



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH


IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Special Issue 2, May 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

**Impact Factor: 8.423**

 9940 572 462

 6381 907 438

 [ijirset@gmail.com](mailto:ijirset@gmail.com)

 [www.ijirset.com](http://www.ijirset.com)

# Lora-WSN Based IOT Frame Work For Precision Agriculture

Prof. Monali shirsath<sup>1</sup>, Prof. Manjusha Patil<sup>2</sup>, Mr. Aksah Pawal<sup>3</sup>, Mr. Asif Maniyar<sup>4</sup>,  
Mr. Bhairavnath<sup>5</sup>, Mr. Arshad Sayyad<sup>6</sup>

Assistant Professor, Department of E&TC, Ajeenkya D. Y. Patil School of Engineering (ADYPSOE), Pune, India<sup>1 2</sup>

UG Student, Department of E&TC, Ajeenkya D. Y. Patil School of Engineering (ADYPSOE), Pune, India<sup>3 4 5 6</sup>

**ABSTRACT:** The emergence of the Internet of Things (IoT) has brought about a trans- formative impact on Precision Agriculture, revolutionizing the monitoring and control of agricultural processes in real-time. Among the various communication protocols, Low-Power Wide-Area Network (LoRa-WAN) technology has gained prominence due to its extensive reach and minimal power consumption. This study introduces a comprehensive IoT framework specifically tailored for Precision Agriculture, utilizing LoRa Wireless Sensor Networks (LoRa-WSN) to effectively address the distinctive challenges and requirements of the agricultural sector. The proposed framework seamlessly integrates diverse sensor nodes, including soil moisture sensors, temperature and humidity sensors, and crop health monitoring devices, all interconnected through LoRa-WAN technology. The LoRa-WSN architecture ensures efficient data collection and transmission across expansive agricultural landscapes, even in remote or low- connectivity areas. Additionally, the framework incorporates data analytics and cloud-based platforms to process the gathered data, furnishing farmers with actionable insights for informed decision-making. These insights encompass assessments of soil quality, predictive analyses of crop yields, and real-time monitoring of environmental conditions, facilitating precise resource management, optimization of irrigation, and effective pest control. Recognizing the paramount importance of security and privacy in agricultural systems, our framework integrates robust encryption and authentication mechanisms to safeguard sensitive data. Moreover, the design emphasizes scalability, cost-effectiveness, and energy efficiency, ensuring long-term sustainability and affordability for farmers.

**KEYWORD:** Long Range Communication [Lora], Internet of Things [IoT], Wireless sensor network [WSN]

## I. INTRODUCTION

The proposed Internet of Things (IoT) framework, based on LoRa (Long Range) technology for Wireless Sensor Networks (WSN), capitalizes on Low-Power Wide- Area Network (LPWAN) capabilities. Specifically, the use of LoRa enables the establishment of a wireless sensor network, facilitating the deployment of numerous battery operated sensors across agricultural areas. These sensors are designed to monitor various parameters, including soil moisture, temperature, humidity, and crop health. The collected data is transmitted over extended distances using LoRa modulation, directing it to a centralized gateway. As the global population continues to grow and climate conditions evolve, the agricultural industry is undergoing a shift towards more efficient and sustainable practices. Precision agriculture, characterized by precise resource management and data- driven decision-making, emerges as a crucial solution to address these challenges. The core of precision agriculture lies in the acquisition of accurate and real-time field data, a role fulfilled by the LoRa-based Wireless Sensor Network (WSN) IoT frame- work. The expanding global population underscores the importance of judiciously managing finite freshwater resources. Agriculture, a major consumer of global fresh- water, poses challenges as approximately half of the world's population faces water scarcity. Balancing the need for adequate soil moisture, crucial for processes like plant growth and nutrient cycling, is vital. Conversely, excessive irrigation can lead to land desalinization and pollution of freshwater sources. Achieving optimal irrigation levels becomes the objective, known as scientific irrigation scheduling, a component of precision agriculture where soil moisture monitoring plays a pivotal role. In the context of vast agricultural fields, employing a wireless solution for soil moisture monitoring proves preferable, avoiding the complexities and costs associated with laying and maintaining extensive cable networks. In this wireless setup, multiple sensors establish a network conveying soil moisture data from different field locations to a central server.

