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Review on IoT based smart agriculture monitoring system

Ms. J. Glory Priyadharshini
Assistant Professor
Department of Electrical and electronics engineering
Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu, India

B. Hariharasudhan
Department of Electrical and Electronics Engineering
Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu, India

R. Neelakandan
Department of Electrical and Electronics Engineering
Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu, India

R.K. Arvind
Department of Electrical and Electronics Engineering
Sri Ramakrishna Institute of Technology, Coimbatore, Tamilnadu, India

Abstract - 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 sensors NPK sensor, moisture & Temperature Sensor and pH sensor. It makes use of sensor networks for noting the soil properties & environmental factors continuously and the soil parameters are continuously monitored. The sensed Values are sent to the microprocessor where the threshold values set. If the sensed values are exceeding the threshold values, it will be notified to the farmer.

Keywords – Internet of Things (IoT), NPK sensor, Moisture & Temperature sensor, pH sensor, Threshold value set.

I. INTRODUCTION

Agriculture the art of cultivating plants is sedentary for humankind. Agricultural products grouped into foods, raw materials, fibres and being independent in the country's economy. India stands the second- highest in agriculture, and the primary concern in agriculture is irrigation, fertilization, and crop rotation. From the beginning of civilization, the farmers practice crop alteration. The population increase in urban areas increases water scarcity. The agriculture field faces more challenges due to related environmental issues such as degradation of land, incorrect irrigation. Also, change in global warming such as temperature, weather and rainfall affect agriculture. Today industries focus on agriculture as a productive process. Most agriculture-related firms aim to maximize the profit associated with production. In the past decade, farmers utilize soil attributes to understand the variations concern to the cultivation field for crop identification across the seasons. However, due to the lack of appropriate technologies, this knowledge utilization was inefficient to target and optimize the agricultural inputs, especially in large-scale farming.

Precision Agriculture addresses these issues by saving water resources utilized for cultivation, increasing the crop yield by continuously sensing the soil moisture, soil humidity, soil temperature, soil pH, and other supporting tasks. In many developed countries, precision agriculture is entirely IoT based which improves the crop yields. The major problem that farmer face is irregular distribution of water in the field and crops do not get the required nutrients because of poor soil quality, which result in improper growth. Smart agriculture requires a perfect time plan concerning irrigation actions based on forecasted meteorological parameters such as soil and plant characteristics and water level. Scheduling irrigation based on the intervening time utilized by the system emphasized the water distribution type. Soil moisture is an essential parameter to schedule irrigation.

The Internet of Things (IoT) is a technology where in a mobile device can be used to monitor the function of a device. The Internet of Things (IoT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things (IoT) is a type of network technology, which senses the information from different sensors and makes anything to join the Internet to exchange information. Moisture sensor measures the moisture content of the soil and a threshold value will be set. Automatic irrigation control designed makes water pump to turn on when the threshold value crosses the set limit. Conventional irrigation agriculture uses 90% of the water in drought conditions. Accurate estimation of the utilization of water in farming measured in precision agriculture for effective water management. Describing irrigation strategies over an area is difficult because of the massive variety of crops planted and the diversity of farmers. Advanced agricultural system aid in IoT due to their efficient and easy maintenance of the farm. In addition, creating this type of automation system helps to water the plants without human assistance. Moreover, it will have the option of planting seeds, measuring soil moisture. The aspects such as sensing, evaluating, and treatment are primarily involved in monitoring the pests causing crop diseases. Recently image processing is the critical technology in which raw images captured from the agriculture field, analyzed to characterize the insect types for pest control. These IoT based devices for pest control has reduced the overall expenditures by supporting the restoration of the natural climate.

II. LITERATURE SURVEY

[1] Crop Selection and IoT Based Monitoring System for Precision Agriculture proposed to improve crop yield. The parameter measured are temperature, humidity, pressure, soil moisture, air quality. The sensor used are DHT11, BMP 180. Raspberry pi b+ is used as the microprocessor due to it 40 time faster than Arduino when it comes to clock speed. Mobile application is developed using thinks pea and coding is done using raspberry, mat lap and machine learning algorithm. Many more improvements can be made in the proposed system for the future development of the model. An alarm or LED can be integrated with this system to notify warnings regarding temperature, humidity, air quality, etc. More sensors like PIR sensor, leaf wetness sensor, etc.

[2] IOT Based Smart Agriculture System designed to improve the yield efficient crop. The parameter measured are temperature, humidity, soil moisture, weather. The hardware used are DHT11, soil moisture, weather, light. Arduino UNO used as controller due to it less cost and coding is done using Arduino ide using python. d. A soil moisture level monitoring system was developed and the project provided an opportunity to study existing systems, as well as their features and constraints. The proposed system can be used to turn off / off the water spray according to soil moisture levels thus making the irrigation process one of the most time-consuming agricultural activities. Agriculture is one of the biggest uses of water.

