



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(3): 211-216
Received: 17-12-2025
Accepted: 21-01-2026

Mohammed Mudassir
B. Tech. Student, Department of
Processing and Food Engineering,
College of Agricultural
Engineering, Kandi, Professor
Jayashankar Telangana
Agricultural University,
Telangana, India

Dr. M Padma
Associate Professor & HOD,
Department of Processing and
Food Engineering, College of
Agricultural Engineering, Kandi,
Professor Jayashankar Telangana
Agricultural University,
Telangana, India

Pandhilla Sai Priya
B. Tech. Student, Department of
Processing and Food Engineering,
College of Agricultural
Engineering, Kandi, Professor
Jayashankar Telangana
Agricultural University,
Telangana, India

Thota Navya
B. Tech. Student, Department of
Processing and Food Engineering,
College of Agricultural
Engineering, Kandi, Professor
Jayashankar Telangana
Agricultural University,
Telangana, India

Corresponding Author:
Mohammed Mudassir
B. Tech. Student, Department of
Processing and Food Engineering,
College of Agricultural
Engineering, Kandi, Professor
Jayashankar Telangana
Agricultural University,
Telangana, India

Design and development of a low cost automated paddy dryer by using sensor

Mohammed Mudassir, M Padma, Pandhilla Sai Priya and Thota Navya

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i3Sc.5309>

Abstract

Post-harvest losses in paddy due to improper and uncontrolled drying remain a major challenge for small and marginal farmers, affecting grain quality, storage stability, and market value. Conventional sun drying depends heavily on weather conditions, requires more labor, and often results in uneven drying and grain cracking. To address these issues, this project focuses on the design and development of a low-cost automated paddy dryer using sensor-based technology for efficient and uniform drying. The system integrates temperature and humidity sensors with a microcontroller to continuously monitor and regulate the drying environment. A controlled heating element and forced air circulation system maintain optimal conditions. Based on real-time sensor feedback, the system automatically adjusts temperature and airflow to ensure safe moisture removal. Freshly harvested paddy with an initial moisture content of 22–25% is dried to a safe storage level of 12–14%. The dryer has a capacity of 5kg/hr, reduces drying time, and consumes less energy than traditional methods. Experimental results showed improved drying efficiency, uniform moisture distribution, and minimal grain damage. The system is cost-effective, reliable, and suitable for small-scale farm

Keywords: Paddy grains, moisture content, temperature, drying rate, humidity, sensors, agricultural sector, flow rate

1. Introduction

Paddy is one of the most important cereal crops cultivated in India and serves as a primary source of income for millions of small and marginal farmers. After harvesting, freshly collected paddy contains high moisture content (usually between 20–25%), which must be reduced to a safe storage level of around 12–14% to prevent fungal growth, spoilage, and quality deterioration. Traditionally, farmers depend on open sun drying, where the paddy is spread over open grounds and manually turned several times. Although this method is simple and cost-effective, it is highly weather-dependent, time-consuming, and inconsistent in quality, often resulting in uneven drying and loss of grains due to wind, birds, and rain.

To overcome these limitations, mechanical dryers have been developed, but their high initial cost, power consumption, and complex operation make them unsuitable for small-scale farmers. Therefore, there is a strong need for a low-cost, energy-efficient, and automated drying system that can be easily operated in rural areas with minimal technical skills.

The proposed low-cost automated paddy dryer aims to address these issues by integrating sensor-based automation with a rotary drum drying mechanism. The system utilizes sensors to continuously monitor temperature, humidity, and moisture content of the drying air and paddy grains. An Arduino-based microcontroller automatically controls the heater and fan to maintain optimum drying conditions, ensuring uniform and efficient moisture removal.

By using locally available materials such as mild steel, GI sheets, and simple heating components, the overall fabrication cost is minimized. The automated control reduces the need for manual supervision, saves energy, and provides consistent drying results. This project not only enhances the quality and shelf life of paddy grains, but also contributes to reducing post-harvest losses, thus improving the economic sustainability of small and marginal farmers.

