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IOT Enabled Power monitoring and Control of Conveyor in Coir Industry

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A B S T R A C T

In the coir industry, where raw coconut husk is processed into coir fiber, there are critical challenges related to energy consumption and machine downtime. This project focuses on the development and implementation of an IoT-enabled power monitoring and conveyor controller system tailored to the needs of the coir industry, with the goal of enhancing energy efficiency, reducing downtime, and improving overall production performance. The primary objectives of this work are to monitor the power consumption in coir processing and to automate the control of conveyor systems, thus optimizing material flow across production stages. By integrating IoT-based sensors and controllers, the system provides real-time data about power usage, equipment status, and machine performance, which can be analyzed to identify inefficiencies or faults. Data from those sensors is continuously transmitted to a cloud-based system, enabling operators to track power consumption trends, detect abnormalities.

Keywords: Power monitoring, Conveyor control, Coir industry

INTRODUCTION

The coir industry is one of the most significant sectors in coconut-producing regions, playing a crucial role in employment generation and economic growth. Coir products such as mats, ropes, brushes, and mattresses require multiple stages of processing, where conveyor systems are used extensively for transporting raw materials and finished goods. However, the traditional conveyor systems employed in the coir industry face several inefficiencies, such as high-power consumption, frequent mechanical failures, lack of real-time monitoring, and manual control issues. These inefficiencies not only lead to increased operational costs and energy wastage but also result in production downtime and reduced overall productivity. To overcome these challenges, integrating Internet of Things (IoT) technology with conveyor systems presents an innovative solution. IoT enables real-time monitoring, automated control, and predictive maintenance, making industrial operations more efficient and cost-effective. The project “IoT-Enabled Power Monitoring and Control of Conveyor in Coir Industry” aims to develop a smart system that monitors power consumption, detects faults, and automates conveyor operation based on real-time data. By leveraging IoT, industries can optimize power usage, reduce downtime, and enhance operational efficiency. By implementing an IoT-enabled power monitoring and control system, the coir industry can significantly enhance efficiency, productivity, and cost savings. The system provides real-time insights, predictive maintenance, and automation, making conveyor operations smarter and more sustainable. This technology-driven approach will modernize traditional conveyor systems, ensuring better energy management and overall growth of the coir industry.

PROBLEM STATEMENT

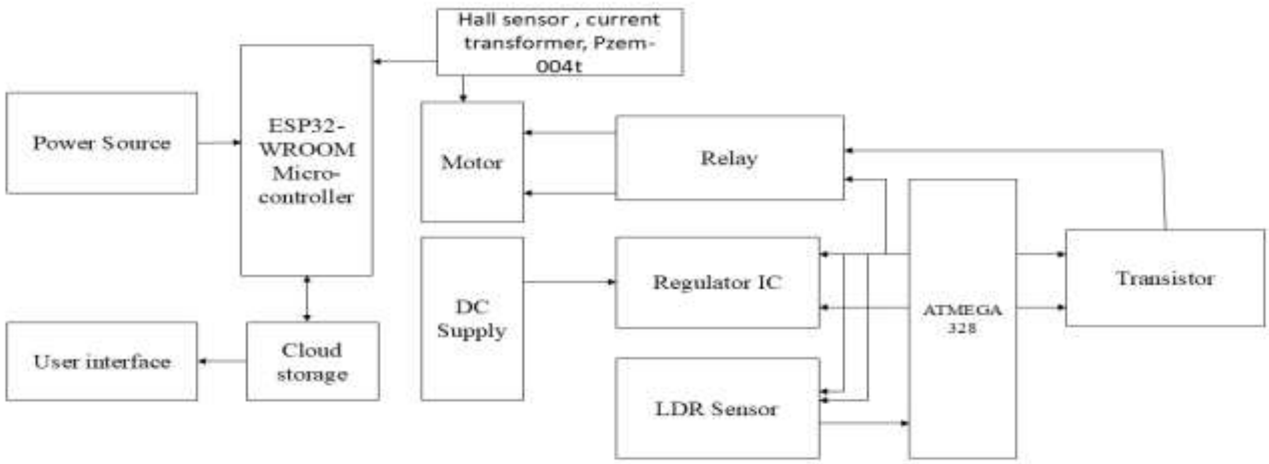
By implementing an IoT-enabled power monitoring and control system, the coir industry can significantly enhance efficiency, productivity, and cost savings. The system provides real-time insights, predictive maintenance, and automation, making conveyor operations smarter and more sustainable. This technology-driven approach will modernize traditional conveyor systems, ensuring better energy management and overall growth of the coir industry.

