International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Conference Proceedings: Volume: 05 ACME – 2026 DOI: 10.55041/ISJEM.ACME138
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

IOT Based Wireless Sensor Network for Real-Time Monitoring and Control of Agricultural Parameters

MS. M. Hema[1, a)], K. Keerthi Sudha[2, b)], P. Dinesh[2, c)], D. Bhanu Prakash[2, d)], P. Harisankar[2, e)]

[1]Assistant Professor, Department of Electronics and Communication Engineering, Annamacharya Institute of Technology and Sciences, Tirupati, Andhra Pradesh, India -517520.

[2]B. Tech Students, Department of Electronics and Communication Engineering, Annamacharya Institute of Technology and Sciences, Tirupati, Andhra Pradesh, India -517520.

[b)]Corresponding author: kodavalurukeerthi@gmail.com

[a)] hema.mandyam64@gmail.com

[c)] dineshpalla582@gmail.com

[d)] dugganibhanuprakash@gmail.com

[e)] phariyadav014@gmail.com

ABSTRACT

Agriculture plays a vital role in the economy, and efficient monitoring of agricultural parameters is essential to improve crop productivity and resource utilization. Traditional farming methods rely heavily on manual monitoring, which is time-consuming, labour-intensive, and often inaccurate. To overcome these limitations, this project proposes an IoT-based Wireless Sensor Network (WSN) for real-time monitoring and control of agricultural parameters. In the proposed system, various sensors such as soil moisture, temperature, humidity, and water level sensors are deployed in the agricultural field to continuously collect environmental data. The sensor data is transmitted wirelessly to a microcontroller, which processes the information and sends it to an IoT cloud platform using a Wi-Fi module. Farmers can remotely monitor real-time field conditions through a web or mobile application from anywhere at any time. Based on predefined threshold values, the system can automatically control agricultural operations such as irrigation, ensuring optimal water usage and reducing human intervention. The proposed IoT-based system enhances decision-making, improves crop yield, minimizes water wastage, and reduces operational costs. This smart agriculture solution provides a reliable, scalable, and cost-effective approach for modern farming practices.

Keywords — *Control of Agricultural Parameters, Arduino, IoT, Wireless Sensor Network, Real-time Monitoring, Solar-Powered Smart Farming, Precision Agriculture*

INTRODUCTION

Agriculture plays a crucial role in sustaining the growing global population, yet farmers face significant challenges such as inefficient irrigation practices, unpredictable climatic conditions, and lack of real-time monitoring of field parameters. Traditional methods depend on manual inspection, which may result in over-watering, under-watering, and inefficient resource utilization. These limitations reduce crop productivity and increase operational costs.

Recent advancements in the Internet of Things (IoT) and wireless sensor networks provide an effective solution for smart farming applications. Environmental sensors can be deployed in agricultural fields to measure soil moisture, temperature, humidity, and light intensity. The collected data can be transmitted wirelessly and accessed remotely, allowing farmers to monitor crop conditions in real time.

This paper proposes an IoT-based wireless sensor network for monitoring and controlling agricultural parameters. Soil moisture, DHT11 temperature-humidity, and LDR light sensors are interfaced with a microcontroller. The data is transmitted using an ESP8266 Wi-Fi module to an online platform. When soil moisture drops below the predefined level, the irrigation pump is automatically activated. The system aims to reduce manual effort, improve water management, and enhance crop productivity.

