International Journal of Engineering & Extended Technologies Research (IJEETR)

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 8, Issue 2, March - April 2026 |

DOI:10.15662/IJEETR.2026.0802190

IOT-Based Automatic Rain-Sensing Umbrella System for Rice Gudon Protection with an Automatic Hot Air Dryer System

Lavanya R, Rajagopal V, Umashsankgar T, Vinothini M, Ganeshkumar B

Dept. of Agricultural Engineering, Gnanamani College of Technology, Namakkal, Tamil Nadu, India

Publication History: Received: 25.02.2026; Revised: 20.03.2026; Accepted: 25.03. 2026; Published: 28.03.2026.

ABSTRACT: The agricultural storage sector faces significant losses every year due to improper protection of stored grains from environmental factors such as rain, humidity, and temperature variations. Rice godowns, in particular, are highly vulnerable to rainwater ingress and excess moisture, which can lead to fungal growth, spoilage, and quality degradation. This project presents an IoT-based automatic rain-sensing umbrella system designed specifically for rice godown protection, ensuring real-time response to changing weather conditions.

The proposed system uses a rain sensor to detect rainfall and automatically deploy a motorized umbrella or protective cover over the rice storage area using a relay-controlled mechanism. An ESP32 microcontroller acts as the central processing unit, handling sensor data, controlling actuators, and enabling IoT-based remote monitoring. Additionally, a heater unit is integrated to reduce internal moisture levels during rainy seasons, preventing condensation and mold formation. Environmental parameters and system status are monitored through an IoT platform, allowing users to observe real- time data and receive alerts.

This system minimizes manual intervention, improves grain safety, and ensures efficient environmental control inside rice godowns. The solution is cost-effective, scalable, and suitable for both small-scale and large-scale agricultural storage facilities.

KEYWORDS: IoT, Rice Godown Protection, Rain Sensor, ESP32, Automatic Umbrella System, Relay Control, Heater Control, Rainy Season Protection, Smart Agriculture, Environmental Monitoring

I. INTRODUCTION

Rice is one of the most widely consumed staple foods, and its storage plays a crucial role in food security. Rice godowns are commonly used for bulk storage, but they are often exposed to environmental risks, especially during the rainy season. Rainwater leakage, high humidity, and sudden weather changes can cause severe damage to stored rice, leading to economic losses for farmers and storage operators.

Traditional godown protection methods rely heavily on manual monitoring and labor-intensive solutions such as tarpaulin covers. These approaches are not only time-consuming but also unreliable during sudden rainfall or when human supervision is unavailable. With advancements in embedded systems and IoT technologies, automated solutions can be developed to enhance storage safety and efficiency.

This project introduces an IoT-based automatic rain sensing umbrella system that detects rainfall in real time and provides immediate protective action. The integration of ESP32 enables wireless connectivity, while sensors and actuators ensure autonomous operation. The inclusion of a heater further enhances protection by maintaining optimal internal conditions during prolonged rainy periods.

II. LITERATURE REVIEW

1.SK Subhani, M Lakshmi Niveditha, K Yaswanth Krishna, K Shushma,G Venkateswara Reddy
Agricultural nations like Bangladesh experience significant crop losses due to unseasonal rainfall, negatively impacting the economy. This project proposes an automated shed system designed to protect crops and plants from unexpected rain in a cost-effective, innovative, and efficient manner. The system operates autonomously, utilizing a rain sensor to

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 8, Issue 2, March - April 2026 |

DOI:10.15662/IJEETR.2026.0802190

detect rainfall and trigger the automatic opening of the shed. Once the rain stops, the shed closes automatically, ensuring minimal human intervention. The system incorporates an umbrella-like shed mechanism, powered by a high-torque motor and controlled by an Arduino microcontroller. By implementing this automated rain protection system, farmers can safeguard their crops, leading to increased agricultural productivity and enhanced economic stability in the sector.

2.YRK Paramahamsa, M. Tech, T. Chinna Kalyani2, M. Lidhin …
Agricultural countries like Bangladesh lose large amounts of crops due to unseasonal rain, which is concerning to the country's economy. This project aims to deliver a proper shed system for saving crops or plants from unwanted rain, which is innovative, cheaper, and effective. The most important advantage of this system is that it is fully automated such as: When it rains, the shed system opens automatically, and when it stops raining, the shed system closes automatically by sensing the rain with the help of a rain sensor and the user will be notified through IoT. For IoT purposes, a Wi-Fi module is used and for this, it is possible to get notifications on phone. This project also describes the project model, testing, and hardware. This system consists of the innovative design of an umbrella system for the shed system, which opens and closes with the help of a hightorque motor and is fully automated and controlled by Arduino. This umbrella shed system is the heart of the project which will protect the crops from unwanted rain as a result people will be benefitted and the economy in the agriculture sector will rise beyond expectations.