[3] IOT based Smart Soil Monitoring System for Agricultural Production developed to provide error free system to end user. The parameter measured are ph, temperature, humidity, field condition. The sensor used in this project are ph sensor, LM35, Humidity, camera. Raspberry pi 2 is used as the microprocessor due to it is 40 time faster than Arduino when it comes to clock speed and software used is android os, ios. The crop image also taken and monitored in order to protect the crop insects, so the farmer can increase the yield and monitor the crop from anywhere at any time using this application. Proposed system helps in increasing the production and reduces the time and money of the farmer.

[4] IOT Based Pest Controlling System for Smart Agriculture implemented to control pest and insect. The parameter monitored are field condition. The hardware used are PIR sensor, acoustic sensor and ultrasonic sound generator. Arduino is used as the microcontroller due to it low cost and coding is done using embedded c. future goal provide the farmers an efficient pest control system with affordable cost to get rid of pests and thus increase their crop productivity. proposed system mainly focuses on these crops. There are numerous pests such as beetles, bugs, moth and rodents including rats, squirrels, mouse, rabbits that feed on crops which causes a massive destruction to the yield of crops.

[5] An IOT based Agriculture Monitoring System proposed to improve the efficiency of irrigation system. The parameter measured are temperature, humidity and human movement. The hardware used are DHT22, PIR sensor, Pi Camera. . Raspberry pi is used as the microprocessor due to it is 40 time faster than Arduino when it comes to clock speed and coding is done using IDE. It can be broadened for any feature applications like power control, surveillance, etc., easily. Moreover, this technique more sophisticated than other industrial automation methods in several ways

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[6] IOT Based Smart Irrigation Monitoring and Controlling System developed to maintain the field without human. The parameter is measured are soil moisture, temperature, humidity, water level. The hardware used in this paper are DHT11, LM393, M116 and ZigBee module. AT mega is used as microcontroller due it less cost and coding is done using java and MySQL. It consists of wireless sensor node1 and node 2. The sensed data from node1 and node 2 is transmitted to master node via ZigBee. The real time sensed data received by master node and which is stored at the cloud for further decision making. ZigBee from node 1and node 2, received at the master node. Master node stores that data to the cloud server.

[7] IOT Based Smart Agriculture System designed to limit the water to field without human. The parameter measured temperature, humidity, sunshine, wind speed, Passive infrared sensor, Seed monitoring, pesticide. The sensor used in this paper are soil moisture sensor, Humidity sensor, Temperature sensor, motion sensor. Arduino r3 is used as the microcontroller due to it low cost and coding is done using embedded c. This system generates irrigation schedule based on the sensed real time data from

field and data from the weather repository. This system can recommend farmer whether or not, is there a need for irrigation. Continuous internet connectivity is required. This can be overcome by extending the system to send suggestion via SMS to the farmer directly on his mobile using GSM module instead of mobile app.

[8] Smart Farming System using IoT for Efficient Crop Growth is proposed to improve efficient crop growth. The parameter measured are soil moisture, temperature, humidity, rain. The sensor used in this paper are soil moisture sensor, DHT11, rain drop sensor. Node MCU is used as controller because of it low cost and coding is done using embedded C. This system is very much helpful to farmers as they need to regularly pump water and check the status of each crop. From anywhere in the world, farmers can know the values of humidity, temperature and soil moisture and if the DC motor is ON through the blynk app present in their smartphones.

[9] Field Monitoring Using IoT in Agriculture is implemented to get good yield. The parameter measured are soil moisture, temperature, humidity. The sensor used in this paper are DHT11 and soil moisture sensor. Arduino UNO is used as controller due its low cost and the coding is done using Arduino IDE. The sensors are deployed in the wheat crop for data capturing. The results are carried out and analysed in the form of temperature, moisture and humidity from the wheat crop field for invocating alarm to the farmer when required.