LITERATURE SURVEY

Khadse and Borkhade [1] define a wireless sensor network architecture for monitoring soil moisture, temperature, and humidity, forming the foundation for real-time agricultural parameter sensing. Nivetha et al. [2] demonstrated an IoT-based wireless monitoring system capable of remotely observing field conditions and transmitting data for analysis. Agarwal et al. [3] validated the integration of IoT with wireless sensor networks for precision agriculture, emphasizing improved decision-making and crop productivity. Pochhi et al. [4] developed a farm monitoring and control system using distributed sensor nodes, highlighting the importance of automated environmental regulation. Gutierrez et al. [5] proposed an automated irrigation system using wireless sensors and GPRS communication, confirming the effectiveness of remote irrigation control. Ruiz-Garcia et al. [6] provided a comprehensive review of wireless sensor technologies and their applications in agriculture, establishing the relevance of WSN in smart farming. Kim et al. [7] demonstrated remote sensing and irrigation control using distributed wireless sensor networks, validating the feasibility of automated water management. Nandurkar et al. [8] designed a precision agriculture system that integrates multiple sensors for real-time monitoring of environmental parameters. Raut et al. [9] presented an IoT-based smart irrigation system that optimizes water usage and reduces manual intervention. Lakshmisudha et al. [10] implemented sensor-based precision agriculture techniques for efficient crop monitoring and management. These studies collectively highlight the importance of continuous environmental monitoring, automated irrigation, and wireless communication in agriculture. However, most existing systems focus either on monitoring or control without integrating both effectively. Additionally, several implementations lack cost-effective deployment suitable for small-scale farmers. The reviewed works emphasize the need for real-time monitoring combined with automated control mechanisms. Therefore, the proposed system integrates wireless sensor networks and IoT technologies to provide a unified solution for monitoring and controlling agricultural parameters.

PROPOSED METHOD

The proposed system consists of environmental sensors, a microcontroller, communication module, and irrigation control unit. Soil moisture, temperature-humidity, and light sensors are placed in the agricultural field to measure environmental conditions. The soil moisture sensor detects water content, the DHT11 sensor measures temperature and humidity, and the LDR sensor determines light intensity.

The sensors are connected to an Arduino Uno microcontroller, which collects and processes the data periodically. The processed values are transmitted to a cloud platform using an ESP8266 Wi-Fi module. Farmers can view the data through a web interface or mobile device.

Threshold values are defined for soil moisture. When the moisture level falls below the set value, the microcontroller activates a relay module that turns on the irrigation pump. Once adequate moisture is reached, the pump is switched off automatically. The system ensures efficient water utilization and reduces manual intervention.

The design focuses on low cost, energy efficiency, and ease of deployment. The wireless communication enables remote monitoring, while automated irrigation improves crop management.

