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Chaff Cutter Machine Using IOT

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Abstract: ***The Chaff Cutter Machine integrated with IoT technology represents a significant advancement in agricultural automation. This system is designed to streamline the process of chopping fodder for livestock, providing an efficient and reliable means to manage large-scale farming operations. The IoT integration allows for remote monitoring and control, ensuring optimal operation with minimal human intervention. By leveraging sensors and data analytics, the system can adjust cutting speed and blade sharpness according to the type of fodder, enhancing efficiency. This innovation reduces labour costs and ensures consistent feed quality, improving livestock health.***
Keywords: IoT, Chaff Cutter, Agriculture, Automation, Arduino, Sensors.

I. INTRODUCTION

The agricultural sector is undergoing a transformative shift with the adoption of smart technologies aimed at improving productivity and reducing labour. One such innovation is the IoT-based Chaff Cutter Machine, designed to automate fodder preparation. In traditional setups, chaff cutters require continuous manual intervention, leading to inefficiencies and inconsistencies in fodder quality.

By embedding sensors, connectivity modules, and data processing capabilities into these machines, farmers can remotely monitor, control, and optimize the chaff-cutting process. IoT- enabled chaff cutters offer benefits such as operational optimization and enhanced safety. This paper outlines the design, implementation, and performance evaluation of the IoT-based machine.

II. METHODOLOGY

A. Retrofitting the Mechanical Chaff Cutter

The development began by selecting a conventional mechanical chaff cutter as the base model, providing a sturdy platform for smart integration.

B. Sensor Integration and Calibration

1) Rotary Encoders: Installed on the blade shaft to measure blade speed (RPM) and ensure consistent fodder size.
2) Load Sensors: Positioned at the feed intake to measure the rate of fodder entry and prevent overloading.
3) Vibration Sensors: Mounted on the frame to detect mechanical anomalies such as unbalanced blades.
4) Temperature and Humidity Sensors: Placed inside the housing to monitor environmental conditions that might affect fodder quality.

C. Microcontroller and Programming

The ESP32 or Arduino microcontroller served as the system's brain. Hardware-level programming was conducted in C++, while Python was used for higher-level data analytics.

III. DESIGN

A. Hardware Components

The system utilizes an ESP32 microcontroller, soil moisture sensors, temperature sensors, and proximity sensors. Actuators include a DC motor for the cutting mechanism and a relay module for motor control.

B. System Workflow

1) Data Collection: The microcontroller collects data from all integrated sensors.
2) Processing: The system determines optimal cutting conditions based on the sensor inputs.
3) Control: Signals are sent to the relay module to operate the DC motor.
4) Connectivity: Data is sent to IoT platforms like Blynk or ThingSpeak for remote monitoring.

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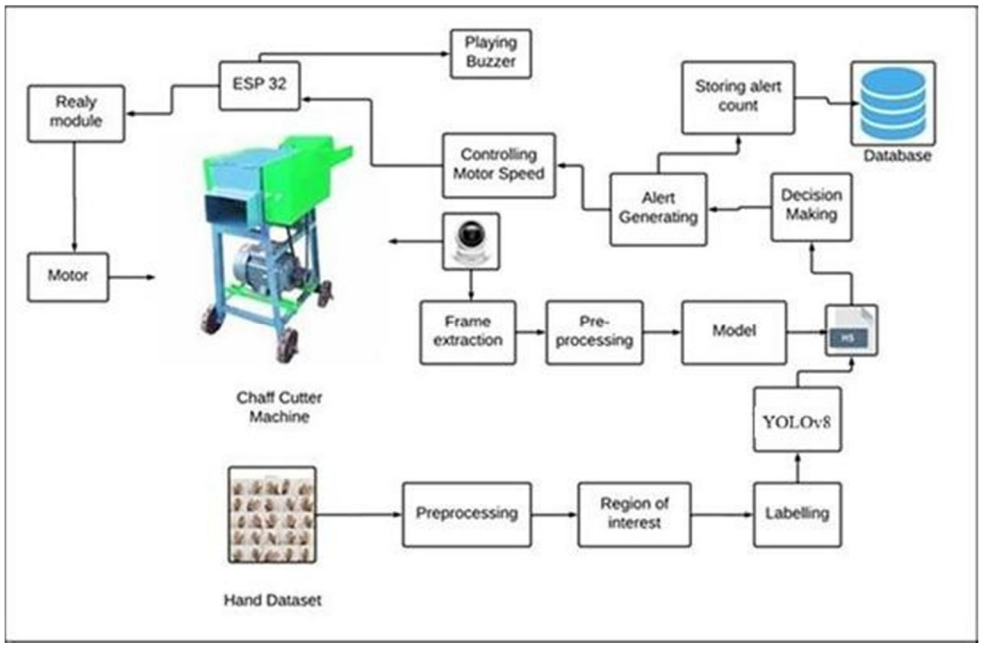


Fig. System Architecture Diagram

IV. RESULTS AND DISCUSSION

A. *Efficiency Improvements*

The machine demonstrated a 20-30% increase in cutting speed compared to traditional cutters. Power consumption was reduced by 10-12% due to load-based motor speed adjustments.