## II. WORKING PRINCIPLE

Wireless Sensor Networks (WSNs) find application in agriculture for tasks such as temperature measurement, environmental monitoring, irrigation system management, and water supply measurement. These networks play a pivotal role in assisting farmers in cultivating high-yield crops. However, the sensor nodes within WSNs necessitate a power supply, typically from batteries. The utilization of WSNs contributes to enhanced crop quality and increased production, directly impacting the economic aspect of agriculture. Ongoing research indicates that the challenges in implementing precision agriculture can be progressively addressed through the adoption and advancement of WSNs. The incorporation of wireless sensor networks into agriculture stands out as a highly advantageous approach, promoting precision agriculture, elevating food crop yields, and alleviating the burdens on farmers. WSNs play a crucial role in ensuring the robust growth of crops in precision agriculture by minimizing pesticide usage, effectively managing weeds and pests, and facilitating efficient and eco-friendly agricultural practices. These networks have the capability to sense and collect real-time data on various aspects of agricultural production, providing prompt feedback to users. The results of data analysis and processing are then communicated to users, enabling the efficient management of precision agriculture.

## III. METHODOLOGY

Precision Farming has the potential to bring about a significant transformation in boosting crop production. Through remote access, farmers gain the flexibility to manage their time and explore part-time businesses or work. In our project or module, farmers can efficiently oversee farm fields from a distance of up to 10 kilometers, utilizing smartphones or laptops. Moisture sensors and humidity-temperature sensors take measurements, transmitting data via LoRa gateway to The Things Network. This network aggregates all the data, sending the combined datasets to Blynk. Blynk, a software based on Math Works, visualizes the data graphically. Based on the analyzed data, proactive measures are implemented to enhance crop yield. The processed data is converted into actionable information and delivered to end-users, supporting both quantitative and qualitative growth of crops in the farm field. On the sensor node, we employ the Arduino Nano board and the SX1278 LoRa-02 Transceiver module. Multiple sensors, including the capacitive soil moisture sensor v1.2 for quantifying soil water content, and the DS18B20 waterproof temperature sensor for measuring soil temperature, are interfaced. To address cold season challenges, where plants may succumb to fog and low temperatures, the DHT22 Temperature & Humidity sensor is utilized to measure ambient temperature and humidity. An automatic irrigation system is facilitated through the use of a 5V Single-channel relay module and a water pump. This integrated system ensures efficient monitoring and management of agricultural parameters for optimal crop growth.

## IV. SYSTEM DESIGN AND IMPLEMENTATION

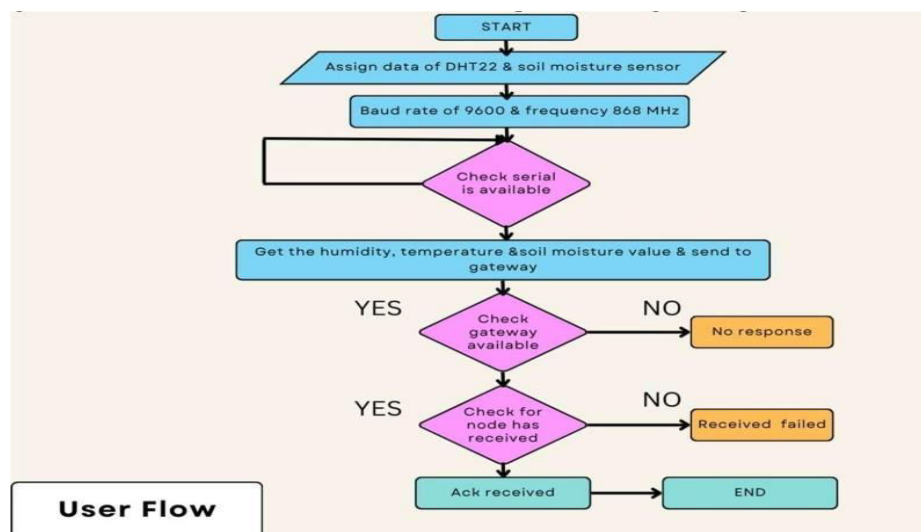


Fig. 1 : User Flowchart

Client Module: The client module comprises a LoRa node paired with an At- mega128 controller, which is linked to sensors responsible for gathering soil conditions, including moisture levels and the humidity- temperature of the surrounding environment. For measuring soil moisture, the FC-28 sensor is employed, while the DHT22 sensor is utilized to gather humidity and temperature data from the field. The collected information is analyzed to derive insights into the water requirements of the field.

