INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 3 - V7I3-1975)
Available online at: https://www.ijariit.com

Effective implementation of smart agriculture monitoring system using IoT sensor network

S. Purushothaman
purushoth.satha@gmail.com
VSB Engineering College, Karudayampalayam, Tamil Nadu

Ajay Kanna R.
ajaykrish2926@gmail.com
VSB Engineering College, Karudayampalayam, Tamil Nadu

Dhivakar G.
dhiva82@gmail.com
VSB Engineering College, Karudayampalayam, Tamil Nadu

Ashok Kumar K.
ashok234@gmail.com
VSB Engineering College, Karudayampalayam, Tamil Nadu

Dilip Kumar E.
dilipn32@gmail.com
VSB Engineering College, Karudayampalayam, Tamil Nadu

ABSTRACT

Agriculture is an essential part of the Indian economy. More than 60% of India's agriculture-based population and a third of the nation's income comes from farming practices. Hence, it plays an important role in the country's development. The possible solution to these problems is to go for modernized agriculture that is part of modern trends. Therefore, agriculture can be made smart with the help of IoT and other technologies. Smart agriculture increases crop yields and reduces water waste and the imbalanced use of fertilizers. The most prominent feature of the project is that it measures various agricultural parameters that affect yields like moisture sensor, temperature sensor, ultrasonic sensor and rain sensor using ATMEGA4809 chip and displays in LCD. Secondly, it sends all data to the cloud for analysis. The paper also includes an android mobile application that allows farmers to easily access information. In addition, the work also proposes an intelligent irrigation system that can optimize water consumption.

Keywords: *Internet of Things (IoT), Farmers, Intelligent Irrigation System, Crop Yields, Sensors, ATMEGA4809 Chip*

1. INTRODUCTION

Agriculture is an important issue, especially in developing countries, as it affects the improvement of the quality of human resources and is also a means of maintaining social and political stability as a prerequisite for the implementation of development [1]. The farm is the source of food security that has become a basic human right that must be fulfilled to ensure survival. India is a country in which rice is almost exclusively processed as a staple food. Hence agriculture should be developed better and more modern, especially when using technology, so that the increase in crop yield is greater and more significant [2][3]. Agriculture is one of the populist economies in India. Agriculture also became the determinant of obduracy, including food autonomy. However, in most of the fertile areas, they rely on agricultural livelihoods to improve living standards [4][5].

The use of technology is one among the conditions for making agriculture higher as a result of the info required will be produced a lot of in order that the analysis are higher and more valid. the utilization of technology in agriculture has to this point been limited to the tools employed in process the land or processing crops, and continues to be terribly restricted in manufacturing knowledge on the cropping method till there's harvest [6][7]. According to the data obtained by the researchers, many farmers still use traditional methods when analyzing the planting process, so the analysis remains the same as the previous cultivation methods.
The technology Internet of Things (IoT) is the connection or network of physical devices. These physical devices are interconnected computing devices, digital and mechanical machines, humans or animals, objects that transmit data through the Internet without human intervention to identify, accumulate and transmit. It is an advanced professional knowledge and mechanized structure that can mediate a common governance structure through discovery, organization, huge intelligence and artificial intelligence innovation. Essentially, the Internet of Things aims to extend the functions of the Internet beyond smart phones and computers. The capacity of the sensor - sensor made according to the purposes of the object that wants to automatically collect data continuously and does not know the time. So the data becomes large and can be used as input for the resulting analytical analysis to create solutions [8]. In agriculture, many things can be done to implement the Internet of Things, namely information about water, about fertilizer needs or about the development of growing plants [8][9]. By combining traditional methods with the latest technologies like the Internet of Things and wireless sensor networks can lead to a modernization of agriculture. The wireless sensor network

(WSN) that collects data from different types of sensors and sends them to the main server via the wireless protocol. There are many other factors have a big impact on productivity which include insect and pest infestation, which can be controlled by spraying the appropriate insecticides and pesticides, and wildlife and bird infestation as crops grow. Crop yield is declining due to unpredictable monsoons, water scarcity and improper use of water.
Some of the literature survey related to this work is Nikesh Gondchawar et al. presented work on IoT based smart agriculture. The paper describes making smart agriculture using IoT technology and some of the automated works are weeding, spraying, moisture sensing etc. [10]. Rajalaskhmi P et al. proposed work on monitor the crop-field by using moisture sensors, temperature sensor, humidity sensor, light sensor and irrigation system [11]. Tanmay Baranwal et al. describe the project based on security and protection of agriculture products from rodent attacks in the field areas and the real time notification of sensing problem by means of security systems [12].