[10] Agriculture monitoring and prediction using Internet of Things (IoT) designed to improve the irrigation system. The parameter measured soil moisture, temperature, humidity, rain, water level. The sensor used in this paper are DHT11, soil moisture sensor, rain sensor. Arduino ATM 328 is used as microprocessor due it low cost and coding is done using Arduino IDE. The evaluation of Rabi & autumn (Kharif) crops is accepted with data like humidity, temperature, and rainfall. It also reduced human efforts, simplifies the techniques of farming, and it is also helpful to gain smart farming. Along with these features, smart farming can help to develop the market for farmers with a single touch and minimum hard work

[11] Monitoring of Soil Parameters and Controlling of Soil Moisture through IOT based Smart Agriculture is developed to improve the quality and quantity of a agricultural products. The parameters measured in this project are moisture content of the soil, ph value, rainfall, temperature and humidity of the soil. The hardware's used are Soil moisture sensor, DHT-22 sensor,ph sensor,rain sensor and Arduino (ATMEGA2560) is used as a microcontroller because of its capable of handling complex projects. The software we have developed using Thingsspeak. The sensed data from the sensors are feed to the microcontrollers. The data was then processed by the Raspberry Pi, and the processed data was saved on a cloud server, so to speak. As a result, this approach aids in the monitoring of soil parameters, which may be further enhanced by monitoring additional soil factors.

[12] Smart Agriculture to Measure Humidity, Temperature, Moisture, Ph. and Nutrient Values of the Soil using Iot is implemented to provide quality crops based on soil nutrient level and its moisture content along with Ph. factor, also been maintained. The parameters measured are moisture content, soil ph level and nutrients in the soil. The hardware's used in this project are Internet of Things, Soil sensor, Ph sensor, Moisture sensor, Color sensor and Arduino uno is used as a microcontroller. The mobile application was developed using Eagle software. The Arduino Uno's 5V power supply will be automatically supplied. Connect the Arduino Uno to the GSM Module to send the Farmer an SMS. After confirming that the specified connections are valid, the matching code will be dumped into the microcontroller, ensuring that the spilled code will not be deleted until additional code is dumped. As a consequence, exact findings will be shown on the LCD, and a notification will be sent to the farmer.

[13] Prediction of Nutrients (N, P, K) in soil using Color Sensor (TCS3200) is developed to use color sensor for detection of NPK levels in the soil and this sensors photodiode is design to decide how much amount of nutrients to add to increase the fertility of the soil. The components used are color sensor, photodiode, LED were used. and node MCU was used as a microcontroller, the Node MCU microcontroller helps to maintain the intensity of light that is falling on soil sample. . Node MCU also uses an ESP8266 wi-fi module to save nutrition information in a data warehouse and shows the results on an LCD. This discovery has the potential to alleviate fellow farmers' issues in determining and quantifying the amount of nutrients in soil at a lower cost than previous methods. It can also help to reduce the amount of fertilizer that is given to the soil that isn't needed. This may be assessed by measuring the light absorption of nutrients through color sensor LEDs and displaying the NPK levels of the soil. We will be able to anticipate acceptable crops for that soil in the future thanks to our research, and we will be able to utilize our soil predictor in laboratories for accurate and quick findings.

[14] Smart agriculture monitoring and protection system using IOT is implemented to prevention of crops from spoilage during rain and recycling the rain water efficiently. The parameters measured are soil moisture content, temperature &humidity, water level. The sensors used are moisture sensor, DHT-11 sensor, PIR sensor. The hardware and software comprises of sensors, Arduino, gsm and wi-fi module and Arduino uno was used as microcontroller. When an intruder (person or animal) enters the farm, the designed system informs the farmer with a buzzer. The experimental configuration of the smart agro system employing wireless sensor network. Temperature, humidity, soil moisture content, and water level are all monitored using a portable device such as a smartphone, as well as human/animal interaction in the farm.

[15] IoT based smart crop-field monitoring and automation irrigation system is proposed to development of crop at low quantity water consumption. The parameters measured are temperature, soil moisture content. The hardwires used are soil moisture sensor, temperature sensor (lm35), relay, buzzer and raspberry pi 3 used as a microcontroller. The program was developed using PYTHON. The system shows the temperature and soil moisture conditions, as well as the motor's status, depending on the two sensors. The state of the system can be checked from afar, and the system's complexity is low, thus firmware troubleshooting is simple. In the

future, we will propose a machine learning technique that will be utilized to process data and minimize the hardware complexity. Using vitalization technology, hardware resources in agricultural information networks are combined into a resource pool, achieving dynamic resource distribution and load balancing, and considerably improving efficiency.

