IJCRT.ORG ISSN : 2320-2882
INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)
An International Open Access, Peer-reviewed, Refereed Journal

Smart agricultural monitoring using IOT

Zakria Ahmed Wais
school of Electronics Engineering
KIIT University
Bhubaneswar, India

Subhra Debdas
School of Electrical Engineering
KIIT University
Bhubaneswar, India

Mohammed Abdella Arebu
School of Electronics Engineering
KIIT University
Bhubaneswar, India

Chernet Asefa Adaye
School of Electronics Engineering
KIIT University
Bhubaneswar,India

Yasin Jemal Sheka
School of Electronics Engineering
KIIT University
Bhubaneswar, India

Dawit Shimeles Tesfaye
School of Electronics Engineering
KIIT University
Bhubaneswar, India

ABSTRACT. The Internet of Things (IoT) is a system of smart sensors that can be used to control and monitor objects from anywhere on the Internet. This sophisticated method can be utilized to boost modern farming's production and quality. As a result, the goal of this study was to offer a novel smart farming application based on the Internet of Things. In this study, a smart agricultural prototype was created to assess the humidity in paddy bags placed in various locations across a farm. The NodeMCU ESP8266 microcontroller and the DHT11 temperature and humidity, MQ135 sensor, Soil moisture sensor, and LDR sensor were used to communicate data to the Blynk server through a Wi-Fi network in this smart capsule. The Dc water pump, exhaust fan, cooling fan, and LED bulb are also some appliances that are also connected can be controlled manually or automatically based on the data collected from the sensors. The Arduino IDE was being used to write the microcontroller's C++ code. The cloud-based dashboard was used to monitor and display real-time humidity data using the Blynk mobile application. The humidity data was examined further and used to create a paddy storage system for the future. Furthermore, when the smart capsule lost contact with the Blynk server, a fast notification was issued to the appropriate parties. As per the results, the developed smart farming and Blynk application can work together efficiently and are suitable for use in smart farming.

Keywords: *Internet of Things, ESP8266, Soil Moisture Sensor, PIR sensors, MQ135 air quality sensor, Blynk.*

1. INTRODUCTION The internet is constructing a contemporary future, a quantifiable and observable international in which individuals and agencies can handle their houses in an understanding manner and make greater timely and higher-knowledgeable choices on what they need or were given to do. the net modern day is creating a substitute global. it is a profound transition for society, tradition, and customers that this changing future carries with it. The IoT will produce many real-lifestyles modifications in the world with the aid of sensing our surrounding ecosystem, growing our fitness, comfort, and protection, even as at the identical time improving power efficiency and comfort. The use of internet access technologies in farming activities has been triggered as a result of the shrinking agricultural workforce, to eliminate the need for human labor. IoT developments can be used by farmers to narrow the supply-demand gap. by maintaining good yields, sustainability, and environmental security. Precision agriculture is a way of using the Internet of Things (IoT) technologies to ensure the most effective use of resources to maximize crop yields while lowering running costs. Specialized devices, wireless networking, applications, and IT services are all part of the Internet of Things in farming. Smart agriculture, and is based on the Internet of things technology, helps growers and producers to minimize pollution and improve efficiency in a range of ways, from the amount of fertilizer used to the number of trips taken by farm vehicles, as well as the effective usage of resources like water and electricity. IoT smart farming solutions is a device that uses sensors to track the crop area (for example, light, humidity, temperature, soil moisture, crop health, and so on.) as well as the irrigation system's automation. Farmers can monitor their fields from anywhere in the world. They can also choose between manual and automatic transmission automatic activities depending on the results. If the soil moisture level falls below a certain threshold Sensors could be used by the farmer to turn on irrigation. Smart farming is much more efficient than conventional agriculture.