3. Meven Philippe Nantes Université, 2023
The present thesis aims at getting new understandings on how ground water ice and periglacial processes influence surface geomorphology on Earth and on Mars. I am hence investigating two periglacial landforms: molards and thermal-contraction polygons. On Earth, molards are cones of loose debris found in landslide deposits. It was recently attested that they are former ice-cemented blocks of sediment, that were transported by a landslide and progressively degraded within its deposits into conical shapes. They could represent accurate spatial and temporal markers of the degradation of mountain permafrost. Therefore, I provide here a systematic way to study molards, based on analogue modelling experiments monitored by an automated time-lapse photogrammetry system I developed. I also present a study on the firstly-identified potential martian molards, that provide insights into the geological setting of the ejecta from the Hale crater. Terrestrial thermal-contraction polygons are known to result from the thermal contraction of ground ice, which forms surficial networks of polygonal fractures.Water or lithic material can infill those fractures, and with repeated freeze-thaw cycles of water generate polygons with various morphologies. On Mars, polygons of similar dimensions and showing similar morphologies are observed.

Proposed system :
The proposed system is an IoT-based automatic rain sensing umbrella mechanism designed to protect materials undergoing sun drying while ensuring uninterrupted and efficient drying.

KEY FEATURES:
- Automatic Rain Detection.
- IoT Cloud Monitoring.
- ESP32 Microcontroller Control.
- Automatic Roof Closing and Opening System.
- Hot Air Dryer System.
- Relay-Based Device Control.
- Protection of Stored and Drying Rice.
- Energy Efficient Operation.
- Reduced Manual Labor.
- Real-Time System Status Monitoring.

III. METHODOLOGY

- STEP 1:Initialize ESP32, sensors, relays, and IoT connection.
- STEP 2:Continuously monitor rain sensor output.
- STEP 3:If rain detected, activate relay to deploy umbrella.
- STEP 4:Upload status to IoT platform.
- STEP5:During rainy season, activate heater based on preset conditions.
- STEP 6:If rain stops, retract umbrella.
- STEP 7:Repeat process continuously

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 8, Issue 2, March - April 2026 |

DOI:10.15662/IJEETR.2026.0802190

Components:

1. Rain sensor
   A rain sensor detects water droplets when rain falls on its conductive plate.
2. ESP32 (Microcontroller)
   The ESP32 is the main microcontroller used to control the entire system.
3. Relay Control
   A relay module works like an electronic switch controlled by the ESP32.
4. Heater Control
   The heater produces hot air used to dry the rice during rainy conditions.
5. Environmental Monitor
   Environmental monitoring sensors measure temperature and humidity in the drying area.
6. Rainy Season Protection
   During the rainy season, sudden rainfall can damage drying rice.
7. Automatic Sheet System
   The automatic sheet system uses a motor or actuator to open and close the protective sheet.

IV. WORKING

The system operates on the principle of real-time environmental sensing and automated response. The rain sensor detects water droplets and sends a signal to the ESP32. Based on predefined threshold values, the controller decides whether to deploy or retract the umbrella system.

Simultaneously, the ESP32 monitors seasonal conditions. During rainy seasons, the heater is activated to prevent moisture accumulation inside the godown. Relay modules act as switching devices, isolating low-power control circuits from high-power actuators. All operational data is transmitted to an IoT platform, enabling continuous monitoring and control.

Advantages :

- Provides automatic protection from unexpected rainfall.
- Ensures continuous drying using hot air when sunlight is unavailable.
- Reduces manual labor and constant supervision.
- Prevents moisture absorption, spoilage, and microbial growth.
- Improves product quality and drying efficiency.
- Enables real-time monitoring and remote control through IoT.
- Saves time and reduces economic losses.
- Suitable for agriculture, food processing, and small-scale industries.

Energy-efficient and cost-effective drying solution.