Objectives

- To design an automated and sensor-based paddy dryer, integrated with sensors to monitor temperature, humidity, and moisture.
- To evaluate the performance efficiency of a low-cost automated paddy drum dryer by measuring, moisture reduction pattern.
- To Reduce drying time, energy use, and post-harvest losses.

2. Materials and Methods

This project was carried out in two major phases: the fabrication of the paddy dryer and the development of a sensor-based drying system for paddy. This chapter describes the materials used and the methods followed for the successful development of the system.

2.1 Design of a Frame Support

The frame support was fabricated using mild steel materials to ensure strength and stability. Four vertical supports were made from MS square pipes of 50 cm length. Horizontal supports were provided using MS L-angles, with two pieces of 67 cm (lengthwise) and two pieces of 34 cm (widthwise). Additional cross supports made of MS square pipes (2–4 pieces) were used for rigidity. All the components were joined using 2–3 mm mild steel welding electrodes through arc welding.



Fig 1: Frame

2.2 Design of Cylindrical using GI Sheet Mesh for Paddy Dryer

The cylindrical mesh used in the paddy drum dryer was made from galvanized iron (GI) sheet with a thickness of 0.5–1.0 mm to ensure it is lightweight and rigid. The mesh size was maintained between 1–1.5 mm to allow proper airflow while retaining paddy grains. The cylinder was designed with a length of 50 cm, an inner diameter of 14 cm, and an outer diameter of 16 cm, maintaining a small clearance of about 1 mm between the drum and the mesh cylinder for smooth placement.



Fig 2: Perforated mesh cylinder

The GI sheet was first measured, marked, and cut to the required size. Mesh holes were then created on the sheet, after which the sheet was rolled into a cylindrical shape using a rolling jig or manual method. The overlapping edges were tack-welded and then fully welded to secure the cylindrical structure. Finally, the weld joints were smoothed and the mesh cylinder was checked for proper dimensions and fitting inside the drum.

2.3 Design of Screw Conveyor System

The screw conveyor system was designed to transport paddy inside the dryer. The main components used were a mild steel (MS) shaft of 15 mm diameter and about 820 mm length, helical flights made from MS material, two pillow block bearings with bronze bushes, Fasteners, welding electrodes, and protective coatings such as Teflon were also used



Fig 3: Screw conveyor

During fabrication, the MS shaft was first cut to the required length and marked for flight positions. The helical flight was formed by bending MS material into a spiral shape and then tack-welded to the shaft. After proper alignment, full welding was carried out to secure the flights. The welded assembly was cleaned, ground, and coated with Teflon to reduce friction and prevent sticking of grains.

Finally, the shaft was fitted with bushes and bearings, mounted inside the housing, and connected to the motor using a coupling. The system was then tested by rotating the conveyor to ensure smooth and vibration-free operation.

2.4 Design of Inlet and Outlet

The inlet and outlet system was fabricated using GI or mild steel sheets of 1.6–2 mm thickness. First, a 50 mm × 50 mm top square opening was cut and cone-shaped panels were formed and welded together to create the hopper. A short square pipe (50 mm × 50 mm) and a long square pipe (45 mm) were attached at the cone outlet and welded properly. Next, a tapered adapter was fabricated using sheet metal panels to connect the cone to a rectangular chute. The chute was attached and reinforced if necessary. Mounting flanges were provided to fix the hopper to the frame. An inspection port of about 100 mm diameter was also added for cleaning and maintenance. Finally, all welds were ground smooth, and the surface was cleaned and coated to reduce friction and prevent corrosion.