2. LITERATURE SURVEY

The more up-to-date state of irrigation systems, waterways, and container evaporation, the rare condition of water use is desperately needed [7]. The aim is to propose a Novel Smart Agriculture Monitoring using IoT in the provision of instant data for effective environmental monitoring (temperature, soil moisture) that will allow them to do intelligent agriculture and to improve overall standards and product quality. Brief Paper Introduction: This paper provides an insight into the construction of a structure for rigorous farming work[1]. The temperature and dampness sensor is adapted to this use in suitable areas for yield observation An estimate of the temperature and dampness of the soil with edge estimates may be altered to a water control path based on a micro-controller [7]. "Agriculture" is one of the primary fields of IoT-focused research and the regular introduction of innovative products to facilitate intelligent and productive optimization techniques. The sector of agriculture is considered to be the most important area for food safety in the world. Talking to Indian farmers now in extreme challenges and weakened in terms of agricultural output, infrastructure, trade, government policy, environment, etc [1]. An ongoing, variable water rate detection, control of a site's specifically reliable direct moving water system structure to improve the performance and negligible water consumption was developed by Y. Kim for the remote detection and control of water system framework, using the remote sensor. The platform offers promising remote control as well as a remote control for water precision [7].

3.SMART AGRICULTURE TECHNOLOGY

Smart agricultural monitoring is an evolving concept of technology where data is collected using smart electronic sensors from many agricultural fields ranging from small to large scale and their surroundings. To draw short-term and long-term conclusions on weather patterns, soil fertility, current crop quality, the amount of water required for the next week to a month, etc., experts and local farmers analyze the data collected. Now in this, our idea is to control the farm switch especially the piano switch which is connected to different loads like temperature sensor, fan, water pump, moisture sensor, etc.[2]Since the only way to make any computer completely automated is via the internet. By this, the software can also talk with the machines nowadays. In this we are going to work with a board, an IDE, one temperature sensor, one moisture sensor, a mobile phone, and some applications and soft wares.[3] Nowadays IoT plays a very crucial role in the world. Most of the things are going to become automated. And also, the future of this project will be very helpful because in this energy consumption is less, don't have any type of losses and also this is very much helpful for those peoples who are unable to walk and for those peoples who always forget to switch off the electrical devices after use.[4] With the increase in productivity and the upgrading of plantation systems, agricultural growth is accelerating. The implementation of technology such as IoT in agriculture, however, may have the biggest effects. In the face of challenges such as extreme weather and rising climate change, as well as the environmental impact of industrial agricultural activities, the need for more food must be fulfilled. Advanced automated IoT technologies have to be used in agriculture to meet the demand. This paper explained the sensor for agriculture and its use in smart agriculture, with reduced human effort and expense, to increase productivity.[5] This paper explained the sensor for agriculture and its use in smart agriculture, with reduced human effort and expense, to increase productivity. Due to factors such as global connectivity via any devices, minimal human efforts, quicker access, time efficiency, and effective communication, the IOT technology is more efficient.[6]

4.Architecture and Process

The Printed Circuit Board (PCB) is very important for all electronic devices which are used for either domestic or industrial use. It also provides mechanical support in addition to electrically connecting the electrical sections. It includes 16 analog-digital multiplexing channels that allow multiple analog sensors to be connected since NodeMCU has only one analog pin (A0). In this PCB, we installed five analog pins and four appliances for output devices. The project works on a DC source given by a 12v adaptor. The brain of the project is the ESP8266 Wi-Fi module. The PCB can handle up to 5 sensors and 4 output appliances at a time, it can get input sources from a different source and give output respond accordingly.

4.1.1. Sensors and Appliance connectivity

In the connection of hardware assembly, we will use Esp8266 Wi-Fi module as a brain of the project. First, we will place Esp8266 Wi-Fi module with the 16- channel analog digital multiplexer since Esp8266 has only one analog pin which is A0. 16 analog digital multiplexers receive A0, GND and VCC and send as an output 16 pins which act as analog pins for this project. In the relay section we used four pins, they are D1, D2. D5, and D6 through resistor to smooth and insure the data transfer to each of the appliance. Then BC547 transistor is connected between the ESP8266 and relay to act as switch. 1n4007 diode is used at the pick to rectify the current. At the end relay is attached to the end section to get command from ESP8266 and act accordingly.