V. RESULT

The developed system successfully detected rainfall and automatically deployed the protective umbrella. The heater effectively reduced internal moisture during rainy conditions. IoT monitoring provided real-time visibility and improved operational control

VI. CONCLUSION AND FUTURE WORK

The IoT-based automatic rain sensing umbrella system offers an effective and intelligent solution for rice godown protection. It minimizes losses due to rain and moisture while enhancing operational efficiency.

Future enhancements may include humidity sensors, solar-powered operation, predictive weather-based control, SMS alerts, and integration with smart agricultural management systems

|ISSN: 2322-0163| www.ijeetr.com | A Bimonthly, Peer Reviewed, Scholarly Indexed Journal |

| Volume 8, Issue 2, March - April 2026 |

DOI:10.15662/IJEETR.2026.0802190

REFERENCES

1. Singh, R., & Kumar, P. (2020). Design and development of automatic rain sensing roof system for outdoor drying protection. Proceedings of the IEEE International Conference on Smart Systems and Inventive Technology.
2. Sharma, A., & Gupta, V. (2019). IoT-based environmental monitoring and automatic control system for agricultural applications. Published by Springer in Advances in Intelligent Systems and Computing.
3. Patel, H., & Mehta, R. (2021). Smart solar drying system with automated weather protection using IoT sensors. International Journal of Engineering Research & Technology (IJERT), 10(5), 234–239.
4. C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor &Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011. DOI: 10.1080/15325008.2010.541746
5. Poornima, G., & Anand, L. (2025). Medical image fusion model using CT and MRI images based on dual scale weighted fusion based residual attention network with encoder-decoder architecture. Biomedical Signal Processing and Control, 108, 107932.
6. Gopinathan, V. R. (2023). Cloud-First AI Security Architecture for Protecting Enterprise Digital Ecosystems and Financial Networks. International Journal of Research and Applied Innovations, 6(6), 10031-10039.
7. Rajasekar, M. (2024). Secure Digital Banking with Federated AI: An AWS Cloud-Based Predictive Analytics Architecture for Financial Risk Intelligence. International Journal of Research and Applied Innovations, 7(3), 10735-10740.
8. C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of Electrical Engineering, Vol.63 (6), pp.365-372, Dec.2012. DOI: 10.2478/v10187-012-0054-2
9. C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011. DOI 10.1007/s00202-011-0203-9
10. S.Tamilselvi, R.Prakash, C.Nagarajan,"Solar System Integrated Smart Grid Utilizing Hybrid Coot-Genetic Algorithm Optimized ANN Controller" Iranian Journal Of Science And Technology-Transactions Of Electrical Engineering, DOI10.1007/s40998-025-00917-z,2025
11. S.Tamilselvi, R.Prakash, C.Nagarajan," Adaptive sliding mode control of multilevel grid-connected inverters using reinforcement learning for enhanced LVRT performance" Electric Power Systems Research 253 (2026) 112428, doi.org/10.1016/j.epsr.2025.112428
12. S.Thirunavukkarasu, C. Nagarajan, 2024, "Performance Investigation on OCF and SCF study in BLDC machine using FTANN Controller," Journal of Electrical Engineering And Technology, Volume 20, pages 2675–2688, (2025), doi.org/10.1007/s42835-024-02126-w
13. C. Nagarajan, M.Madheswaran and D.Ramasubramanian- 'Development of DSP based Robust Control Method for General Resonant Converter Topologies using Transfer Function Model'- Acta Electrotechnica et Informatica Journal , Vol.13 (2), pp.18-31,April-June.2013, DOI: 10.2478/aeei-2013-0025.
14. C.Nagarajan and M.Madheswaran - 'DSP Based Fuzzy Controller for Series Parallel Resonant converter'- Springer, Frontiers of Electrical and Electronic Engineering, Vol. 7(4), pp. 438-446, Dec.12. DOI 10.1007/s11460-012-0212-0.
15. C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
16. C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
17. Suganthi Mullainathan, Ramesh Natarajan, "An SPSS and CNN modelling based quality assessment using ceramic materials and membrane filtration techniques", Revista Materia (Rio J.) Vol. 30, 2025, DOI: https://doi.org/10.1590/1517-7076-RMAT-2024-0721
18. M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
19. Kumar, S., & Reddy, M. (2018). Automatic rain sensing window and roof control using microcontroller. International Journal of Innovative Research in Science, Engineering and Technology, 7(4), 1120–1125.
20. Documentation and hardware design guides from Arduino for sensor interfacing, motor control, and IoT system development.