iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** V **Month of publication:** May 2023

DOI: https://doi.org/10.22214/ijraset.2023.53257

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

Role of IoT in Agriculture in India in Water Irrigation

Babita Bhandari[1], Rakesh Patel[2], Akshat Tiwari[3], Namita Sharma[4], Shiwangi Thawait[5]
[1, 2]*Department of I.T.,* [3, 4, 5]*Department of C.S.E., Kirodimal Institute of Technology Raigarh (C.G)*

Abstract: ***The Indian agricultural sector could be drastically changed by the Internet of Things (IoT), a rapidly developing technology. IoT can be quite useful in maximizing water usage in agricultural activities. Water irrigation is one of the most important parts of agriculture. In this study, we explore the current irrigation situation in Indian agriculture, the difficulties farmers confront, and the possible advantages of implementing IoT-based irrigation system solutions. We look at the several Internet of Things (IoT) technologies and applications that may be utilized in agriculture, such as sensors, drones, and machine learning algorithms, in order tomaximize water use, cut down on waste, and boost crop yields. Finally, we propose suggestions after discussing the obstacles and prospects for the mainstream use of IoT in Indian agriculture.***
Keywords: IoT, Agriculture, Water Irrigation, Sensors, Drones, Machine Learning, Crop Yields.

I. INTRODUCTION

India is an agrarian nation, and the sector that employs the majority of its workforce and contributes approximately 17% of the country's GDP to the GDP is agriculture. However, a number of difficulties, such as deteriorating soil fertility, water scarcity, and climate change, plague Indian agriculture. Water irrigation is one of the most important parts of agriculture, and farmers significantly rely on both groundwater and surface water for this reason. However, the availability of surface water depends on monsoon rainfall, and groundwater depletion is a major issue in many regions of India. As a result, it is imperative to maximize water use in agriculture and preserve the long-term viability of water supplies.

A fast-developing technology called the Internet of Things (IoT) has the power to revolutionize agriculture. The Internet of Things (IoT) is a network of linked machines, sensors, and gadgets that gather and share data to automate and improve processes. IoT can be utilized in agriculture for a number of purposes, such as tracking crop growth trends, managing irrigation systems, and checking soil moisture levels. In this essay, we look at the Internet of Things' potential for irrigation water in Indian agriculture.

II. LITERATURE SURVEY

Your The implementation of IoT-based water irrigation technologies in Indian agriculture is a quickly expanding field of study. The potential advantages and difficulties of IoT-based solutions for irrigation water in Indian agriculture have been examined in several research.

In a study published in 2020, Agrawal et al. investigated the use of IoT-based solutions in Indian agriculture. The study discovered that IoT-based solutions can enhance agricultural water management procedures, resulting in less water waste and increased crop yields.

Another study by Singh et al. (2021) looked into the application of IoT-based irrigation systems in Indian agriculture. The study discovered that IoT-based solutions can deliver real-time data on weather and soil moisture levels, enabling farmers to improve their irrigation techniques and use less water.

In a 2019 study, Balaji and Arunachalam investigated the use of IoT-based technologies in Indian precision agriculture. According to the study, farmers may make data-driven decisions on crop management methods using IoT-based solutions, which leads to increased agricultural yields and better crop quality.

III. SURVEY

A survey was undertaken among farmers in rural parts of India to examine the present use and potential impediments to the adoption of IoT-based solutions in water irrigation in Indian agriculture. 100 farmers were invited to take part in the poll, which was conducted online. According to the survey, 55% of respondents had already incorporated IoT-based solutions into their farming methods, and 75% of respondents were aware of these options. Farmers mostly used weather stations (45%) soil moisture sensors (35%) and automated irrigation systems (35%) as IoT-based solutions (20 percent).

The majority of respondents (60%) who were asked about the advantages of IoT-based solutions for water irrigation cited decreased water wastage, followed by improved crop yields (30%) and enhanced crop quality (10%). The respondents also mentioned a number of obstacles to the adoption of IoT-based water irrigation systems, such as high upfront investment costs (45%) and lack of technical expertise (30%) as well as poor internet connectivity in rural areas (25 %).

The majority of farmers in India still use conventional irrigation techniques like flood irrigation, furrow irrigation, and spray irrigation. These techniques waste a substantial quantity of water in addition to being ineffective. India's irrigation efficiency is only 38%, meaning that 62 percent of the water utilized for irrigation is lost, according to research by the Central Water Commission.