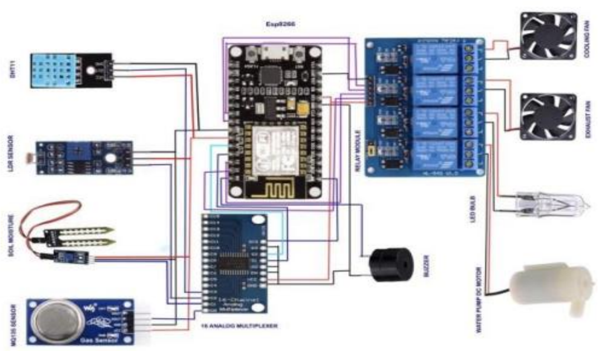

Fig 1.2: sensors connection

4.2 NodeMCU Board

A NodeMCU (Node Micro-controller Unit) is an open-source programming environment for software and hardware based on the ESP8266, a low-cost System-on-a-Chip (SoC).The name "NodeMCU" incorporates the words "node" and "MCU" (micro-controller unit). The term 'NodeMCU' refers to the industry as opposed
to the production kits that are associated with it.

Fig 2: ESP8266 Wifi Module

It is a single-chip computer. These components are used to automate vehicle engine control, insert medical equipment, and operate office machinery.

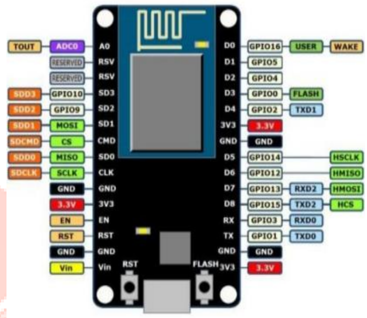

Fig 2.1: ESP8266 pin detail

4.3. Temperature Sensor Module (DHT11)

A DHT11 is a temperature and moisture sensor that is mainly used as serial data for the output values of temperature and moisture, the sensor comes with an NTC dedicated temperature measurement and an 8-bit micro controller. It's a low-cost wireless temperature and humidity sensor that's easy to use. It uses a capacitive humidity sensor and a thermistor to estimate the air around it and outputs a digital signal on the data pin (no analogue input pins required).

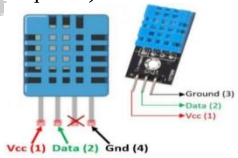

Fig 3: DHT11 Pin Detail

So, this sensor could be the right option for you if you want to measure in this range.

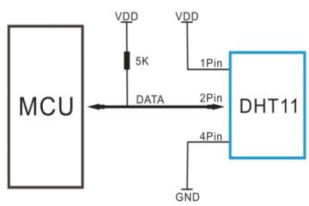

Fig 3.1: DHT11 with ESP8266

4.3.1. DHT11 Specifications:

Operating Voltage: 3.5V to 5.5V, operating current: 0.3mA (measuring) 60uA, output: serial data, temperature range: 0°C to 50°C, humidity rrange: 20% to 90%, rresolution: temperature and humidity both are 16-bits, accuracy: ±1°C and ±1%.

4.4. Soil Moisture Sensor

The soil moisture sensor (SMS) is a sensor that measures soil moisture before each scheduled irrigation event, as well as material in the active root region, and bypasses the cycle if soil moisture is above a user- defined set point. The water content (humidity) of the soil is measured using the Moisture Sensor. When there is a water shortage in the soil, the module output is high; otherwise, the output is low. This sensor notifies the consumer when it's time to water their plants and keeps track of the soil's moisture content. In agriculture, land irrigation, and botanical gardening, it has been used widely.

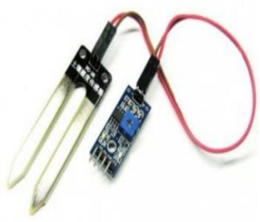

Fig 4: Soil moisture sensor

Capacitance is used by the Soil Moisture Sensor to determine the dielectric permittivity of the surrounding medium. Soil moisture sensors are used in a range of research applications, including agricultural sciences and horticulture, such as irrigation planning, climate research, and en vironmental science, such as solvent transport studies, as well as as auxiliary sensors for measuring soil respiration.