Gateway Module: Serving as a crucial intermediary between the LoRa nodes and the cloud, the gateway module is responsible for collecting data from LoRa nodes and transmitting it to the cloud for analysis. With an impressive communication range, the LoRa gateway can effectively interact with LoRa nodes situated up to 10 kilometers away in open fields, surpassing the range capabilities of current technologies.

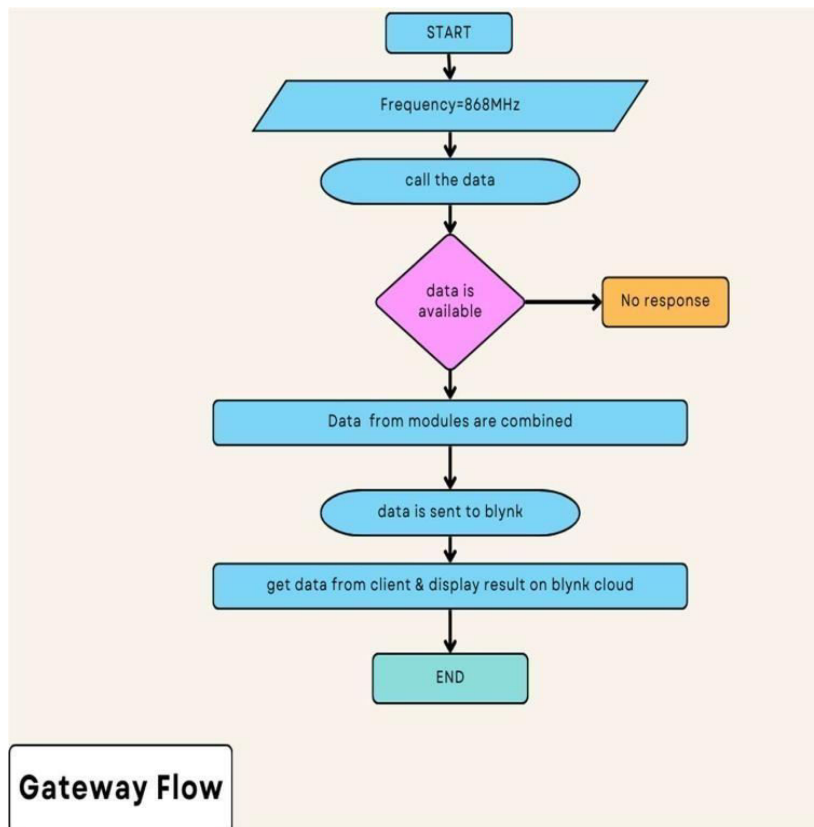


Fig. 2 : Gateway Flowchart

Primarily, the gateway employs two communication technologies: LoRa technology for gathering information from LoRa nodes positioned in the fields, and WiFi for uploading the collected data to the cloud. The communication between the gateway and the cloud is facilitated using the HTTP protocol. The strategic placement of the gateway is crucial to efficiently receive data through LoRa communication from nodes and subsequently upload the data to the cloud via HTTP protocol. To store and analyze the data, users need to create accounts for The Things Network and Blynk, the latter serving for data visualization. Following account creation, integration between the gateway and The Things Network is established, involving the use of application session-keys, network session-keys, and device addresses. The Things Network aggregates all the data and transmits it to the Blynk Cloud for further processing.