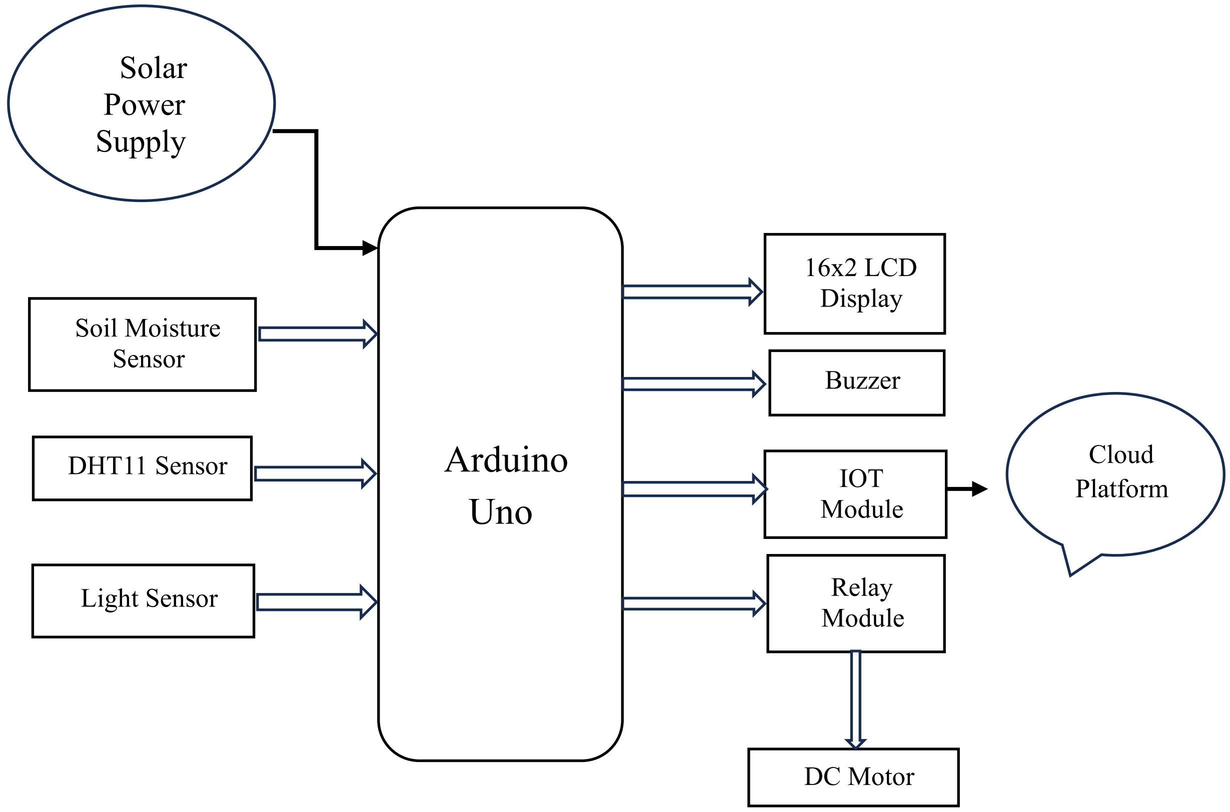

Fig1: IOT-Based Agricultural System Block Diagram

RESULTS

The proposed IoT-based agricultural monitoring system was successfully implemented and tested under different environmental conditions. The system continuously collected readings from the soil moisture sensor, DHT11 temperature and humidity sensor, and LDR light intensity sensor. The sensor values were stable and responded accurately to environmental changes. The soil moisture sensor effectively detected variations in soil water content. The DHT11 sensor provided consistent temperature and humidity readings during testing. The LDR sensor measured ambient light intensity under different lighting conditions. The collected data was processed by the microcontroller without any issues. The processed data was transmitted wirelessly using the ESP8266 Wi-Fi module. The Wi-Fi module maintained a stable internet connection throughout the testing period. The sensor readings were successfully uploaded to ThingSpeak cloud platform. The platform displayed temperature and humidity values in real time. The uploaded values were updated at regular intervals. The system also displayed real-time sensor readings on an LCD display. The LCD provided immediate feedback in the field. The soil moisture value was monitored locally for irrigation control. When soil moisture dropped below the threshold value, the relay module activated the water pump. The irrigation system started automatically without manual intervention. The pump turned off automatically when sufficient moisture was reached. The system operated continuously for long durations without requiring resets. Overall, the system proved to be reliable, low-cost, and suitable for smart agricultural monitoring.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Conference Proceedings: Volume: 05 ACME – 2026 DOI: 10.55041/ISJEM.ACME138
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

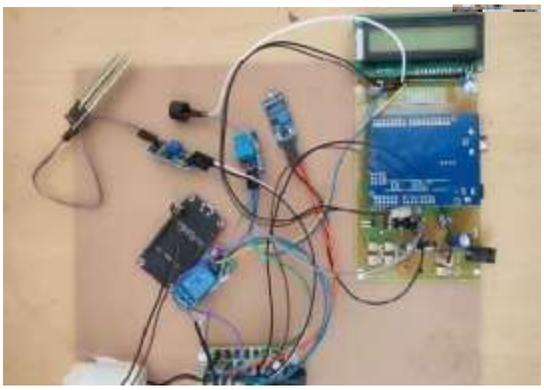

Fig 2: Hardware Implementation

Fig 3: Soil Moisture Indication

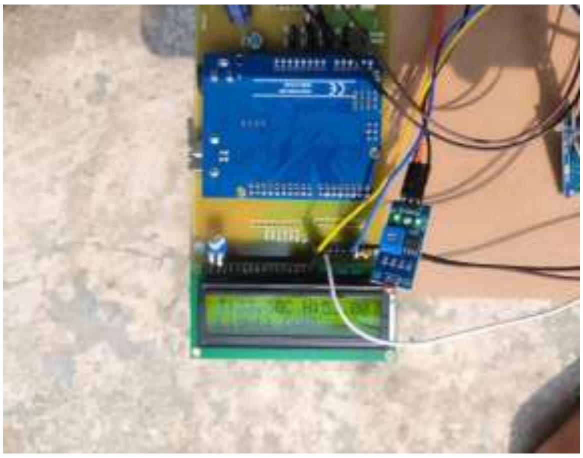

Fig 4: Light Intensity Indication

Fig 5: Output of ThingSpeak Displaying Temp & Humidity Values

CONCLUSIONS

The final conclusions can be drawn based on our project results:

• The proposed system provides an efficient solution for real-time monitoring of agricultural parameters using IoT technology.
• Soil moisture, temperature, humidity, and light intensity were successfully measured using Soil Moisture, DHT11,andLDRsensors.
• The ESP8266 Wi-Fi module enabled reliable wireless transmission of sensor data.
• Temperature and humidity values were uploaded to the ThingSpeak cloud platform for remote monitoring.
• The LCD display showed real-time readings directly in the field for immediate observation.
• Automatic irrigation control reduced water wastage by turning the pump ON and OFF based on soil moisture levels.
• The system proved to be low-cost, easy to implement, and suitable for smart agricultural applications.

REFERENCES

[1] R. D. Khadse and G. Borkhade, "Implementation of wireless sensor network for real time monitoring of agricultural parameter," *International Journal of Science and Research*, vol. 4, no. 4, pp. 143–146, Apr. 2015.

[2] R. Nivetha, P. R. S. Kumar, and S. S. Nair, "IoT based wireless sensor for agriculture monitoring," in *Proc. International Journal of Engineering Research & Technology (IJERT)*, 2018, pp. 1–4.

[3] A. Agarwal, S. Sharma, and M. Gupta, "Wireless sensor network-based internet of things for precision agriculture," in *Proc. International Conference on Intelligent Computing and Communication (ICICC)*, 2022, pp. 1–6.

[4] R. Pochhi, A. Kumar, and P. Singh, "Using wireless sensor network for monitoring and controlling of farm," *International Journal of Computational and Electronic Aspects in Engineering*, vol. 2, no. 1, pp. 25–30, 2021.

ISSN: 2583-6129
Conference Proceedings: Volume: 05 ACME – 2026
DOI: 10.55041/ISJEM.ACME138
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

[5] J. Gutierrez, J. F. Villa-Medina, A. Nieto-Garibay, and M. Á. Porta-Gándara, "Automated irrigation system using a wireless sensor network and GPRS module," *IEEE Transactions on Instrumentation and Measurement*, vol. 63, no. 1, pp. 166–176, Jan. 2014.

[6] L. Ruiz-Garcia, L. Lunadei, P. Barreiro, and J. I. Robla, "A review of wireless sensor technologies and applications in agriculture and food industry," *Sensors*, vol. 9, no. 6, pp. 4728–4750, 2009.

[7] Y. Kim, R. G. Evans, and W. M. Iversen, "Remote sensing and control of an irrigation system using a distributed wireless sensor network," *IEEE Transactions on Instrumentation and Measurement*, vol. 57, no. 7, pp. 1379–1387, Jul. 2008.

[8] S. R. Nandurkar, V. R. Thool, and R. C. Thool, "Design and development of precision agriculture system using wireless sensor network," in *Proc. IEEE International Conference on Automation, Control, Energy and Systems (ACES)*, 2014, pp. 1–6.

[9] M. D. Raut, P. S. Raut, and S. A. Pande, "Smart irrigation system using IoT and wireless sensor network," *International Journal of Engineering Research and Technology*, vol. 9, no. 5, pp. 320–324, 2020.

[10] K. Lakshmisudha, S. Hegde, N. Kale, and S. Iyer, "Smart precision-based agriculture using sensors," in *Proc. International Conference on Electronics and Communication Systems (ICECS)*, 2011, pp. 1–5.

FUTURE SCOPE

The system can be extended by integrating additional sensors such as rainfall, pH, and nutrient sensors for improved crop monitoring. Mobile application support can enhance remote accessibility. Automated fertilizer and pesticide control can be added to increase automation. Solar power integration can improve energy efficiency for remote locations. Data analytics and machine learning techniques can be used for predictive irrigation. Multiple sensor nodes can also be deployed for large-scale agricultural fields.