LITERATURE SURVEY

Ujwala V. Dongare, Bhimrao S. Umre, Makarand S. Ballal, Vikas P. Dongare, "Online Inter-Turn Fault Detection in Wound Rotor Induction Motors Based on VI Loci Pattern", **(**IEEE Transactions on Industry Applications, vol.60, no.1, pp.411- 425, 2024**)** In this paper, a new method is investigated for online condition monitoring of wound rotor induction motors, which are used in high- torque industrial applications. The proposed online method diagnoses stator and rotor inter-turn faults, which are more likely to develop in a WRIM because of its intricate structure. It utilizes stator voltages and stator/rotor currents to detect stator inter-turn faults and rotor inter-turn faults. SITFs and RITFs are detected using the 3-phase loci of stator voltages and stator currents. The proposed motor inter-turn fault detection scheme, which has not yet been deployed for motor winding ITF detection, provides a sophisticated, non-invasive, and cost-effective online solution for incipient level fault detection and the precise identification of faulty phases in induction motors. Experimental validation is conducted on a 3-phase, 7.5 hp, 415 V WRIM by externally creating the ITFs of different severity levels on the stator and rotor circuits under varied load conditions, mitigating the effects of unbalanced supply voltages, winding asymmetries, and sensing element errors.Imran S.Khan , Prof. Ravindra Gandhe, Study And Analysis of Roller Conveyor In Material Handling, Khan,4(8): August, 2015] ISSN: 2277-9655 (I2or). In industries, it is very necessary to move the components from one area to the other in a regular basis making it desirable to minimize the workers involved in it. In this work we have designed a conveyor which can be used in industries. It is very necessary to send material from one place to another in an industry in a convenient manner and hence a need to find a way to transmit the materials and hence in this work we have made a conveyor model which is used for the material transformation from one end to another. The main objective of this study is to explore the analysis of a roller. This has entailed performing a detailed static analysis. The study deals with static analysis. A proper Finite Element Model is developed using Cad software Pro/E Wildfire 4.0.

BLOCK DIAGRAM

Figure 1 This block diagram represents a motor control and monitoring system of conveyor with various integrated components. The power source provides energy to the microcontroller, conveyor motor, and connected sensors. The microcontroller serves as the central processor, managing inputs from the Hall sensor, current transformer, and the Pzem-004t module. The Hall sensor measures the rotational speed of the conveyor motor using magnetic field detection. The current transformer monitors the current flow to the motor to detect variations in load or abnormal power usage. The Pzem-004t module is an energy meter, responsible for tracking parameters like voltage, current, power, and energy consumption. The ATMEGA 328 controller controls the overflow of coir pith and chattering by using a switching transistor and an LDR sensing device. Because the ATMEGA 328 includes built-in timers, it conducts the delay operation during the unevenly distributed coir load period. As a result, the conveyor motor is kept from chattering. A Wi-Fi module connects the microcontroller to a cloud storage system, enabling remote data storage and access. Through the user interface, users can monitor the motor's performance and control its operations remotely.