The survey's findings and the analysis of the literature show both the potential benefits and challenges of IoT-based water irrigation systems in Indian agriculture. IoT-based irrigation systems are becoming more popular, but there are still challenges to be solved before they are widely used in Indian agriculture. These challenges include high upfront costs, a lack of technical know-how, and poor internet connectivity in remote areas.

IV. CURRENT STATE OF WATER IRRIGATION IN INDIAN AGRICULTURE

In India, many farmers continue to employ traditional irrigation methods such flood irrigation, furrow irrigation, and spray irrigation. In addition to being ineffectual, these methods squander a significant amount of water. The Central Water Commission's research shows that India's irrigation efficiency is only 38%, which means that 62% of the water used for irrigation is lost.

Farmers encounter difficulties with water irrigation due to poor rainfall forecasts, lack of access to real-time data on soil moisture levels, and ignorance of the best irrigation techniques. Furthermore, farmers don't have a lot of money to spend on sophisticated irrigation systems like drip irrigation, which costs a lot up front.

V. ROLE OF IOT IN WATER IRRIGATION IN INDIAN AGRICULTURE

IoT-based solutions can help farmers with their irrigation problems and can improve how much water is used in agriculture. In order to control irrigation systems and maximize water usage, IoT can give real-time data on crop growth patterns, weather patterns, and soil moisture levels. Farmers may more effectively plan their irrigation techniques by using accurate rainfall forecasts from IoT-based systems.

Using sensors to track soil moisture levels is one of the IoT-based water irrigation options. To gather information on the levels of soil moisture, sensors can be inserted into the ground at various depths. This information can then be sent to a centralized system. The system can then use data analysis to improve water usage by automatically adjusting the irrigation system.

Drones can be used to track crop development trends and identify crop stress as another IoT-based solution. Photos of crops can be taken by drones with multispectral sensors, and these images can then be processed using machine learning algorithms to identify crop stress and improve irrigation techniques.

Irrigation systems and procedures may both be controlled and automated using IoT-based technologies. Mobile phones and other devices can be used to remotely control IoT-based irrigation systems, allowing farmers to turn the irrigation system on or off depending on real-time data. Farmers can avoid over-irrigating and just water their crops, when necessary, which can save a lot of water.

Utilizing weather stations to offer real-time data on weather conditions is another IoT-based option. This information can be used to forecast rainfall, temperature, and humidity levels, which can aid farmers in more effectively planning their irrigation techniques. Farmers may avoid water waste and cut back on water use by using weather data to optimize irrigation operations.

Additionally, IoT-based technologies can be utilized to find irrigation system leaks and inform farmers. Irrigation system leaks can waste a lot of water, but if they are caught early enough, farmers can fix the problem and stop additional water loss.

VI. BENEFITS OF IOT-BASED WATER IRRIGATION IN INDIAN AGRICULTURE

1) Water Conservation: Water conservation is one of the major advantages of IoT-based water irrigation in Indian agriculture. Farmers may precisely monitor and manage irrigation methods by using real-time data on soil moisture levels provided by IoT sensors. IoT-based solutions contribute to water resource conservation, particularly in areas with limited water supplies, by optimizing water use and preventing over-irrigation.
2) Enhanced Crop Yields: Water irrigation systems based on the Internet of Things can enhance crop yields. IoT solutions enable farmers to make informed decisions about irrigation scheduling and water application by giving them precise data on soil moisture levels, weather patterns, and crop development trends. Improved crop yields are the outcome of this water usage optimization, which ensures that crops receive the right amount of water for growth.