In present work, we proposed the process of developed increased in production with low cost by monitoring the performance and efficiency of soil wealth, temperature, humidity, rain fall monitoring and additionally water irrigation and control system also implemented in this work. All this monitoring tools based on the Internet of Things (IoT), which also relates to the design and equipping of hardware and software.

2. METHODOLOGY

2.1 Design of Automated Agriculture Monitoring System

This section explains how to create tools to monitor agricultural data by implementing a prototyping process in Figure.1.

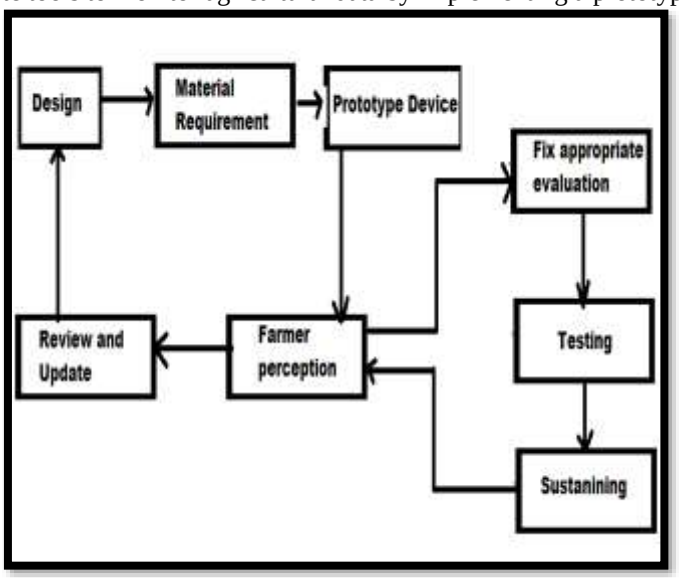

Fig.1: Smart Agriculture Monitoring Workflow

The assembly phase begins, and a cycle process begins, which independently controls two parameters, farmland conditions and energy consumption [10]. It also defines material requirements based on hardware, software, and data communications. After all, the materials are available, and the prototype is made according to the project and needs to be evaluated directly by the farmer so that the repair process can be estimated effectively. It then tests until the farmer agrees that the tool meets his requirements [11].

In order to start building intelligent monitoring equipment based on IoT agriculture, the communication process must be realized from the data stream to form the required demand tools. This is a solution for designing smart agricultural monitoring system.

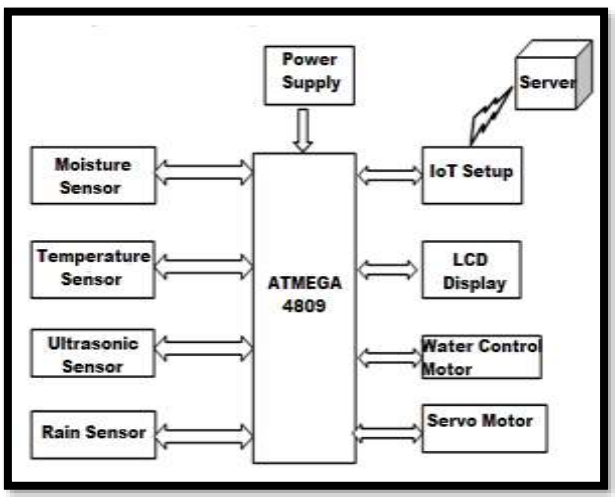

Fig. 2: Block diagram of Smart Monitoring Agriculture

Figure.2 depicts overall block diagram of smart agricultural monitoring system. In this proposed model ATMEGA 4809 microcontroller is the main block to control and execute various parameters from sensors and IoT device. It is portable, low power, secure and reliable connection. Four sensors are needed, namely rain sensor, temperature sensor, ultrasonic sensor and rain sensor are assembled with the Arduino microcontroller, so they can be linked together. This is necessary to ensure proper operation of the sensors, as indicated by the transmission of detection data from the four sensors [12]. Farmers can view the data directly in real time and store it on servers and in the cloud, whereas farmers can view the data directly in real time and also store it on servers and in the cloud.