. **Figure 1**: Block Diagram of IOT Enabled Power monitoring and Conveyor Control in Coir industry

CIRCUIT DIAGRAM

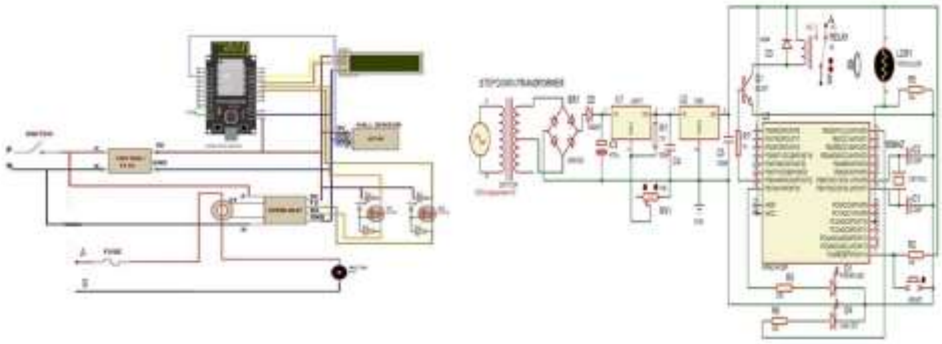


Figure 2: Circuit Diagram

The circuit diagram shows a simple electrical circuit. The circuit begins with a power supply connected to the "P" and "N" terminals. A fuse is placed in series with power supply to protect the circuit from excessive current. A switch is connected between the power supply and allowing for control of the power flow. The positive terminal of the power supply connected to the microcontroller's VCC pin, providing it with power. The microcontroller's output pin are connected to the input pins of the motor driver, which controls the direction and speed of a motor. A hall sensor is connected to the microcontroller's input pins. This sensor detects the presence of a magnetic field, such as detecting the position of a rotating shaft of the motor. The LCD display is connected to the input pin in microcontroller and output connected to the PZEM-004T.The PZEM-004T is connected to the current transformer and then it connected to level shifter is an output pin connected to the microcontroller. Finally, an LED is connected to the microcontroller's output pins. The LED can be turned on or off by the microcontroller, providing a visual indication of the circuit operation. With the help of proteus software, the conveyor controller is simulated, and the motor load is connected to the relay. In simulation, the values from the previous parameter analysis are substituted for the relevant resistor and capacitor; When the light intensity is high, the resistance is low to LDR, and the relay receives the signal from diode D4, and the motor operates normally. If the light intensity to LDR is low, the resistance value is regarded high, and the relay will not receive the signal from diode D4 and will not open the motor-to-relay contact. The relay is controlled by an NPN transistor. As a result, because the transistor cannot work at high voltage, the relay is regulated by negative supply to prevent the controller from failing. When the load is normal, the relay is turned ON; when the load is overflow, the relay is switched OFF. When the light intensity value is high, LED D4 will become red. It refers to turning on the LED and the relay. The LED will become blue and the light intensity will be minimal. The LED is referred to, and the relay is switched off.

HARDWARE

It aims to enhance energy efficiency, reduce operational costs and ensure the smooth functioning of conveyor systems in coir industries. The "IoT-Enabled Power Monitoring and Control of Conveyor in Coir Industry" project aims to enhance the efficiency, automation, and sustainability of conveyor systems used in the coir industry. By integrating IoT-based monitoring and control mechanisms, this system will optimize power usage, reduce downtime, and improve overall productivity.

Figure 3: Hardware image

OUTPUT WAVEFORMS

The above shows the line graph of current, voltage ,power ,frequency ,power factor and speed of conveyor motor. From which the performance of the motor can be predicted.

CONCLUSION

IoT facilitates predictive maintenance by analyzing data tends to forecast potential equipment failures before they occur. This foresight leads to reduced downtime and maintenance costs, as issues can be addressed proactively rather than reactively. Additionally, IoT allows for the remote operation and monitoring of industrial processes, providing flexibility and reducing the need for on-site presence. In conclusion, adopting IoT-enabled power monitoring and control in the coir industry's conveyor systems represents a strategic move towards smarter manufacturing. The integration of real-time data collection, predictive analytics, and remote monitoring not only streamlines operations but also contributes to sustainability efforts, positioning the industry for future advancements and competitiveness.

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