Fig 4: Inlet and outlet

2.5 Installation of Heat Chamber

The heat chamber was designed to supply hot air for drying paddy. It operates on 230 V AC power using a nichrome heating coil with a power capacity of 1.5–2 kW, suitable for drying about 10 kg of paddy per batch. A centrifugal blower (100–250 W) was used to circulate air at a capacity of about 0.07–0.1 m³/s, maintaining an adjustable air temperature of 40–60 °C. The chamber was fabricated using GI or mild steel sheets (about 2 mm thickness) and insulated with glass wool or ceramic wool to reduce heat loss. Air was supplied to the drying chamber through a 75–100 mm diameter duct. Electrical components such as a switch, thermostat, and temperature controller were used to regulate the heating system.



Fig 5: Heater cum Blower

2.6 Arduino UNO Microcontroller

Grain moisture content is an important factor in post-harvest management as it affects storage quality and processing. Traditional methods like oven drying are accurate but time-consuming. In this study, a low-cost Arduino Uno-based system was developed to measure grain moisture using an analog moisture sensor. The Arduino processes the sensor readings and converts them into moisture percentage through calibration. The system provides fast, portable, and non-destructive moisture measurement suitable for field and storage applications.

Objectives

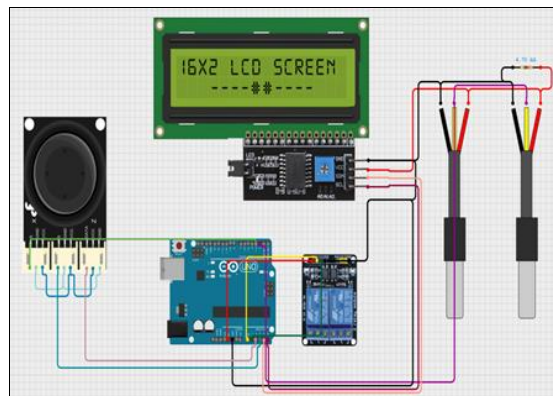
- To design a low-cost grain moisture measurement system using Arduino Uno.
- To measure analog sensor data and convert it into percentage moisture content.
- To calibrate the sensor readings using dry and wet reference samples.
- To display moisture percentage in real time for field usability.

2.7 Materials and Components

The system consists of an Arduino Uno microcontroller, an analog moisture sensor (resistive or capacitive type), jumper wires, and a breadboard for circuit connections. A 5 V DC power supply from a USB or adapter is used to operate the system, and the readings are displayed through the serial monitor or an LCD display.

Working Principle

The sensor works based on the change in electrical resistance or capacitance of grains with moisture content. Dry grains show higher resistance, while wet grains show lower resistance. The sensor outputs an analog voltage that is read by the Arduino ADC, converting it into a digital value (0–1023). After calibration, this value is mapped to display the moisture percentage (0–100%).