V. BLOCK DIAGRAM

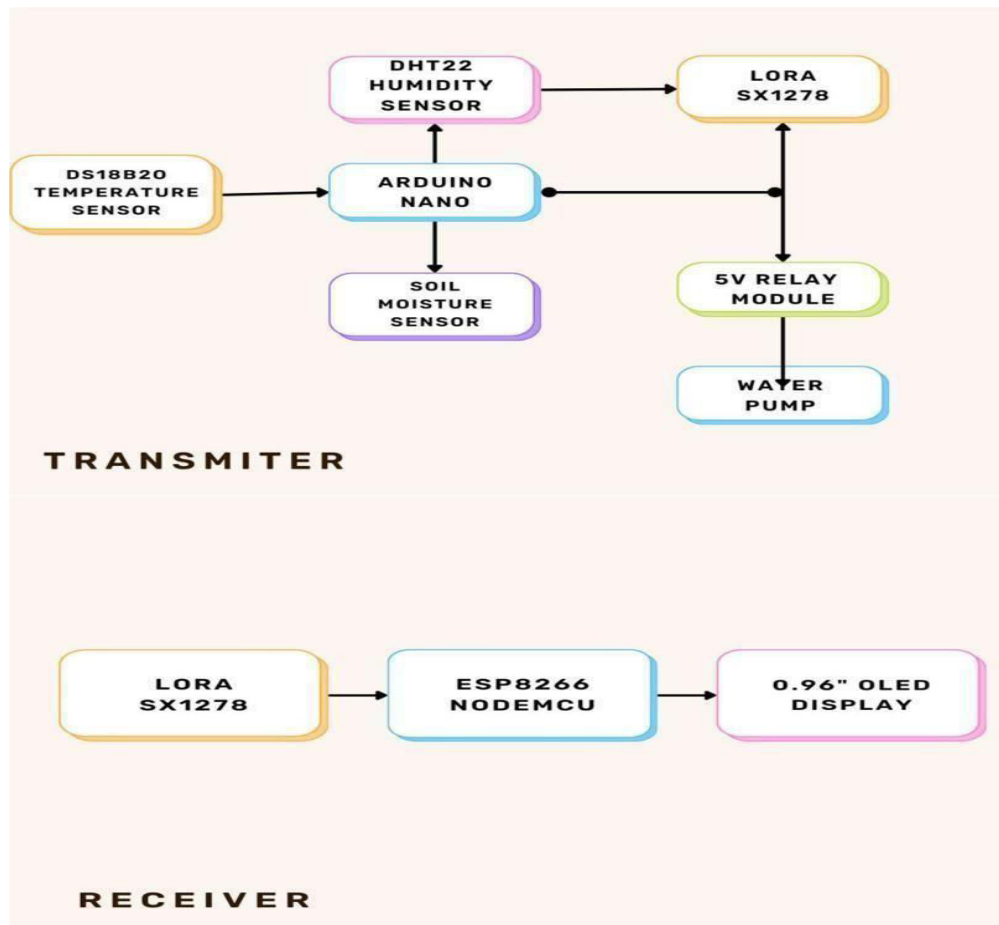


Fig. 3 : Block Diagram of Transmitter and Receiver

VI. RESULT

The Arduino Nano collects data from the soil moisture sensor, DHT22 sensor, and DS18B20 sensor. It formats the collected data into packets suitable for transmission. Using the LoRa SX1278 module, the Arduino transmits these datapackets wirelessly. The LoRa SX1278 module sends the packets to a receiver module located within its range.