[16] IoT based system for smart agriculture is developed to monitor the parameters that have a direct impact on crops by using libelium for smart agriculture. The parameters measured are contactless sensor for measuring surface temperature., sensor for temperature measurement of leaves and flower buds., shortwave global radiation sensor, uv global radiation sensor, temperature, humidity and pressure in air. The hardwires used are contactless sensor, shortwave global radiation sensor, uv global radiation sensor, temperature, humidity sensor. lebilium platform is used. As future work we envision testing the system for denial of service (dos) attacks. We will focus on implementing dos attacks to limit data transmission between meshlium and the server, and as well, to prevent a legitimate user, a farmer, accessing their data from the server

[17] Internet-of-things (IoT) based smart agriculture is implemented to reduce human effort, saves time, helps in precise agricultural practices. The components used are leaf sensor, stem sensor, temperature and humidity sensor, soil moisture sensor and Arduino uno is used as microcontroller. The software was developed using thingspeak. Wireless sensors, unmanned aerial vehicles, and cloud computing have all been discovered to be highly useful technologies for ensuring long-term agricultural output. Increased agricultural efficiency through smart device process automation, which can automate multiple processes throughout the production cycle, such as irrigation, soil sampling and mapping, fertilization or pest control, yield monitoring, forecasting, and harvesting, and maintain higher standards of crop quality and growth capacity.

[18] IoT based smart agriculture is proposed to make smart agriculture using IOT technologies, by remote controlled robot to perform weeding, humidity maintenance, theft detection. The hardwires used are motion detector, light sensor, humidity sensor, temperature sensor, room heater, cooling fan and AVR processor was used. the programmer AVR studio version 4 was utilized. For various circuit designs of microcontroller, hex files that can be readily burnt into the microcontroller and proteus 8 simulator were utilized. The robot can be controlled remotely utilizing wireless transmission of pc commands to r-pi, according to test results. R-pi sends orders to the microcontroller, which sends signals to the motor driver, which drive
the robot.

[19] IOT based smart farm monitoring system is proposed to reduce the manual work of the farmers. The parameters measured are soil moisture, temperature, humidity to increase cultivation. The hardware's used are dht11 sensor, moisture sensor & PIR sensor, gsm module. Arduino uno was used as a microcontroller. the program was developed using Arduino IDE. The findings are also communicated to the gsm module, which uses the gsm network to provide the information, data, or values to the farmer. The farmer does not require a smart phone for this; regular mobile phones may also be used to communicate information with farmers in the fields. This is the most significant benefit of the suggested system. IoT in irrigation can be enhanced in the future to reduce human intervention in farmed fields.

[20] Smart agriculture system using IoT technology is proposed to increase the cultivation by analysing the climatic condition, soil condition, temperature, humidity and also helps farmers to monitor the farm land conditions. To see remotely the conditions as picture and video, remote cameras have been used. The sensors used are Humidity sensor, Temperature Soil moisture sensor, Water level sensor and the ARM processor are used in this project. All of the sensors are connected to a microcontroller, and the data is sent to the farmers through a wifi module. This initiative is extremely beneficial to farmers in terms of monitoring and maintaining farm grounds.

[21] Automation of Irrigation System using IoT is proposed to Provide Automatic Irrigation. The Parameters measures the values of Temperature, Humidity and Soil Moisture. The sensors used in the project are DHT11 sensor, Soil moisture sensor and The Arduino is used as the controller device to help the makers build connected objects in a quick, easy and secure way. Mobile application is developed using THINGSPEAK and JSON. In the Future, this system can be made as an intelligent system, where in the system predicts user actions, rainfall pattern, time to harvest, animal intruder in the field and communicating the information through advanced technology like IoT can be implemented.

[22] Plant One an Arduino -based Ph. and Moisture Based Soil Plant Identifier is designed to a farming application that will monitor the soil pH level & soil moisture. The parameters measure the soil moisture level & ph. level. The sensors used in the paper are soil moisture sensor, pH sensor, ESP 8266 Wi-Fi module and Arduino UNO is used as the controller device because it is an open-source electronic platform. Mobile application is developed using PLANTONE application. Plant One application provides farming best practices on the level of soil acidity or alkalinity and soil moisture. The developed application system was considered an innovation to the farming system. This contributed to the success of integrating various sensors that will provide farming data analysis working remotely with farming experts and consultants.

[23] IoT Based Smart Agriculture Automation in Artificial Intelligence is focuses to obtain a brief analysis on the current execution of computerization in agribusiness. The parameters measure the soil type, PH value, Humidity, temperature, Rainfall sensor. The sensors used in the paper are DHT11 sensor, DHT11 sensor, Rainfall sensor DS18B20. The Arduino UNO used as the controller device to help the makers build connected objects in a quick, easy, and secure way. Mobile application is developed using IOT. From the yield diagrams the best season of planting, plant development and collecting of plant can likewise be discovered alongside expectation for crops.

