3 mm

- Low power: in sleep mode, down to 1mA.
- Voltage supply: 3.4–4.4V
- CS-1, 2, 3, and 4 coding systems Class 4 (2W) and Class 1 (1W) Tx power

Liquid Crystal Display

An electronically manipulated optical system, such as a LCD is a category of flat panel display that utilizes polarization components and liquid crystals' light-modulating properties. Liquid crystals reflect light off a background to produce color or monochromatic images rather than directly generating light. The LCD panel is one type of electrical presentation component with some practises. A 16x2 LCD presentation is a fairly basic component that is regularly seen in several dissimilar electronics and applications. These components are favoured above various multi-section LEDs, as well as seven distinct segments. The arguments for this are as follows: LCDs can display superior and even adapted typescripts (unlike in seven segments); they are affordable; they are easily configurable; and they can display visuals and other content. An LCD that is 16 by 2 may show up to 16 characters on each of its two lines[10]. Each one of the characters is shown in a 5x7 array of pixel on this LCD. This LCD has two different types of registers: Commands and Files. The command register contains the command instructions that are transmitted to the LCD. An LCD is given commands to perform specific tasks, such as resetting, vacuuming its screen, adjusting display, and so on. We refer to these directives as commands. Statistics that will be showed on the LCD is stored in the statistics catalogue.

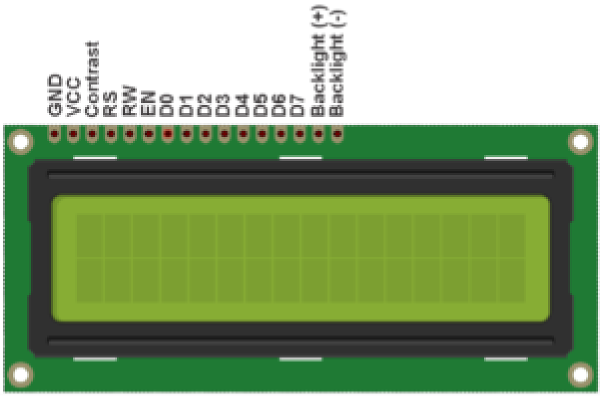

Figure 5: LCD Display

Soil Moisture Sensor

SMS is linked to a drip irrigation controller, measures the soil's active root zone's moisture content prior to each scheduled irrigation event. The cycle is skipped if the soil moisture content is greater than a user-specified set point. The amount of moisture in the soil is measured by a soil moisture sensor. The detector outputs both an analog and a digital signal. The digital outcome is fixed, however the threshold values of the analogue signal are modifiable. Its operation is based on the open and short circuits principle [11]. If the power level is high or low, it is indicated by the LED. Since no electricity can pass through the dehydrated Earth's surface, it functions as an open circuit. As a result, it is claimed that the output is optimal. As the current moves from one terminal to the other, the moisture in the soil shortens the circuit's component parts and produces no output.

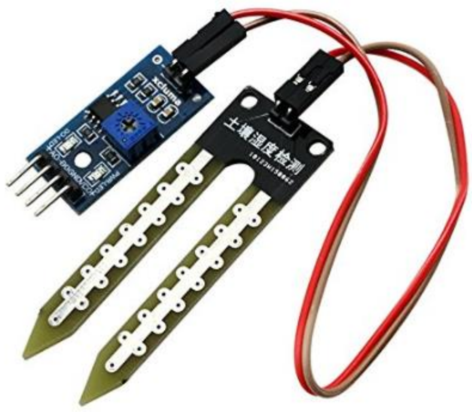

Fig. 6: Soil Moisture Sensor

Sensors of Temperature (LM35)

An analogue signal proportional to the current ambient temperature is generated by the LM35 temperature sensor. The voltages' output can be easily interpreted to determine the interior temperature in Celsius. The advantage of the LM35 over the thermometer is that it does not require external calibration. The LM35 sensor is commonly used because its voltage distribution scales linearly with temperature expressed in degrees Celsius. It has a broad operational range. The ideal production is 5V. Ten millivolts will be added to the output for each degree that the surrounding temperature rises. It ranges from -55 to +150 degrees in temperature [13]. The three connections are ground, VCC, and the analogue sensor. The least quantity of electricity is used by it. Therefore, it is efficient in terms of energy. It works incredibly well in farming. It is simple to utilize the UI.