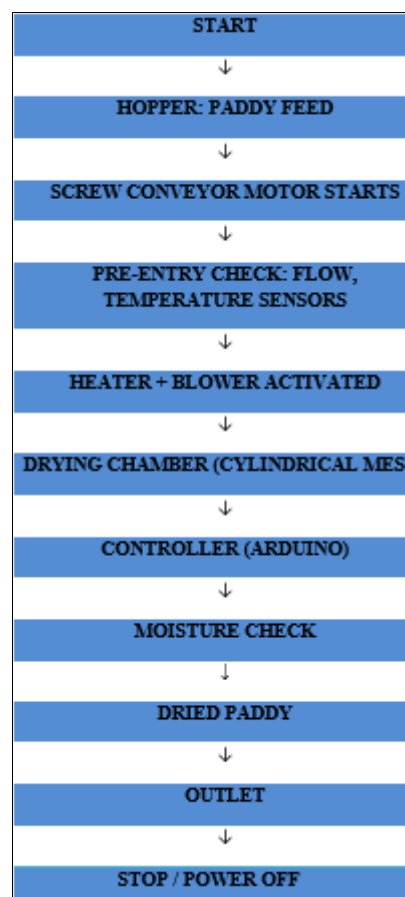
2.8 Circuit Diagram Description

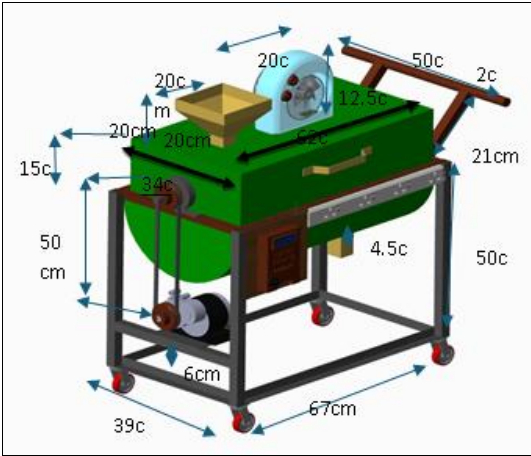
- The sensor's analog output is connected to Arduino A0.
- VCC and GND of the sensor are connected to 5V and GND of Arduino.
- The measured values are displayed through the Serial Monitor.

2.9 Algorithm / Flowchart

1. Start the system.
2. Initialize serial communication.
3. Read analog value from the sensor pin.
4. Map the sensor value to moisture percentage.
5. Constrain the output to 0–100%.
6. Display the value on the serial monitor.
7. Repeat every second

2.10 Process Flowchart

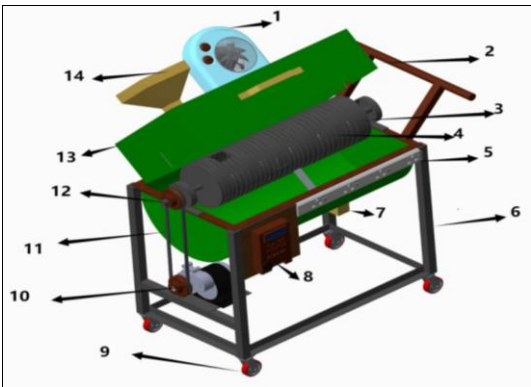




2.11 3D Module of Paddy dryer with its components

1.	Heater	8.	Sensors system
2.	Handle	9.	Wheel
3.	Screw conveyor	10.	Motor
4.	Cylindrical mesh	11.	Belt
5.	Switch board	12.	Shaft
6.	Frame	13.	Top cover
7.	Outlet	14.	Hopper

2.12 3D module with its Dimensions



3. Results and Discussion

3.1 Sun Drying

Weight of grains: 1000 g
Initial moisture: 19.8%

Table 1: Time vs Relative Humidity

Time in minutes	RH in%
10	24
20	22
30	21
40	20
50	20
60	20
70	20

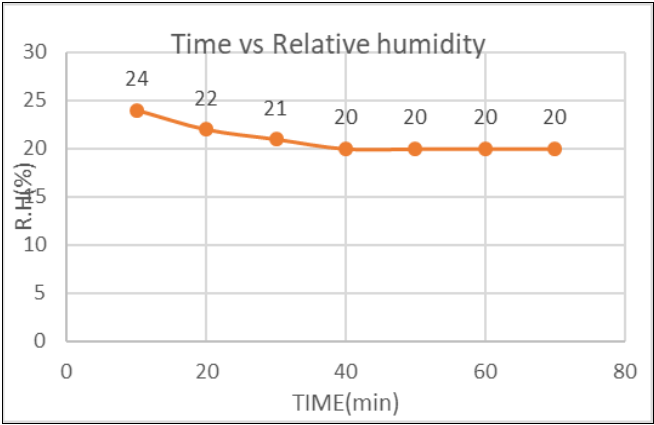


Fig 6: Time vs Relative humidity

Table 2: Time vs moisture

Time in minutes	Moisture in%
10	19.4
20	18.1
30	16.9
40	16.9
50	15.4
60	15.4
70	12.9