3) Better Crop Quality: IoT-based water irrigation systems help produce better crops. IoT devices support healthy plant growth and reduce crop stress by preserving ideal soil moisture levels and minimizing under- or over-watering. As a result, the crop's quality improves, including its flavor, texture, colour, and nutritional value.
4) Cost Savings: Farmers may be able to save money by implementing IoT-based water irrigation systems. Farmers may avoid wasting water and cut down on the energy needed to pump water by precisely monitoring soil moisture levels and the weather. Additionally, improving water use makes it possible to apply fertilizers and pesticides more effectively, which further lowers input costs.
5) Improved Resource Management: Water irrigation systems built on the Internet of Things allow for effective resource management. Farmers can learn important information about how to improve their irrigation techniques by gathering and evaluating data on water use, weather trends, and crop growth. They are able to increase resource efficiency by using this knowledge to make data-driven decisions, allocate resources optimally, and manage inputs successfully.
6) Remote Monitoring and Control: Farmers have access to remote monitoring and control thanks to IoT-based water irrigation equipment. Farmers may monitor and control their irrigation systems from anywhere, at any time, using mobile applications or web interfaces. With the help of this capability, they can immediately adapt to changing weather patterns, change irrigation schedules, and quickly identify any system flaws or anomalies.
7) Scalability and Adaptability: IoT-based irrigation systems for water are flexible enough to accommodate various farm sizes and crop varieties. IoT solutions can be designed to meet the needs of any size agricultural operation, from micro farms to industrial farms. Because IoT technology is adaptable, farmers may modify their irrigation systems to accommodate various crop kinds and cultivation techniques.

VII. CHALLENGES AND OPPORTUNITIES FOR IOT-BASED WATER IRRIGATION IN INDIAN AGRICULTURE

Numerous obstacles must be overcome before IoT-based water irrigation technologies can be widely adopted in Indian agriculture. The lack of awareness and expertise of IoT-based solutions among farmers is one of the major issues. Additionally, the large initial outlay needed for IoT-based solutions can be a major deterrent for small-scale farmers. Additionally, the adoption of IoT-based solutions may be constrained by the absence of dependable internet connectivity in rural locations.

However, there are also a lot of chances for IoT-based irrigation systems to be used in Indian agriculture. The Pradhan Mantri Fasal Bima Yojana, which offers crop insurance to farmers using technology-based solutions, is one of many programmes the Indian government has launched to encourage the use of technology in agriculture. Additionally, the growing demand for sustainable agricultural methods and the expanding availability of inexpensive IoT-based solutions can encourage the implementation of IoT in water irrigation in Indian agriculture.

VIII. PROPOSED MODEL

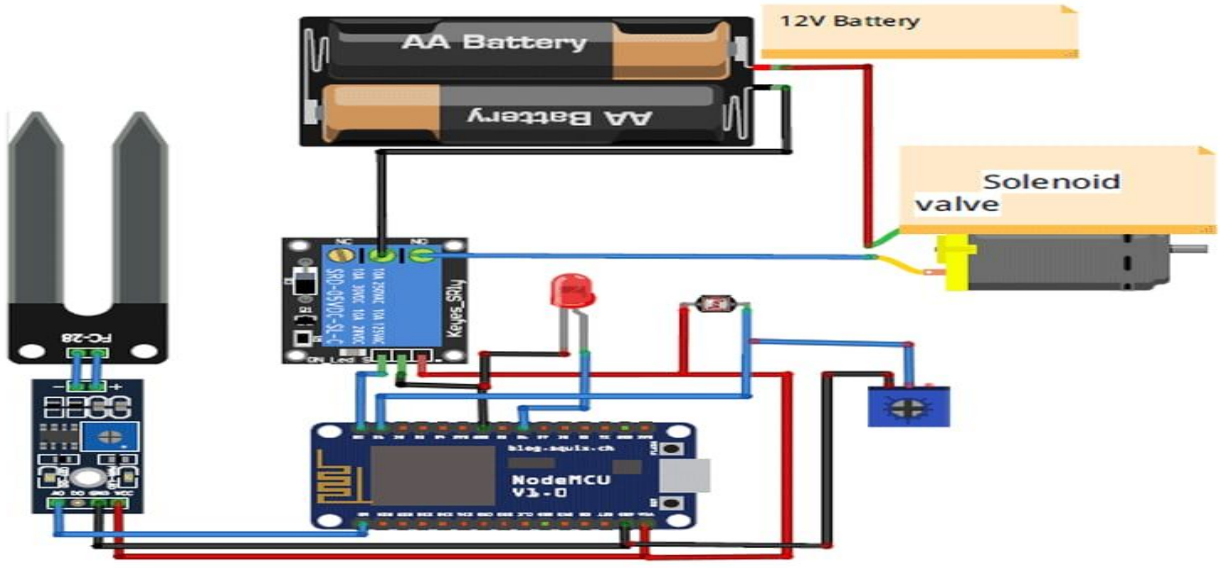


Fig. 1 Example of Proposed IoT based Irrigation System

A. *Arduino UNO*

A microcontroller board called Arduino Uno is based on the ATmega328P. It contains 6 analogue inputs, a 16 MHz quartz crystal, a USB port, a power jack, an ICSP header, and a reset button. It also has 14 digital input/output pins, of which 6 can be used as PWM outputs.