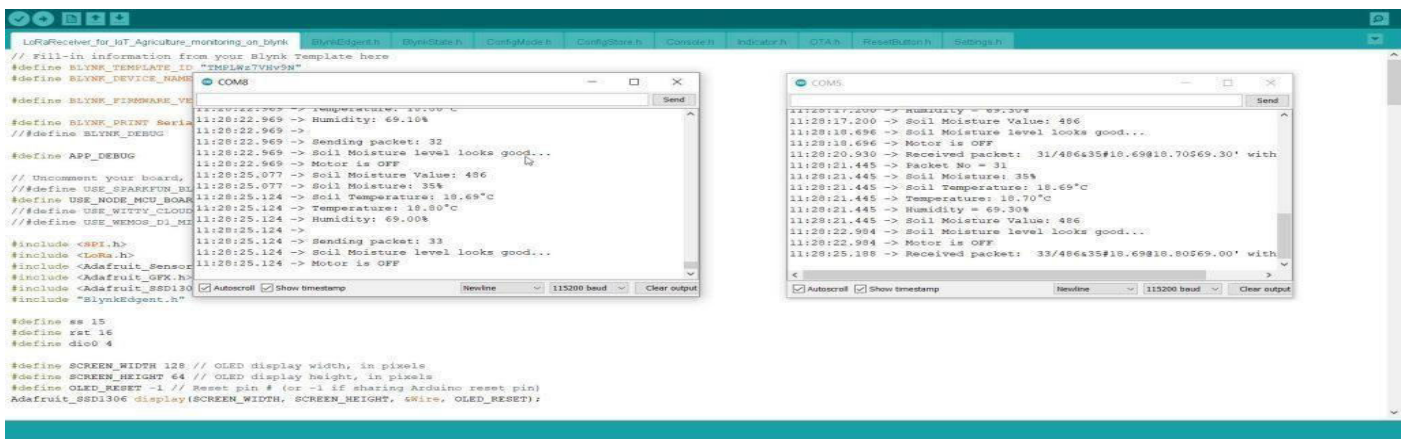


Fig. 4 : Real time data can transmit and receive in serial monitor

The LoRa SX1278 module receives data packets transmitted by the sender. The NodeMCU ESP8266 receives these data packets from the LoRa SX1278 module. The NodeMCU ESP8266 processes the received data packets, extracting relevant information. The extracted data is then displayed on the 0.96" OLED display in a text format.

## VII. CONCLUSION

LoRa stands out as a resilient, systematic, cost-effective, and exceedingly adaptable solution. LoRaWAN dictates the communication protocol for the network, while the physical layer of LoRa facilitates extensive and long-range communication connections. In this context, various variables related to crop growth in agriculture, including temperature, humidity, pH, soil moisture, etc., are taken into account. The procedure has been thoroughly tested and proven to be both cost-effective (more affordable) and accurate compared to existing methodologies.

## REFERENCES

1. Agriculture Census of India Kaewmard, Nattapol, Saiyod, Saiyan —Sensor data collection and irrigation control on vegetable crop using
2. smart phone and wireless sensor networks for smart farm, IEEE Conference on Wireless sensors (ICWiSE), Pg.no.106 – 112, 2014.
3. T. Sujithra, S. Durai and M. Thanjaivadivel, Measuring macronutrients of the soil for smart agriculture in coconut cultivation, International Journal of Civil Engineering and Technology, 2017, Pg.no.768-778.
4. Arjun K.M., "Indian Agriculture- Status, Importance & Role in Indian Economy", International Journal of Agriculture and Food Science Technology, Page No.343-346., 2015
5. Precision Agriculture in India: Opportunities & Challenges Rahul Tripathi, Mohammad Shahid, Central Rice Research Institute, Odisha, India
6. I. F. Akyildiz and E. P. Stuntebeck, "Wireless underground sensor networks: Research challenges," Ad Hoc Netw., vol. 4, no. 6, pp. 669–686, 673 Nov. 2006. 674
7. A. N. Harun, M. R. M. Kassim, I. Mat, and S. S. Ramli, "Precision irrigation using wireless sensor network," in Proc. Int. Conf. Smart Sensors Appl. (ICSSA), May 2015, pp. 71–75.
8. M. C. Vuran, A. Salam, R. Wong, and S. Irmak, "Internet of underground things: Sensing and communications on the field for precision agriculture," in Proc. IEEE 4th World Forum Internet Things (WF-IoT), Feb. 2018, pp. 586–591
9. A. J. Wixted, P. Kinnaird, H. Larijani, A. Tait, A. Ahmadinia, and N. Strachan, "Evaluation of LoRa and LoRaWAN for wireless sensor networks," in Proc. IEEE SENSORS, Oct. 2016, pp. 1–3.
10. J. de Carvalho Silva, J. J. Rodrigues, A. M. Alberti, P. Solic, and A. L. Aquino, "LoRaWAN—A low power WAN protocol for Internet of Things: A review and opportunities," in Proc. 2nd Int. Multidisciplinary Conf. Comput. Energy Sci. (SpliTech), Jul. 2017, pp. 1–6.
11. S. Subashini, R. Venkateswari, and P. Mathiyalagan, "A study on LoRaWAN for wireless sensor networks," in Computing, Communication and Signal Processing. Singapore: Springer, Sep. 2019, pp. 245–252.
12. M. A. Ertürk, M. A. Aydın, M. T. Büyükakkaşlar, and H. Evirgen, "A survey on LoRaWAN architecture, protocol and technologies," Future Internet, vol. 11, no. 10, p. 216, Oct. 2019.



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details