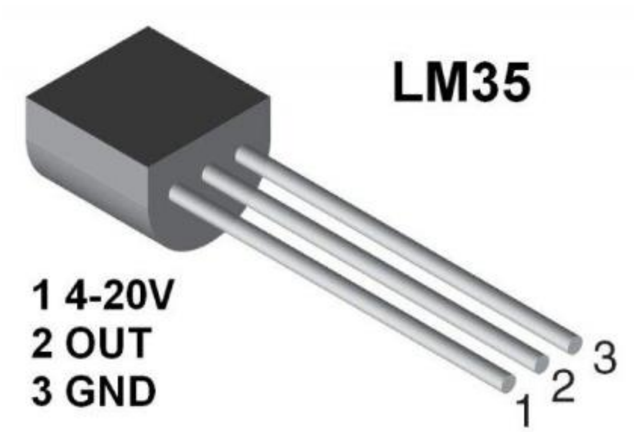

Figure 7: LM35 Temp Sensor

Internet of Things

The Internet of "things," is a network of real, corporal substances, or people, that are connected with devices, devices, connections, and software that allows them to gather and conversation facts. The Internet of Things, also referred to as IoT, seeks to connect relatively small devices like toasters and kettles to the internet in addition to commonplace gadgets like laptops, tablets, and smartphones. Almost everything is made "smart" by IoT, which enhances elements of our lives by utilizing networks, AI algorithms, and data collection [12]. An animal equipped with gadgets for tracking, a person with an implanted diabetes monitor, etc. can likewise be considered an IoT object. With the IoT Cloud platform ThingSpeak, sensor data may be uploaded to the cloud.

Moreover, you can use MATLAB or other software for analysing and viewing your data and create custom apps. MathWorks is the company that runs the ThingSpeak service.

Iv. Conclusion

IoT will improve intelligent farming. The irrigation system can be monitored and operated by using the IoT system's ability to predict the moisture and soil moisture levels. IoT improves dust management, surveillance of crops, administration of water, efficiency of time, and pesticide and insecticide control among other farming domains. This system also encourages intelligent farming, streamlines farming operations, and uses less human work. Apart from the advantages this approach provides, intelligent farming could open up new markets for farmers with only a single click and minimal labor. This work describes an IOT-based automated watering system. Together, Cloud computing and the IOT create a structure that effectively handles the agriculture industry. This technology will detect every aspect of the surroundings and transmit the information to the user through the cloud. Actuators will be used to accomplish the motion control that the user takes. This resource enables the farmer to enhance production in a manner that best suits the needs of the crop at hand. Improved yields from crops, prolonged duration of production, higher standards of quality, and decreased application of preventive chemical pesticides are the consequences.

References

[1] Ramya Venkatesan and Anandhi Tamilvanan, "A Sustainab Agriculture System Using IOT", International

[2] Conference on Communication and signal processing, April 6-8,2017.

[3] Prof. K A Patil,N R Kale,A Model for Smart Agriculture using IOT" ,International Conference on Global Trends and signal processing ,Information Computing and Communication,2016.

[4] Muthunoori Naresh, P Munaswamy, Smart Agriculture System using IoT Technology, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 (Online), Volume-7 Issue-5, January 2019

[5] K. Lakshmisudha, Swathi Hegde, Neha Kale,ShrutiIyer," Smart Precision Based Agriculture © 2020 IJSRET 2216 International Journal of Scientific Research & Engineering Trends Volume 6, Issue 4, July-Aug-2020, ISSN (Online): 2395-566X Using Sensors", International Journal of Computer Applications (0975-8887), Volume 146- No.11, July 2011

[6] Prathibha S R, Anupama Hongal, Jhothi M," IOT Based Monitoring System in Smart Agriculture" ,International Conference on Recent Advances in Electronics and Communication Technology,2017

[7] P. Lashitha Vishnu Priya 1 *, N. Sai Harshith 1 , Dr. N. V. K. Ramesh 2, Smart agriculture monitoring system using IoT, International Journal of Engineering & Technology. y, 7 (2.7) (2018) 308-311. Website: www.sciencepubco.com/index.php/IJET.

[8] Amandeep, Arshia Bhattacharjee, Paboni Das, Debjit Basu, Somudit Roy, Spandan Ghosh, Sayan, T.K. Rana,(2017) Smart farming using IOT, Conference: 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON). DOI:10.1109/IEMCON.2017.8117219.

[9] Nikesh Gondchawar, Prof. Dr. R.S.Kawitkar, "IoT Based Smart Agriculture", International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE), Vol.5, Issue 6, June 2016.

[10] M.K. Gayatri, J. Jayasakthi, Dr. G.S. Anandhamala, "Providing Smart Agriculture Solutions to Farmers for Better Yielding Using IOT", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development

[11] Chetan Dwarkani M, Ganesh Ram R, Jagannathan S, R.Priyadharshini, "Smart Farming System Using Sensors for Agricultural Task Automation", IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015).

[12] A.Anusha , A.Guptha , G.Sivanageswar Rao ,Ravi Kumar Tenali, ”A Model for Smart Agriculture using IOT”, International Journal of Innovative Technology and Exploring Engineering ISSN:2278-3075,April-2019

[13] Dr.Sanjay N Patil, Madhuri B Jadhav, ”Smart Agriculture Monitoring System using IOT” ,International Journal of Advances Research in Computer and Communication Engineering,April-4,2019

[14] https://www.oracle.com/in/internet-of-things/what-is-iot/#:~:text=What%20is%20IoT%3F, and%20systems%20over%20the%20internet.

[15] https://nskelectronics.in/LM35%20Temperature%20Sensor#:~:text=LM35%20is%20a %20temperature%20 sensor,not%20require%20any%20external%20calibration.