4.5. MQ135

The MQ-135 Gas sensors air quality control systems can detect or quantify NH_3, NOx, Alcohol, Bence, Smoke, and CO_2. The sensor module MQ-135 has a Digital Pin that allows it to be used without a micro-controller, which is helpful since only one gas is attempted to be detected. If we need to measure the gases in PPM, we can use the analogue pin. The analogue pin is TTL powered and operates on 5V, allowing it to be used with the key micro-controllers. The gas sensor senses the current state of agriculture and sends the information to the Blynk app through the Esp8266 micro controller wifi module.

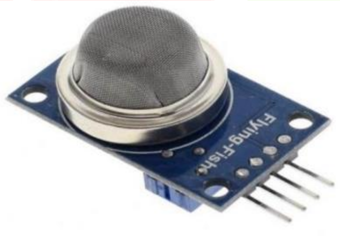

Fig 5: PIR Sensor

4.6 LDR sensor module

As lights are turned on, a piece of exposed semiconductor material, such as cadmium sulphide, changes its electrical resistance from thousands of Ohms to a few hundred Ohms, causing hole-electron pairs to form. Its conductivity has improved as a result, and its resistance to increased illumination has reduced. Photo sensory cells often take several seconds to react to a change in light intensity.

Fig 6: LDR Sensor

5. Methodology

Internet of Things refers to the network of machine-to- machine information sharing that creates a self- configuring network. The improvement of specialized Smart Farming IOT-based machines is speedily becoming the modern world of agricultural productivity, not only by working to improve it but also by making it even more cost-effective and genuine in water usage. The purpose of this paper is to propose a novel smart agriculture monitoring system based on IoT. Data is collected as well as stored on the server using a soil moisture sensor and a Blynk app. To provide efficient heat and shine light, use equipment such as a water pump motor, a cooling fan, and an LED bulb. This research paper constructs the foundation for efficient work in the agricultural field of smart farming and easy for farmers. One of its main areas where IOT-based research is taking place and new products are emerging on a daily basis to make the future smarter and more efficient in terms of production. In this proposal, we will concentrate on production and problem-solving techniques, emphasizing the importance of precision Farming.

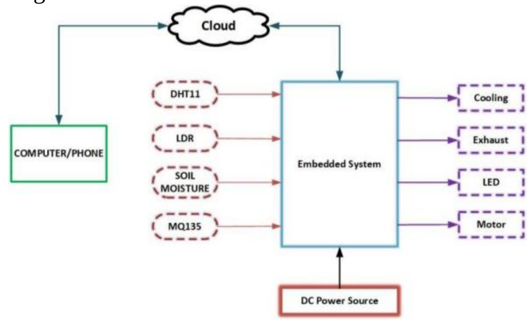

Fig 8: project layout

Internet - of - things execution in the field of smart agriculture: The worldwide population is estimated to increase by 9.6 billion by 2050, posing a significant challenge for the agricultural industry. Despite challenges such as extreme weather, rising climate change, as well as the health impacts of farming, the demand for more food must be considered. Agriculture must become more technologically advanced in an attempt to reach these increasing demands.New smart agricultural applications based on IoT technology will enable the agricultural sector to reduce waste and increase productivity. It is an application of new Information and Communication Technology designed to monitor crop fields using sensors (light, humidity, temperature, soil moisture, etc.). Farmers can monitor field conditions from any location. Soil humidity sensor implementation in smart agriculture: Soil humidity sensors evaluate the volumetric water content of the soil. Reflected microwave energy is impacted by soil moisture and has been used in hydrologic processes, and agricultural sectors for remotely sensed. Growers can use portable probe instruments. Soil moisture sensors aid in water management. A well-managed irrigation system produces better crops, uses fewer inputs, and increases profitability. Water Table Sensor Evaluation in Smart Agriculture: Water is a useful and necessary factor in agricultural and farm production and even a key factor in our quality of life. Monitoring the water level of a water source, such as a water tank is essential in the agricultural sector. Monitoring the level of water of a water source, such as a pool of water is necessary for water conservation. Maintaining a trace of the groundwater table in a reservoir could be used to conserve water and analyze how water ages. As a consequence, monitoring water levels is a critical task in agriculture. In this prototype experiment of the proposed system, a NodeMCU board with an Ethernet shield would be used for Wireless internet. In this prototype, a water level sensor should only be used for illustration purposes. [7]