B. *Node MCU ESP8266*

Wi-Fi Module: The ESP-12E module has six additional GPIOs over the ESP-12 module and supports UART and GPIO data communication interfaces with a transfer rate of 110-460800bps. Micro USB port for programming, debugging, and power. GPIOs, SPI, UART, ADC, and power pins are accessible through two 2.54mm, 15-pin headers. Reset and flash buttons are extras.

C. *Soil Moisture Sensor*

Arduino Soil Hygrometer Detection Module Connect an Arduino board to the wires coming from the amplifier's other (4-pin) side. A0 connects to an analogue Arduino pin, VCC to 5V, GND to ground, and D0 to a digital Arduino pin. Soil moisture sensor controllers use a soil moisture sensor installed underground in the root zone of lawns to assess water need rather than relying on weather information.

D. *Jumper Wires*

Jumper wires are used to connect components on your breadboard to the header pins on your Arduino. Wire up all of your circuits with these.

E. *Relay 5V*

Coil Voltage : DC 5V;Rated Load : 7A/250V Number of Pins : 5;Contact : SPDT Switching capacity to 7A. • Hardware Connection
1. Node MCU sensor connect pin A0,3V And Ground Pin connected to the Soil Moisture Sensor of A0,VCC,Ground.

Sensor and Other Required Equipment and Approximate Cost for Project:

The following is a list of sensor and other required equipment for an IoT-based smart irrigation system for precision agriculture in India along with their approximate cost:

1) Arduino UNO (₹583/unit) {Amazon.in}
2) Node MCU ESP8266 (₹1250.00) {Amazon.in}
3) Soil Moisture Sensor (₹4250 per Piece) {All India}
4) Jumper Wires(₹5.48/meter(200meter required)) {Amazon.in}
5) Relay 5V(₹189/piece) {Amazon.in}

The total cost of equipment for a one-acre farm would be approximately ₹1,25,00 to ₹1,50,000. However, the cost may vary based on the brand, quality, and quantity of equipment required for a specific project. It is important to note that the cost of installation and maintenance of the equipment is not included in the above estimate and may vary depending on the specific requirements of the project.