2.2 Requirement of Hardware, Network and Algorithm

The hardware requirements in this study are divided into two parts: equipment for manufacturing Internet of Things (IoT) devices and equipment for supporting communication and storage circuits. The following are some basic equipments; ESP32, 12V fan, Arduino Uno and electronic components, water pH sensor; temperature and humidity sensor; soil pH sensor and groundwater level sensor. Communication equipment required for two-way communication associated with Wi-Fi equipment; on-site IoT equipment and farmer communication equipment. Using the necessary software to connect the main hardware to the support hardware and to translate the receipt of the data generated by the sensors in the farmer device. Software to synchronize IoT sensors can read agricultural parameter, here PIN configuration below;

```
void setup()
{
        Serial.begin(9600);
        lcd.begin(16,2);
        pinMode(trigPin, OUTPUT);// triggering of ultrasonic wave//
        pinMode(echoPin, INPUT);          // receiving ultrasonic wave//
        dht.begin();
        pinMode(3,INPUT);  // moisture//
        pinMode(2,INPUT);  // Rain//
        pinMode(A0,OUTPUT);// Rain motor//
        pinMode(A5,OUTPUT);// water motor//
        pinMode(A2,INPUT); //temperature//
}
```

3. RESULTS AND DISCUSSION

Fig. 3: Hardware setup

Figure.3 shows the experimental setup of our smart agriculture monitoring system. The hardware setup contains a microcontroller, then the sensor is soil moisture, and the last one is a motor connected through a relay. In this, microcontroller it provides the basis for real-time transmission of temperature, humidity, and soil humidity, and sends the information from the sensors to the server through the ESP8266 WiFi module, and also sends the data from these sensors to the mobile application. The sensor and the microcontroller are interconnected and powered on. Microcontroller reads the value from the sensor, and then the microcontroller sends the information to the cloud server. When the soil moisture value drops below a certain threshold, the relay opens, causing the engine to start automatically, and as long as the moisture value reaches the threshold level, the relay automatically shuts down the engine.

3.1 Readings of the sensors on the mobile app

Fig.4: Normal condition of active sensors shown in mobile app and LCD display

Figure 4 shows normal state of active sensors like temperature, moisture, water level and rain sensor which was displayed in mobile app depicits all sensors in the mobile app are not enabled and also LCD display shows all the sensors display in LOW state.

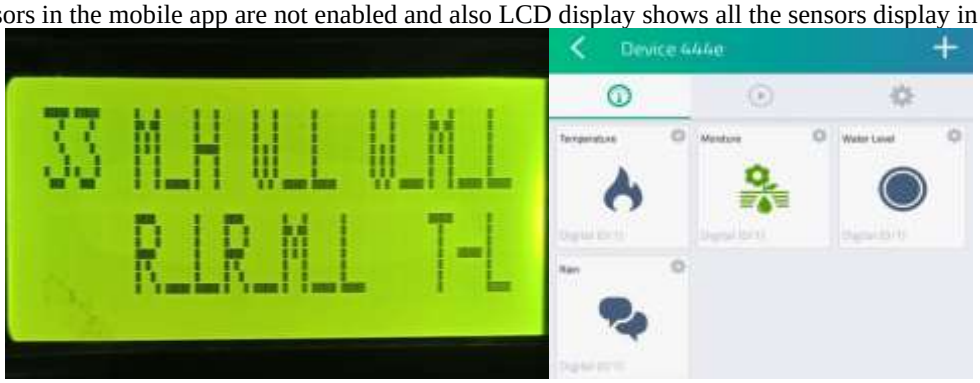

Fig. 5: Schematic representation of moisture sensor is HIGH

Figure 5. shows schematic representation of moisture sensor when it gets enabled, displays HIGH in LCD display and also depicits green color blinking in the mobile app. During day time the sensor reads the soil moisture, when the soil is DRY it indicates the alarm and sends the information to the LCD display and also in mobile application.