6. Application

Any part of conventional farming methods is radically altered by integrating the most recent sensing and Internet of things developments into agricultural practices. Smart agriculture can now achieve previously unknown heights thanks to the smooth convergence of wireless sensors and the internet of things[8]. The internet of things will continue to reinforce the solutions to several conventional farming problems, such as drought response, yield optimization, land suitability, irrigation, and pest control, by adopting smart agricultural practices. Although there are several occasions where new innovations are assisting at different levels to improve overall performance. Precision farming, also known as precision agriculture, is described as something that makes livestock and crop production more regulated and precise. [9,10] Irrigation management system: To maximize water use in farming and related operations, modern agriculture needs an enhanced irrigation management system. [11,12,13]. Integration of real-time prediction results, monitoring of the farmer's system from anywhere in the world using a home, allowing Wi-Fi and Ethernet connections, and incorporating connectivity with moisture sensors mounted in the farmer's yard are all common features of an extremely smart irrigation system, and showing monthly bills for farmers while also aiding in the management of scarce water supplies. Pest and disease control: Using pesticides and fertilizers in a regulated manner improves crop production thereby lowering agricultural costs. However, we'd rather keep an eye on the likelihood and prevalence of pests in crops to limit pesticide use. We must also gather disease and bug pest information using sensor nodes, sorting, and mining to predict this. [14]

7. Limitation

The use of technology in farming and agriculture, resulting in smart agriculture, is, of course, a sincere and much-needed effort, given the rising demand for food. However, there's a chance that smart farming would force those skill sets to grasp and run the machines.It's extremely doubtful that a normal farmer will own or even grow this data in the case of kits like robots and computer-based intelligence for operating the machines. Farmers don't seem to be used to such sophisticated equipment. They have little understanding of programming languages or artificial intelligence. The Internet of Things is crucial for smart agriculture, which will necessitate computation and computer-based knowledge. This isn't going to be balanced.

There may be a flaw in the air conditions report. -In agriculture, the majority of the policy is determined by the temperature. It's a phenomenon that, considering modern technologies, has the potential to be volatile. There is a concern where the robots used in smart agriculture have a negative effect on the environment. Since technology requires so many computers, there is a risk that data will be incorrect from time to time. If there are faulty processing equipment or sensors then it'll cause a situation where the wrong decisions are taken. This may lead to misuse of capital such as fertilisers and water, as well as overuse of fertilisers and pesticides on crops.

8. Result Analysis

We experimented with a real field on Blynk software cultivation to test the approach suggested in this article. In addition, we compared the suggested approach to the other approaches in an experiment. Those techniques include using a timer to monitor soil moisture in a typical farm and greenhouse.

Fig 10: Blynk app collecting instant data

The proposed system would collect data from the soil moisture and another sensor every 1 minute, and would provide water movement into the farm in the evening and morning by using a timer to monitor soil moisture. We kept track and reported all statistics of each section of the plants to know the growth rate, producing rate, and water-saving rate of each process in the experiment. When comparing the conventional farm and the proposed system, the proposed method outperforms the traditional farm by 41% and outperforms a timer to monitor soil moisture by 23%.

9.CONCLUSSION

We experimented with a real area of Blynk app cultivation to test the approach suggested in this article. We also tested the suggested approach against other approaches in an experiment. Those techniques include using a timer to monitor soil moisture in conventional farms and greenhouses.This system's future work could involve centralizing data and delivering resources for each crop separately.This device can be used to track agricultural parameters such as temperature, humidity, moisture, leaf formation, water spraying, Printed Circuit Board (PCB), NodeMCU ESP8266 Wi-Fi module, DC cooling Fan, and pesticides using a motor pump using an IOT module, as well as the services given to farmers to digitalize agriculture.