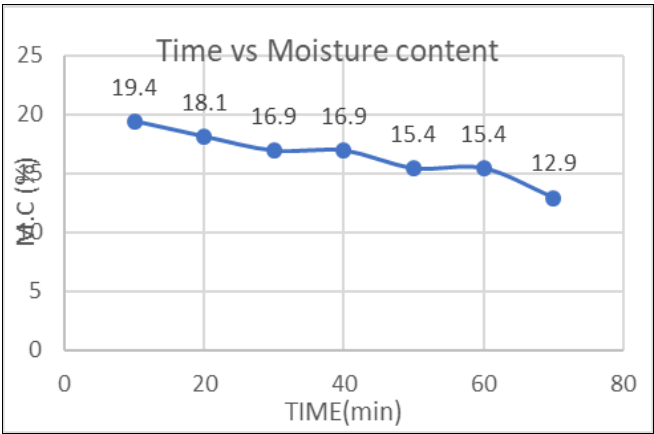


Fig 7: Time vs Moisture content

3.2 Paddy Drying

Temperature: 40°C
Weight: 1000g
Initial moisture: 19.4%

Table 3: Time vs Relative humidity

Time in minutes	RH in%
10	24
20	21
30	20
40	20
50	20

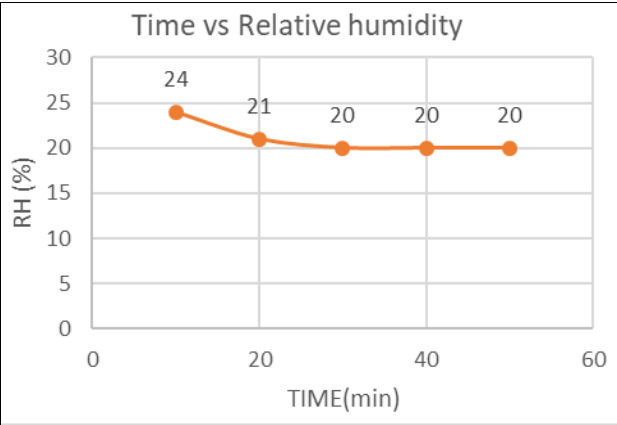


Fig 8: Time vs Rilative Humidity

Table 4: Time vs Moisture content

Time in minutes	Moisture in%
10	19.1
20	17.1
30	16.5
40	15.2
50	12.5

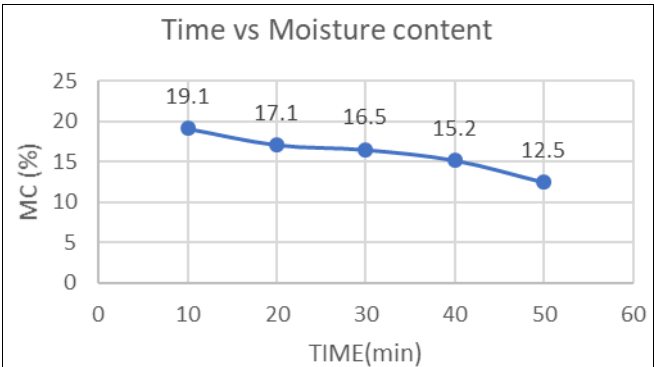


Fig 9: Time vs Moisture content

4. Conclusion and Summary

The integration of the Arduino microcontroller into the rice drying process represents a significant advancement in agricultural technology, namely in the critical post-harvest stage. This system utilizes a DS18B20 temperature sensor to provide accurate monitoring and control of the temperature in the drying environment. This degree of control is crucial in minimizing frequent post-harvest concerns like mold development or unintended germination owing to inappropriate drying temperatures. Another important component in the system is the use of a Nichrome wire heater cum blower. The Nichrome wire heater cum blower offers a reliable and even heat source, which sets it apart from other drying techniques. Uniformity is essential to provide equal drying of all rice grains, hence reducing the occurrence of partly dried grains that might result in a decline in quality. Moreover, the inclusion of a blower facilitates the dispersion of heat and the elimination of humid air from the drying chamber. This not only enhances the effectiveness of the drying process but also leads to a more consistent drying environment. The integration of these components enables a rapid decrease in moisture levels in rice batches, which is crucial for maintaining the quality and durability of the stored grain. The system’s capacity to process up to 5 kg/hr each operation