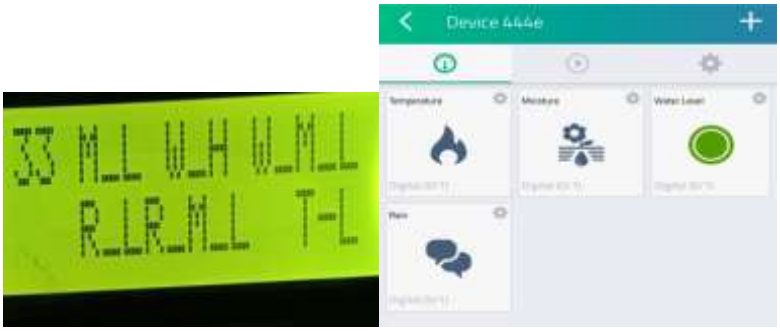

Fig. 6: Schematic representation of water level is HIGH

Figure 6. shows schematic representation of water level indication. When moisture level is DRY it enables the water sensor to pour the water to the crop field. This representaion of water level in the well or tank display HIGH and it shown in mobile application and also in LCD display. From the figure it shows W_H in the LCD display and green light indication in the mobile app.

Fig. 7: Schematic representation of rain sensor is HIGH

This rain sensor enables if excess water in the field means it enables and indicates in the LCD display and also in the mobile app. From the figure it shows red color indication in mobile app. This excess water can be drained and oozed out from the crop field through rain motor.

From our above observations we can say that monitoring water level is an prominent task in agriculture in this prototype model various evaluation will continue to be carried out to become a researchers to make improvements and developments for the future purpose.

4. CONCLUSIONS

In this work, we have demonstrated the design, workflow and implementation of smart agricultural monitoring system based on internet of things. This proposed model aims at increasing the crop yield by helping in assumption of better crop sequence for a soil conditions and the environmental predictions. This system measures moisture of the soil and environmental temperature and also water level in the tank and gives information to the farmer through mobile app. We have analyzed many reading samples of the soil moisture, humidity, temperature etc. Data on the cloud also helps the farmer in improvement of crop yield and evaluating the causes and illness in the field. In future, this prototype system can be improved by including several modern soil sensors and techniques like pH sensor and also usage of solar power source.

5. ACKNOWLEDGEMENTS

The authors immensely thank to Head of the Department, Principal and Management of VSB Engineering College, Karur, Tamil Nadu for his full support extended to carry out this research in college campus agriculture field.