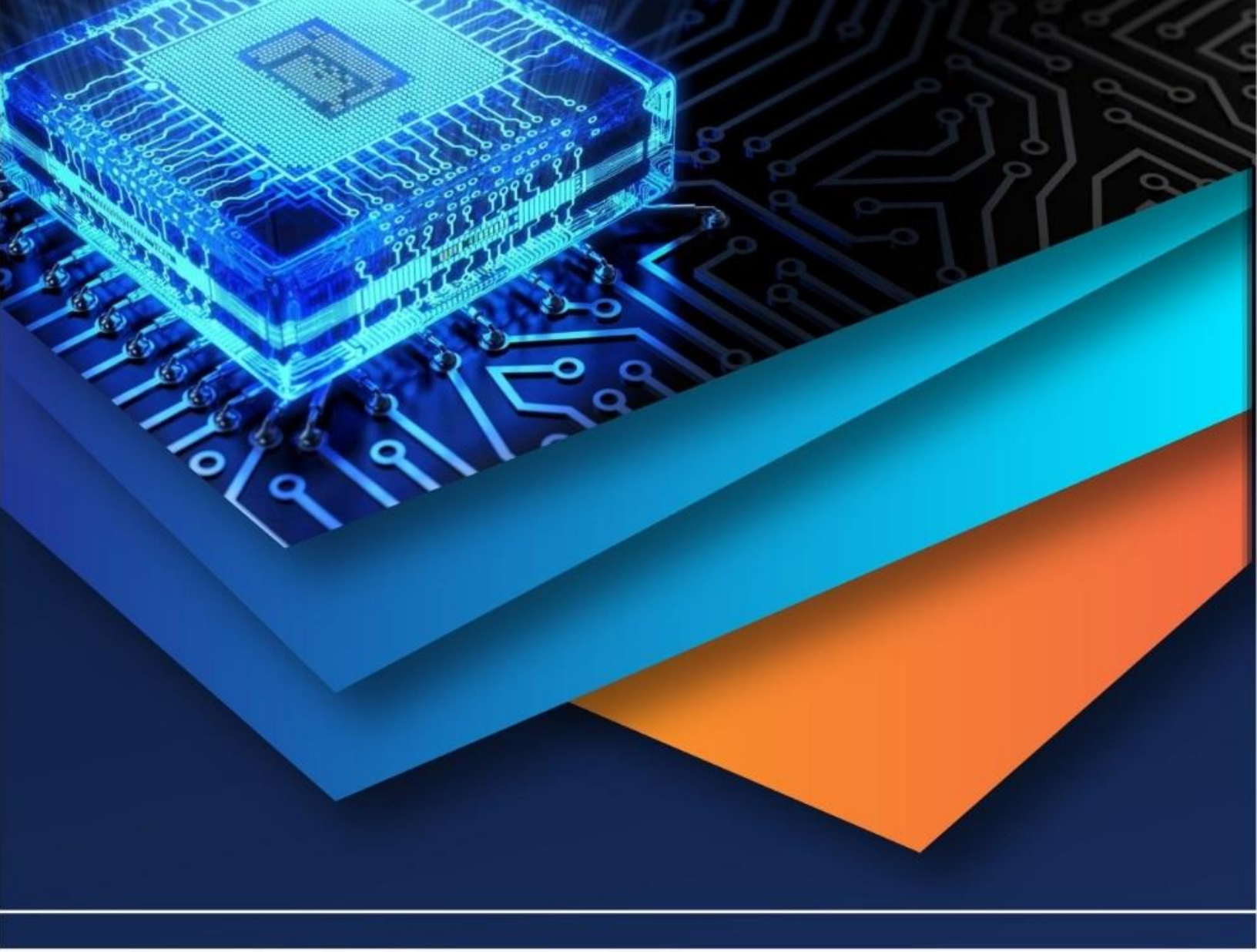
IX. CONCLUSION

Adoption of IoT-based irrigation systems in Indian agriculture has the potential to bring about a number of positive outcomes, including improved crop quality, increased crop yields, and optimal water use. The widespread adoption of IoT-based solutions in Indian agriculture, however, confronts a number of obstacles, including low farmer knowledge, expensive upfront costs, and spotty internet access in rural areas. Policymakers and stakeholders must take proactive measures to raise awareness, offer incentives for the adoption of IoT-based solutions, and enhance internet access in rural regions in order to promote the adoption of IoT-based solutions for water irrigation in Indian agriculture.

REFERENCES

[1] Agrawal, A., Bajaj, V., Singh, R., & Kumar, P. (2020). Adoption of IoT in Agriculture: Challenges and Opportunities in Indian Context. In Advances in Intelligent Systems and Computing (Vol. 1069, pp. 209-218). Springer.
[2] Balaji, V., & Arunachalam, R. (2019). Internet of Things Based Precision Agriculture System: A Survey. International Journal of Advanced Computer Science and Applications, 10(8), 454-462.
[3] Singh, N., Sharma, R., & Shukla, A. (2021). IoT in Agriculture: A Review of Indian Scenario. In Intelligent Systems and Applications (pp. 267-276). Springer.
[4] Survey conducted by the authors. (2023). Survey on the Adoption of IoT-based Solutions in Water Irrigation in Indian Agriculture. Unpublished raw data.

[5] Bansal, S., & Mehta, S. (2021). IoT based Smart Irrigation System: A Review. Journal of Critical Reviews, 8(4), 129-134.
[6] Chauhan, V. K., & Kumar, V. (2020). IoT Enabled Smart Irrigation System for Precision Agriculture. In 2020 International Conference on Emerging Trends in Information Technology and Engineering (ICETITE) (pp. 1-6). IEEE.
[7] Ghosal, A., & Sinha, A. K. (2019). Internet of Things (IoT) based Smart Agriculture: A Comprehensive Review. In 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1-6). IEEE.
[8] Jain, A., & Rana, R. (2019). IoT based Smart Agriculture using Machine Learning: A Review. In 2019 3rd International Conference on Computing Methodologies and Communication (ICCMC) (pp. 135-138). IEEE.
[9] Kumar, A., Mishra, M., & Tiwari, V. (2021). Smart Irrigation using IoT: A Review. International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 6(1), 1-7.
[10] Saha, S., & Ghosh, A. (2021). IoT based Smart Agriculture: An Overview of Technologies and Researches. In 2021 International Conference on Sustainable Energy and Green Technology (SEGT) (pp. 162-166). IEEE.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY