IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 8, August 2024

DOI: 10.17148/IJIREEICE.2024.12803

IoT Based Smart Irrigation Monitoring and Controlling System

Deepika N[1], Meghana B S[2]

Research Scholar, Dept. of MCA, P.E.S College of Engineering, Mandya, India[1]

Assistant Professor, Dept. of MCA, P.E.S College of Engineering, Mandya, India[2]

Abstract: Internet of Things (IoT) is an interconnection of devices that can used to transfer information over the internet and to control operations. In many rural areas, electricity supply can be unpredictable, often being available only during the night time. This makes difficult for farmers to manage irrigation, as they need to turn on water pumps at night. Operating water pumps at night poses risks. Farmers may encounter wild animals or other dangers while working in their fields during night hours. There have been chances where farm fields have caught fire, leading to significant crop loss. The lack of real-time communication is also major reason to this problems. Farmers often lack the means to communicate effectively with their fields, especially when issues like power supply, wild animals, or fires arise.

Keywords: Internet of Things (IoT), Soil Moisture Sensor, Water Level monitoring, Fire detection, Animal detection.

I. INTRODUCTION

This project aims to develop system which can measure the moisture level of the soil. By measure soil moisture system can automatically turn on / off the water pump to irrigate the soil. It gives the message when the water pump turn off to the User. And also the system can detect the animals present in the farm field by using the IR Sensor. If this sensor senses the animal, it gives a message to the User as animal detected, and also can detect the fire caught in the farm field using the fire sensor. If the sensor senses the fire, it gives the message for the User as fire detected. And also User can see the live camera feed using ESP 32 CAM.

II. RELATED WORK

IoT based Smart System for enhanced Irrigation in Agriculture: The proposed IoT-based smart farming system effectively enhances agricultural productivity by monitoring crucial soil and environmental parameters like moisture, temperature, and pH levels. Through the integration of sensors and microcontrollers, the system automates irrigation and soil management, reducing water wastage and improving crop yield. The implementation on the Thing Speak IoT cloud platform allows for remote monitoring and decision-making, ensuring better resource management in agriculture.

IoT based Soil Moisture Sensor for Smart Farming: The IoT-based soil moisture sensor system presented in this paper successfully enables real-time monitoring and analysis of soil moisture levels, optimizing irrigation for organic farming. By integrating sensing units, data processing, and user-friendly interfaces, the system enhances plant health and water management. This approach supports more efficient and effective precision agriculture practices.

IoT based low cost smart irrigation system: The proposed IoT-based smart irrigation system effectively manages water usage by monitoring soil moisture, temperature, and humidity in real-time, reducing water wastage up to 95%. By integrating wireless sensors and the MQTT protocol, the system ensures precise water delivery based on plant needs, enhancing agricultural efficiency and sustainability. This approach addresses water scarcity challenges while optimizing irrigation practices.

III. METHODOLOGY

1. Internet of Thing (IoT)

The Internet of Things (IoT) refers to a network of interconnected devices that transfer and exchange of data over the internet. These devices are always connected with sensors and actuators. They are used to collect and transmit data, and also enabling real-time monitoring, control, and automation of various systems and processes. IoT applications can include multiple sectors, they are smart homes, healthcare, industrial automation, agriculture, and transportation. By leveraging IoT technology, organizations can enhance efficiency, it reduce costs. Security and interoperability are critical considerations in IoT deployments to ensure data integrity and seamless integration.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 8, August 2024

DOI: 10.17148/IJIREEICE.2024.12803

2. Proposed Methodology

The brain of this system is Arduino microcontroller and in this system we have soil moisture sensor which will measure the moisture level of the soil and send the data to Arduino micro controller, and then the microcontroller will decide weather the water pump should turn on or off based on the moisture level of the soil. On the other hand we have animal detection using IR sensor which will help the farmer to get notification SMS when animals enters the farm field and he can view the live feed from the IP camera present in the farm field. We have fire detection using flame sensor which will help the farmer to get notification SMS when the fire has caught the farm field and he can view the live feed from the IP camera present in the farm field.

3. Flowchart of Implementation

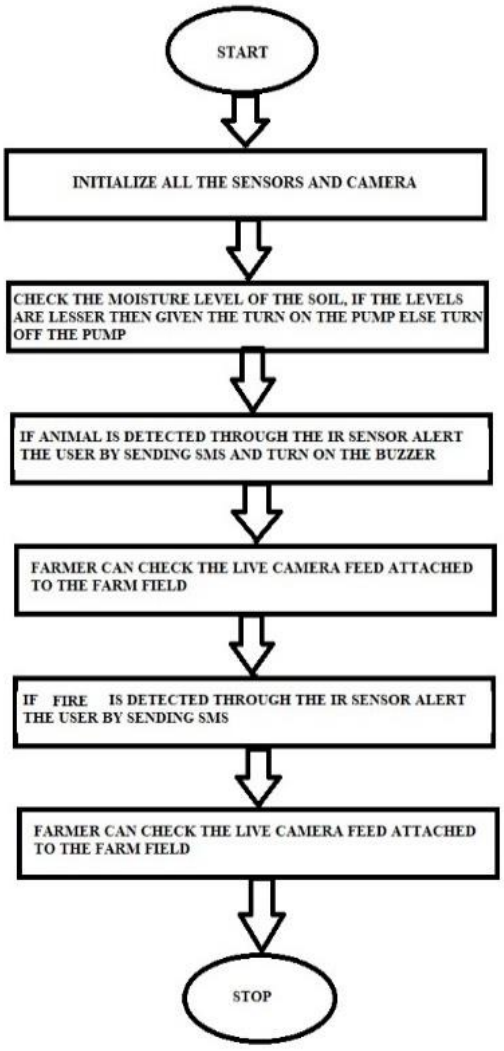

Fig 1: Flowchart

This outlines the steps involved in the moisture level checking process in IoT. It starts with the user initiating the check, followed by the activation of the moisture sensor, reading the moisture level, if the moisture level is lesser than 700 it turns on the pump and sends the message to the user. The process begins with the sensor detecting animal presence. If the sensor senses the animal present, it alerts the user by notified about the animal presence, the process begins with the sensor detecting flame presence. If the flame is present it alerts the user by notified about the flame presence.

IV. HARDWARE COMPONENTS

Arduino Uno: The Arduino Uno is the microcontroller board.

IR Sensor: An IR sensor detects infrared light, commonly used for motion detection or sensing, enabling the system to identify the presence of animals in the farm field.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 8, August 2024

DOI: 10.17148/IJIREEICE.2024.12803

Battery: A rechargeable battery provides portable power to the system.
Fluid Pump: A fluid pump is used to irrigate the farm field by moving water from a source to the soil.
Soil Moisture Sensor: A soil moisture sensor measures the water content in the soil.
Relay: A relay acts as an electrically operated switch that allow the Arduino to control high power devices to low-power signals like the water pump.
ESP32 CAM: The ESP32 CAM module combines an ESP32 microcontroller with a camera, enabling the system to provide live video streaming and surveillance of the farm field.
GSM Module: A GSM module allows the system to communicate over mobile networks, sending real-time alerts and notifications to the user through SMS.
Potentiometer: A potentiometer is a resistor used to adjust and control sensor thresholds or other parameters within the system.

V. IMPLEMENTATION

The proposed system introduces an automated irrigation system that leverages a combination of software and hardware solutions. To address the limitations of the existing manual irrigation methods. Key features of the proposed system include: Soil moisture sensor, water level monitoring, SMS controlled water pump, animal detection, fire detection.

1. Soil moisture sensor: the system incorporates a soil moisture sensor to measure the moisture content in the soil. This real-time data is crucial for determining when irrigation is required, preventing under- or over-irrigation and promoting optimal soil conditions for crop growth.

2. Animal detection: the system includes an animal detection feature to address the issue of animals damaging crops. IR sensors are employed to detect the presence of animals in the farm field during night time. Upon detection, an alert SMS are sent to the farmer. The farmer can then view the live feed from an ESP32 camera in the field to confirm the intrusion.

3. Fire detection: the system incorporates fire detection functionality to mitigate the risk of fire damage to crops. In the event of a fire outbreak, the system triggers an SMS to notify the farmer. The farmer can promptly assess the situation by accessing the live feed from the IP camera in the farm field.

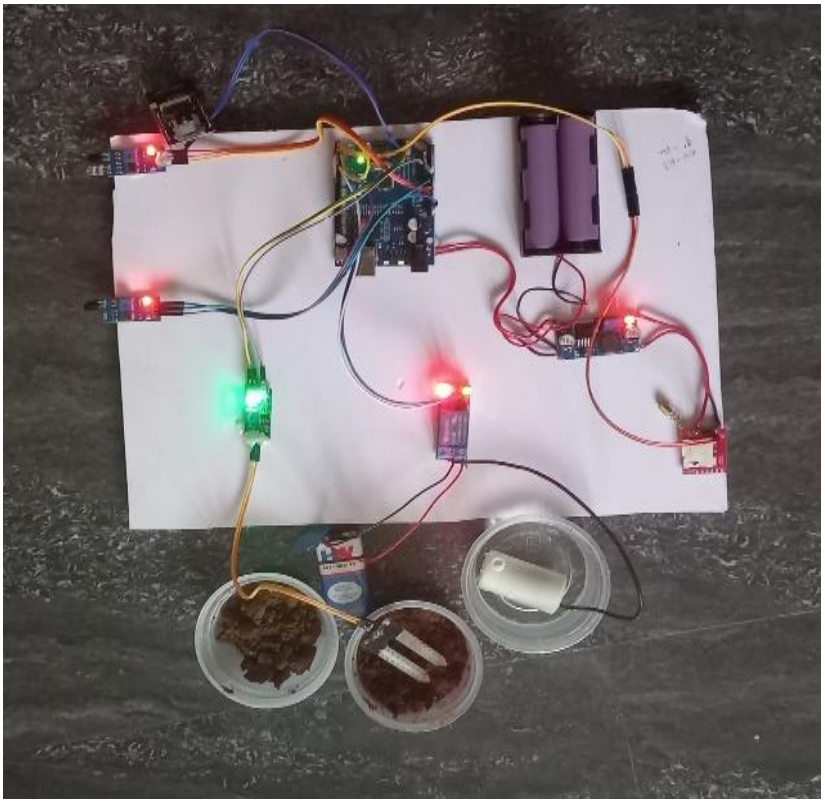

Fig 2: Connection of the Project.

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 8, August 2024

DOI: 10.17148/IJIREEICE.2024.12803

VI. RESULT

The system effectively prevents both under and over-irrigation by providing real-time soil moisture data, leading to optimal soil conditions and improved crop yield. This ensures efficient water usage and to get healthier crops. Continuous monitoring and automated control of the water pump ensure that soil moisture levels are maintained within the desired range. The animal detection feature successfully alerts the farmer, reducing crop damage caused by animals. This enhances crop protection and allows the farmer to take timely action by confirming intrusions via the live camera feed. The fire detection system provides a warning of fire outbreaks, allowing the farmer to quickly respond and mitigate potential damage. Access to live camera feeds enables immediate assessment and action, reducing the risk of significant crop loss.

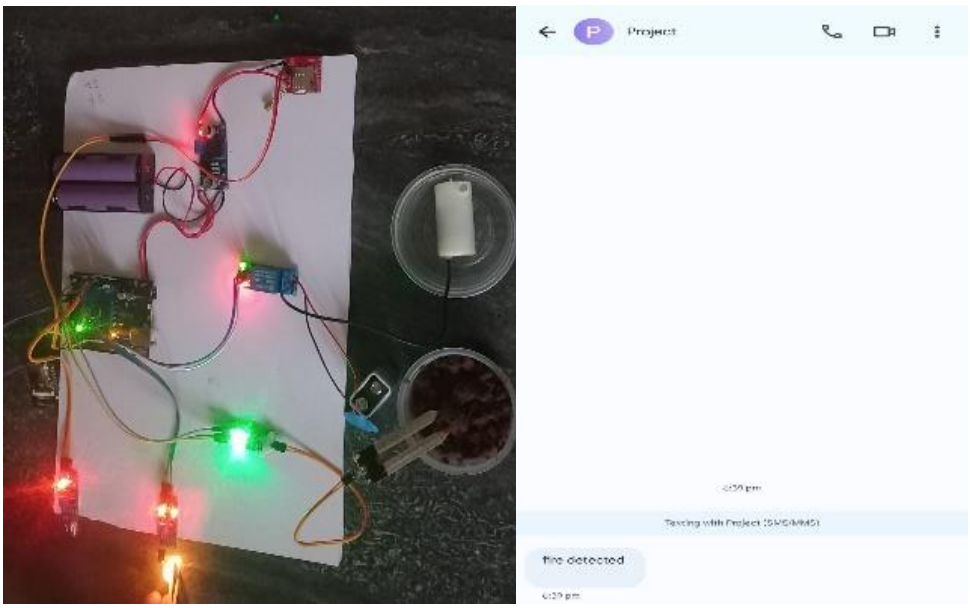

Fig 3: Fire detection

When the sensor detects Fire, it gives a message to the User as “fire detected”.

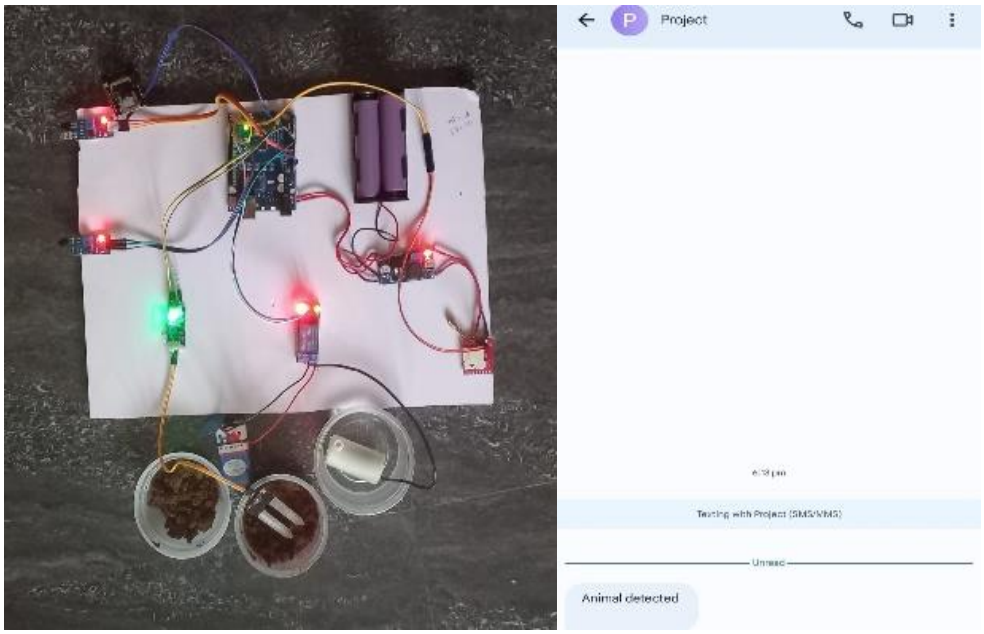

Fig 4: Animal detection

IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.021 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 12, Issue 8, August 2024

DOI: 10.17148/IJIREEICE.2024.12803

When the sensor detects Animal, it gives a message to the User as “Animal detected”.

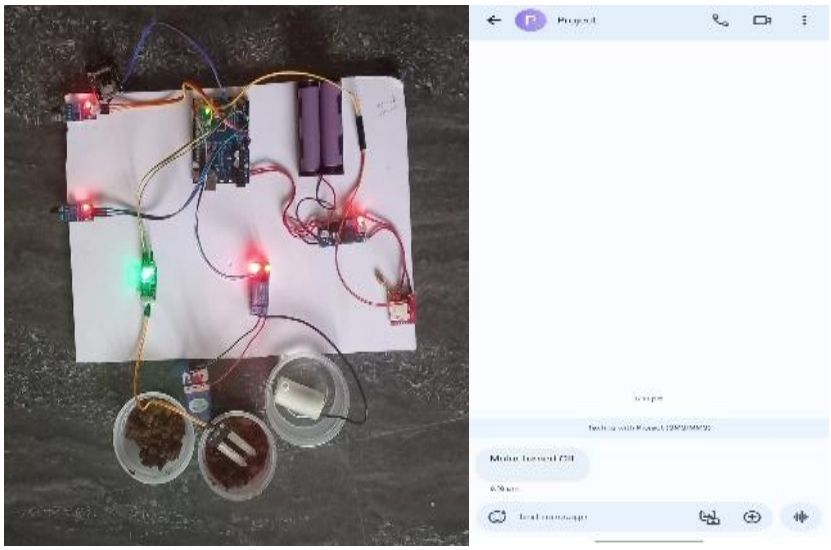

Fig 5: Motor turn/off

When the Moisture level exceeds the given value Motor is turned off. When the Moisture level lesser than the given value, it automatically turn on the pump and gives the Moisture level.

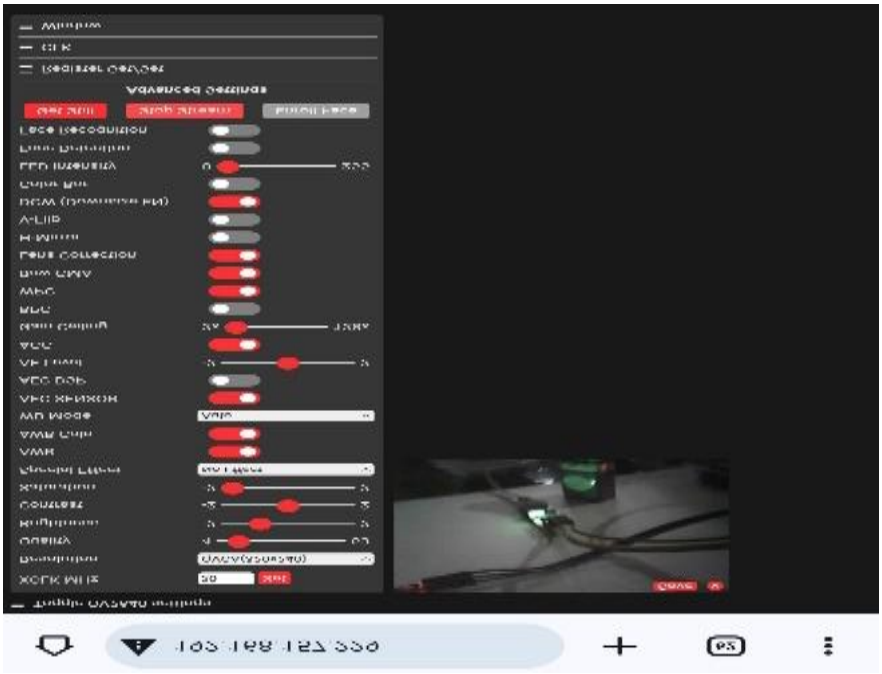

Fig 6: Farm live feed

User can see the farm field lively using ESP32 camera.

VII. CONCLUSION

The proposed automated irrigation system demonstrates significant improvements in resource efficiency, crop protection, and real-time monitoring. By integrating soil moisture sensors, water level monitoring, animal detection, and fire detection, the system ensures optimal irrigation and timely alerts for potential threats. This results in enhanced crop yield, reduced manual labor, and better overall farm management.

DOI: 10.17148/IJIREEICE.2024.12803

REFERENCES

[1] Yunseop (James) Kim, Member, IEEE, Robert G. Evans,and William 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, JULY 2008

[2]Purnima, S.R.N. Reddy, PhD "Design of Remote Monitoring and Control System with Automatic Irrigation System using GSMBluetooth" International Journal of Computer Applications (0975 – 888)Volume 47– No.12, June 2012.

[3] Xihai Zhang, Junlong Fang, Xiao Yu – 2010. "Design and Implementation of codes Based on CC2430 for the Agricultural Information Wireless Monitoring". IEEE.

[4] Vasif Ahmed, Siddharth A Ladhake – 2010. "Design of Ultra Low Cost Cell Phone Based Embedded System for Irrigation". IEEE.

[5]. Francois Depienne –2007. "Wireless Sensor Networks Application for Agricultural Environment Sensing in Developing Countries".

[6]Yunseop (James) Kim, Member, IEEE, Robert G. Evans, and William 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, JULY 2008

[7]Purnima, S.R.N. Reddy, PhD "Design of Remote Monitoring and Control System with Automatic Irrigation System using GSM Bluetooth" International Journal of Computer Applications (0975 – 888)Volume 47– No.12, June 2012.

[8] Xihai Zhang, Junlong Fang, Xiao Yu – 2010. "Design and Implementation of codes Based on CC2430 for the Agricultural Information Wireless Monitoring". IEEE.

[9] Vasif Ahmed, Siddharth A Ladhake – 2010. "Design of Ultra Low Cost Cell Phone Based Embedded System for Irrigation". IEEE.

[10] Francois Depienne –2007. "Wireless Sensor Networks Application for Agricultural Environment Sensing in Developing Countries".

[11] S. Christodoulou, A. Agathokleous, A. Kounoudes, M. Milis –2010.

[12] Wireless Sensor Networks for Water Loss Detection". E.W.Publications.

[12] William L. Kranz, Robert J. Evans, Freddie R. Lamm, Susan A. O'Shaughnessy, Troy G. Peters – 2010. "A Review of Center Pivot Irrigation Control and Automation Technologies". Paper Number: IRR10- 9632. ASABE conference.

[13] Y Zhang, L Wu, "Artificial Bee Colony for Two Dimensional Protein Folding", Advances in Electrical Engineering Systems, Vol.1, No.1, pp. 19-23, 2012.

[14] Mehdi Ghiyasvand, "A polynomial-time implementation of Pla's method to solve the MCT problem", Advances in Computational Mathematics and its Applications, Vol.1, No.2, pp. 104-109, 2012

[15] Y Zhang, L Wu, "A Robust Hybrid Restarted Simulated Annealing Particle Swarm Optimization Technique", Advances in Computer Science and its Applications, Vol.1, No.1, pp. 5-8, 2012.

[16] Yahya Qaid Hasan, "Modified Adomian decomposition method for second order singular initial value problems", Advances in Computational Mathematics and its Applications, Vol.1, No.2, pp. 94-99, 2012