6. REFERENCES

[1] A. Kaloxylos et al., "The Use of Future Internet Technologies in the Agriculture and Food Sectors: Integrating the Supply Chain*," Procedia Technol.,*vol. 8, no. Haicta, pp. 51–60, 2013.
[2] R. Nikkilä, I. Seilonen, and K. Koskinen, "Software architecture for farm management information systems in precision agriculture," *Comput. Electron. Agric*., vol. 70, no. 2, pp. 328–336, 2010.
[3] M. Prabhavathi and A. Kiranmai, "Smart Security for agriculture using IoT," *Int. J. Adv. Eng. Res. Sci. Spec.* Issue-4, vol. 6495, no. 4, pp. 2456–1908,2017.
[4] C. Future and F. Tichakunda, "Challenges and Prospects of Zimbabwe ' s Command Farming in Unlocking the Country ' s *Smallholder Agricultural Economy*," vol. 3, no. 4, pp. 76–82, 2018.
[5] F. Kurniawan, A. P. Wibawa, Munir, S. M. S. Nugroho, and M. Hariadi, "Makassar smart city operation center priority optimization using fuzzy multi-criteria decision-making," *Int. Conf. Electr. Eng. Comput. Sci. Informatics*, vol. 4, no. September, pp. 289–293, 2017.
[6] F. TongKe, "Smart Agriculture Based on Cloud Computing and IOT," *J. Converg. Inf. Technol.*, vol. 8, no. 2, pp. 210–216, 2013.
[7] H. Kausarian, J. Tetuko, S. Sumantyo, D. Bagus,and E. Putra, "Image processing of alos palsar satellite data , small unmanned aerial vehicle (UAV), and field measurement of land deformation," vol. 4, no. 2, pp. 132–141, 2018
[8] M. Farooq, M. Waseem, A. Khairi, and S. Mazhar, "A Critical Analysis on the Security Concerns of Internet of Things (IoT)," *Int. J. Comput. Appl.*, vol. 111, no. 7, pp. 1–6, 2015.
[9] G. P. -, S. Y. -, C. J. -, D. M. -, and L. B. -, "Enterprise-oriented Communication among Multiple ESBs based on WSNotification and Cloud Queue Model*," Int. J. Adv. Comput. Technol*., vol. 3, no. 7, pp. 255–263, 2011.
[10] J. Xiao and R. Boutaba, "The design and implementation of an energy-smart home in Korea," *J. Comput. Sci. Eng.*, vol. 7, no. 3, pp. 204–210,2013.
[11] X. Ma, C. Lin, H. Zhang, and J. Liu, "Energy-aware computation offloading of IoT sensors in cloudletbased mobile edge computing*," Sensors (Switzerland),* vol. 18, no. 6, pp. 1–12, 2018.
[12] H. Atlam, R. Walters, and G. Wills, "Fog Computing and the Internet of Things: A Review," *Big Data Cogn. Comput.*, vol. 2, no. 2, p. 10, 2018.
[13] Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar, "IoT based Smart Agriculture" *International Journal of Advanced Research in Computer and Communication Engineering* Vol. 5, Issue 6, ISSN (Online) 2278-1021 ISSN (Print) 2319 5940, June 2016.
[14] Rajalakshmi.P, Mrs.S.Devi Mahalakshmi"IOT Based Crop-Field Monitoring And Irrigation Automation" 10 *th International conference on Intelligent systems and control (ISCO),* 7-8 Jan 2016 published in IEEE Xplore Nov 2016.
[15] Tanmay Baranwal, Nitika , Pushpendra Kumar Pateriya "Development of IoT based Smart Security and Monitoring Devices for Agriculture" 6th *International Conference - Cloud System and Big Data Engineering,* 978-1-4673-8203-8/16, 2016 IEEE.
[16] Nelson Sales, Artur Arsenio, "Wireless Sensor and Actuator System for Smart Irrigation on the Cloud" 978-1-5090-0366-2/15, 2 nd *World forum on Internet of Things (WF-IoT)* Dec 2015, published in IEEE Xplore jan 2016.
[17] Mohamed Rawidean Mohd Kassim, Ibrahim Mat, Ahmad Nizar Harun "Wireless Sensor Network in Precision Agriculture Application" 978-1-4799-43838/14,
[18] Mohamed Rawidean Mohd Kassim, Ibrahim Mat, Ahmad Nizar Harun, "Wireless Sensor Network in Precision agriculture application" *International conference on computer, Information and telecommunication systems (CITS)*, July 2014 published in IEEE Xplore.
[19] Zhang, X., Davidson, E. A, "Improving Nitrogen and Water Management in Crop Production on a National Scale", American Geophysical Union, December, 2018. How to Feed the World in 2050 by FAO.
[20] 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.
[21] S. Navulur, A.S.C.S. Sastry, M. N. Giri Prasad, "Agricultural Management through Wireless Sensors and Internet of Things*" International Journal of Electrical and ComputerEngineering (IJECE),* 2017; 7(6) :3492-3499.
[22] E. Sisinni, A. Saifullah, S. Han, U. Jennehag and M. Gidlund, "Industrial Internet of Things: Challenges, Opportunities, and Directions," in *IEEE Transactions on Industrial Informatics*, vol. 14, no. 11, pp. 4724-4734, Nov. 2018.
[23] M. Ayaz, M. Ammad-uddin, I. Baig and e. M. Aggoune, "Wireless Possibilities*: A Review," in IEEE Sensors Journal*, vol. 18, no. 1, pp. 4-30, 1 Jan.1, 2018.
[24] J. Lin, W. Yu, N. Zhang, X. Yang, H. Zhang and W. Zhao, "A Survey on Internet of Things: Architecture, Enabling Technologies, Security and Privacy, and Applications," in *IEEE Internet of Things Journal*, vol. 4, no. 5, pp. 1125-1142, Oct. 2017.
[25] hi, X.; An, X.; Zhao, Q.; Liu, H.; Xia, L.; Sun, X.; Guo, Y., "State-of-the-Art Internet of Things in Protected Agriculture", Sensors 2019, 19, 1833.
[26] O. Elijah, T. A. Rahman, I. Orikumhi, C. Y. Leow and M. N. Hindia, "An Overview of Internet of Things (IOT) and Data Analytics in Agriculture: Benefits and Challenges," in *IEEE Internet of Things Journal*, vol. 5, no. 5, pp. 3758-3773, Oct. 2018.
[27] Thea K., Martin C., Jeffrey M., Gerhard E, Dimitrios Z, Edward M., Jeremy P., Food safety for food security: Relationship between global megatrends and developments in food safety", *Trends in Food Science & Technology*, Vol 68,2017,Pages 160-175.