11. REFERENCES

[1] 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, Volume-8 Issue-6, April 2019.

[2] M. Ganesh Ram "Smart Farming System using Agricultural Task Automation Sensors", R., Jagannathan, S., & Priyatharshini, R. (2015). ", IEEE International Conference on Technological Innovations in IoT for Agriculture and Rural Development.

[3] Thool, V. R., & Thool, R. C. (2014). "Design and development of the Wireless Sensor Network Precision Agriculture System", IEEE International Conference on Automation.

[4] 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT).

[5] Vidya Devi, V., & Meenakumari, G. (2013). "Modernized Agriculture Real Time Automation and Control System", International Journal of Review and Research in Applied Sciences and Engineering (IJRRASE) 3(1) 7-12.

[6] M P3" IOT BASED MONITORING SYSTEM IN SMART AGRICULTURE" 2017 International Conference on Recent Advances in Electronics and Communication Technology.

[7] Ritika Srivastava, Vandana Sharma, Vishal Jaiswal, Sumit Raj "A RESEARCH PAPER ON SMART AGRICULTURE USING IOT", International Research Journal of Engineering and Technology, ISSN: 2395-0072 Volume: 07 Issue: 07 | July 2020.

[8] Zhang, L., Dabipi, I. K. and Brown, W. L, "Internet of Things Applications for Agriculture". In, Internet of Things A to Z: Technologies and Applications, Q. Hassan (Ed.), 2018.

[9] Khanna A., Kaur S., "Evolution of Internet of Things (IoT) and its significant impact in the field of Precision Agriculture", Computers and Electronics in Agriculture, Vol. 157, February 2019.

[10]Tzounis A, Katsoulas N, Bartzanas T, Kittas C., "Internet of things in agriculture, recent advances and future challenges". Biosystems Engineering, Vol164, Dec 2017, Pages 31-48.

[11]RainMachine,2014,http://www.amazon.com/gp/product/B00CT5PNBU?tag=iotenableddevices-20[12]S. Shimizu, N. Sugihara, N. Wakizaka, K. Oe and M. Kat-suta, Cloud services supporting plant factory production forthe next generation of agricultural businesses,Hitachi Review64(1) (2015), 63–68.

[13]G. Vijay, E.B.A. Bdira and M. Ibnkahla, Cognition in wirelesssensor networks: A perspective,IEEE Sens. J.11(3) (2011),582–592. doi:10.1109/JSEN.2010.2052033.

[14] C. Wenshun, Y. Lizhe, Y. Lizhe and S. Jiancheng, Design and implementation of sunlight greenhouse service platform basedon lOT and cloud computing, in:Proceeding of the IEEE Inter-national Conference on Measurement, Information and Con-trol, China, 2013, pp. 141–144 .

[15] N.Suma,Sandra Rhea Samson, S.Saranya, G.Shanmugapriya, R.Subhashri "IOT Based Smart Agriculture Monitoring System" International Journal on Recent and Innovation Trends in Computing and Communication , Volume: 5 Issue: 2, pages: 177 – 181.

[16] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and

future directions," Future Generation Computer Systems, 2013, pp. 1645–1660.

[17]Muthukumaran.N and Ravi.R,'The Performance Analysis of Fast Efficient Lossless Satellite Image Compression and Decompression for Wavelet Based Algorithm', Wireless Personal Communications, Volume. 81, No. 2, pp. 839-859, March 2015, SPRINGER.

[18] Muthukumaran. N and Ravi. R, 'Hardware Implementation of Architecture Techniques for Fast Efficient loss less Image Compression System',Wireless Personal Communications, Volume. 90, No. 3, pp.1291-1315, October 2016, SPRINGER.

[19] c.perera.A.Zaslavsky, p. christen, and D.Georgakopoulos, "context aware computing for the Internet of Thing: a survey,'' IEEE communications survey and Tutorials,submitted 2013.

[20] 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 (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6, April 2019.