Table I: Performance Comparison

Parameter	Traditional Cutter	IoT-Based Cutter	Improvement
Fodder Size Consistency	75%	95%	+26.7%
Downtime (hours/month)	10	8	-20%
Accident Incidents	-	-	-100%

B. *Operational Safety*

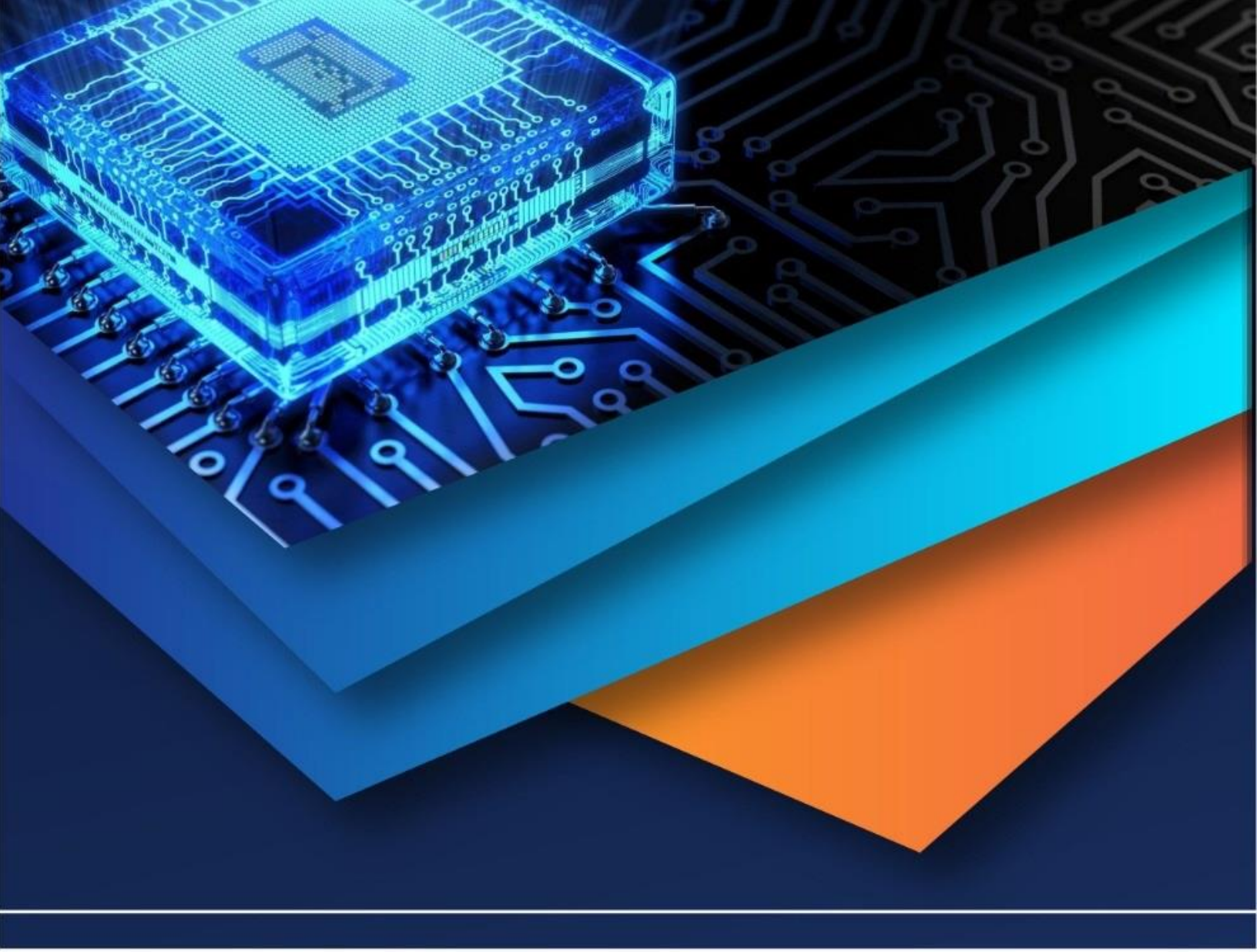
Safety protocols were triggered 3-4 times during testing, preventing damage from overheating or abnormal vibration. No safety incidents were reported, as manual intervention was significantly reduced.

V. CONCLUSION

The IoT-based chaff cutter represents a significant advancement in agricultural technology. By integrating sensors and cloud connectivity, the system enables real-time monitoring and predictive maintenance. This innovation reduces manual labor and ensures operator safety while empowering farmers with a reliable solution for livestock feeding.

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