makes it adaptable and suitable for rice fields of different sizes. This scalability is vital for its adoption in many agricultural contexts, from small family farms to major commercial enterprises. To summarize, this rice grain drier, which is controlled by an Arduino, demonstrates the capability of incorporating intelligent technology into agriculture. Compared to older techniques, it enables a more efficient, regulated, and quality-consistent drying process. This technological breakthrough not only boosts the quality of the rice but also has the potential to raise the overall efficiency and profitability of rice cultivation by minimizing losses associated with poor post-harvest management.

References

1. Ayong Hiendro A, *et al.* Development of a real-time paddy grain drying and monitoring system utilizing long range Internet of Things (LoRa-IoT) technology to ensure product quality and safety throughout the drying process. *Journal of Smart Agricultural Technology.* 2025;12(3):215-223. https://www.researchgate.net/publication/LoRa-IoT_Paddy_Drying_System
2. Chokphoemphun S, Donmuang A, Mongkolvai J, Hongkong S. Design and performance evaluation of a tray-type paddy dryer allowing gravity-assisted downward flow for uniform drying. *Asian Journal of Agricultural Engineering.* 2025;18(2):144-152. https://www.researchgate.net/publication/Tray_Type_Paddy_Dryer_Design
3. Fernando AJ, Wimalaweera TPM, Weerasooriya GVTV, Bandara DMSP. Drying performance of electric-powered hot-air batch dryer for freshly harvested paddy (BG350) at different moisture contents. *Sri Lankan Journal of Agricultural Sciences.* 2025;33(1):58-65. https://www.researchgate.net/publication/Hot_Air_Paddy_Dryer_BG350
4. Ying T, Spang ES. Specific energy consumption and efficiency evaluation in paddy drying processes: a comparative study. *Renewable Energy in Agriculture.* 2024;9(4):101-109. https://www.researchgate.net/publication/Specific_Energy_Consumption_Paddy_Drying
5. Nebrida AP. Development of an Arduino-based rice grain drying system to prevent post-harvest losses and maintain grain quality. *International Journal of Smart Farming.* 2024;5(2):45-52. https://www.researchgate.net/publication/Arduino_Rice_Drying_System
6. Alam MS, Wazed MA, Hasan SMK, Alam MS, Sarker MSH. Design and testing of a mobile hybrid grain and seed dryer (HMD) for efficient drying of paddy. *Bangladesh Journal of Agricultural Engineering.* 2024;41(1):72-80. https://www.researchgate.net/publication/Mobile_Grain_Seed_Dryer_HSTU
7. A’yuni DQ, Kurniawan D, Prayoga MPI, Kumoro AC, Djaeni M, Subagio A. Improvement of paddy drying efficiency through controlled heat and airflow systems. *Journal of Agricultural Processing and Technology.* 2024;15(2):231-238. https://www.researchgate.net/publication/Paddy_Drying_Efficiency_Control
8. Leilayi M, Arabhosseini A, Kianmehr MH, Amiri H. Design, construction and performance evaluation of paddy rice solar drum dryer equipped with perforated drum. *Clean Energy.* 2023;7(2):328-339.

https://skoge.folk.ntnu.no/prost/proceedings/ecce6_sep07/upload/4032

9. Akhtaruzzaman M. Evaluation of drying characteristics, energy consumption and quality of parboiled paddy: two-stage drying. Journal of Agriculture and Food Research. 2022;10:100284-100284.
<https://doi.org/10.1016/j.jafr.2022.100284>