[24] IoT Enabled smart farming and Irrigation system is developed to process Smart Farming and Irrigation. The parameters measure the values of Temperature, Moisture level and Humidity level. The sensors used in the project are Humidity sensor, Temperature Sensor, Soil moisture sensor and Arduino UNO is used as the controller device to help the makers build connected objects in a quick, easy, and secure way. Mobile application is developed using IoT. The paper has been used to grow a tomato plant and it was successfully grown by automatic process. It helps us to achieve a healthy farming. Increase in agriculture also helps us to increase the economical state of the country.

[25] IoT Based Smart Agricultural Device Controlling System proposes an IoT based smart agricultural device controlling system to help the farmer effective agriculture. The parameters used to measure the Soil PH level, moisture level, temperature level, Humidity level. The Sensors used in this project are pH sensor, DHT11 sensor, Soil moisture sensor, LDR sensor and The Arduino MEGA used as the controller device to develop stand-alone interactive objects. Mobile application is developed using THINGSPEAK IOT. This low-cost simple system can help the farmer in automatic controlling of most of the farming requirements. Information collected from sensors will transmit through the cellular network and can be interpreted by the system to take corrective and preventive measures.

[26] An IoT Based System for remote monitoring of soil characteristics proposed to design a device for remote monitoring soil characteristics. The parameters measure the pH value, temperature and moisture content of soil. The hardware components used in the project are DHT11 sensor, DS1B20 sensor, Ph sensor and STM32LI52RE is used as the controller device to help the makers build connected objects in a quick, easy and secure way. Mobile application developed using STM32 Nucleo Platform. The determination of soil temperature is done using the DS18B20 sensor working on the Dallas one wire protocol. The system is integrated with Bluetooth for the transfer of data to a nearby cell phone.

[27] IoT Based Smart Agriculture Management System is designed to help the farmers to increase the crop yield. The parameters measures Temperature, Humidity, moisture level. The sensor used in the paper are DHT11 sensor, soil moisture sensor and Raspberry PI 3 & Node MCU is used as the controller device because multiple sensors can be connected to it simultaneously. Mobile application developed using THINGSPEAK IoT. The automated system developed helps the end user, i.e., farmer to view and analyse the factors that are to be considered while growing a crop such as temperature, humidity and moisture. The farmer can view and understand the pattern of changing environmental variables. Accordingly, suitable crop to be grown is suggested through machine learning techniques.

[28] Agricultural Field Monitoring using IoT is proposed to improvise the production with the art of making use of automation and Internet of Things. The parameters measure the soil moisture level, Temperature level, IR level. The sensors used in the project are LM35 Temperature sensor, IR sensor, moisture sensor, ESP8266 WIFI and The Arduino UNO used as the controller device to help the makers build connected objects in a quick, easy, and secure way. Mobile application is developed using IOT. The soil moisture sensor detects the moisture level and automatically turns the motor ON/OFF. The temperature displays the accurate temperature in degree/Celsius and the IR sensor is mainly used for the security purposes. To give an alert or warning message to those who have enter the field without 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS) 279 the proper acknowledgement.

[29] Water System is implemented to design and deploy a WSN for monitoring energy, water and crop development to further develop a nexus model based on real-time data. The parameters used to measure the soil moisture level, Temperature, solar radiation. The hardware components used in this paper are soil moisture sensor, Temperature sensor, Solar Radiation sensor, water pump and The Arduino MEGA used as the controller device to develop stand-alone interactive objects. Mobile application is developed using IOT. This paper presents the design and implementation of smart farm prototype to further investigate and model the energy, water and food nexus in the future. In this paper, the overall system design, implementation and functionality is explained.

[30] Smart Agriculture Based on IOT and Cloud Computing is designed to involve the IoT and Cloud Computing in Drones. The parameters used to measure the navigation, flight parameters and camera. The Sensors used in the paper are vision sensor, gyroscope, tilt and current sensors and thermal camera. In this they used Sky Drone FPV2 as controller device. Mobile application is developed using embedded IoT wireless technologies. The Application cloud as to provide Agriculture has a Service for all the users of this resource and data center of IoT based on Cloud Computing needs to provide more reliable virtualized platforms which will help in building a more sustainable smart agriculture.

III.CONCLUSION

Thus, the above method helps the farmers to monitor the farms by using IOT technologies. All the sensors measured value will be send to the user through Wi-Fi module so the farmer know status of the farm immediately. All monitored things will help the farmer to produce more crops and agricultural products. The advantage of this design is that we can monitor it immediately. This research can reduce the man power, problems of fellow farmers in determining. and calculating the amount of nutrients in the soil.in future the project can be further developed by following method We will be able to anticipate acceptable crops for that soil in the future, and we will be able to use our soil predictor in laboratories for accurate and quick findings

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