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Integrated IoT System for Protection of DC Motor

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ABSTRACT –

The use of DC motors is prevalent in various industries, and in particular, in automation systems that use conveyor belts or job cranes. In case of motor damage due to overheating or overload, the company faces significant production and financial losses. Hence, it is essential to have a system that informs the user about the status of the motor to prevent severe damage. To achieve this, an ESP32 microcontroller and various sensors, such as current, speed, voltage, and temperature sensors, have been used to continuously monitor the motor condition. Real-time values of various parameters like current, voltage, temperature, and speed can be monitored using an app. The monitoring and protection system can avoid various faults, such as short-circuit faults and thermal overload, and can help the motor give better performance.

Key Words: ESP32, Control, Monitoring, Protection, Sensor, etc.

1. INTRODUCTION

In industrial automation systems, DC motors are commonly used in a variety of applications, such as conveyor belts or job cranes, to perform critical tasks. The reliable and efficient performance of these motors is essential for the smooth operation of these systems. However, these motors are susceptible to various faults that can result in significant production losses and financial losses for the company.To address this problem, the development of a system that can protect, control, and monitor the condition of DC motors is necessary. The proposed system aims to provide real-time information about the motor's condition and enable proactive measures to be taken to avoid damage and prevent significant losses.The system consists of an ESP32 microcontroller and various sensors, such as current, voltage, and temperature sensors that continuously monitor the motor's condition. The sensors measure the motor's current, voltage, and temperature, which are critical parameters for determining the motor's performance and health. These parameters are then transmitted to an app, where real-time values can be monitored and analyzed. The monitoring system helps to detect any changes or abnormalities in the motor's condition, such as variations in current or temperature, which can indicate potential faults. The system is designed to provide early warnings before any significant damage occurs, allowing proactive measures to be taken to avoid production losses and motor damage.

The proposed system also includes protective features that can help prevent various faults, such as short-circuit faults and thermal overload. The system continuously monitors the motor's condition and takes corrective action to prevent damage to the motor.In the event of any abnormality, the system sends an alert message to the company to take action. This approach can significantly reduce the risk of motor damage and avoid production losses, thereby increasing the efficiency of the overall system.

1.1 Motor Protection Scheme

In the motor protection scheme, we have provided protection against over heating and over current. We have used sensor which gives accurate and precise protection to motor in abnormal or fault condition.

1.2 Motor Control Scheme

In the motor control scheme, we have provided on/ off control and speed control of DC motor. For speed control, we have used PWM(Pulse Width Modulation) technique.

1.3 Motor Monitoring Scheme

Real time values of several parameters like voltage, current, temperature and speed are sensed by sensors and uploaded to the application which gives us feature of real time monitoring of motor from one device. The values are compared with default values to determine the condition of the motor.

2. METHODOLOGY

The proposed methodology for the protection, control, and monitoring of DC motors in industrial automation systems involves the use of various sensors and microcontrollers to continuously monitor the motor's condition and performance. The system uses an ESP32 and various sensors such as current, voltage, and temperature sensors to monitor the motor's real-time values. The methodology involves the development of a system that can detect potential faults such as short-circuit faults, thermal overload, or any abnormality in the motor's performance. If any abnormality is detected, the system sends an alert message to the company to take immediate action.

The methodology also involves the use of an app that can display real-time information about the motor's performance, enabling quick detection of potential faults or abnormalities. The app can also provide alerts to the user in case of any detected fault or abnormality in the motor's performance.The proposed methodology also includes the design and implementation of a control system that can protect the motor from various faults and ensure better performance and extended lifespan. The control system can regulate the motor's speed and current, ensuring that it operates within safe limits and reducing the risk of damage or failure.

Overall, the proposed methodology for the protection, control, and monitoring of DC motors in industrial automation systems is a comprehensive and integrated approach that aims to improve the efficiency, reliability, and safety of industrial automation systems that use DC motors.

2.1 Block Diagram

The block diagram provides a high-level view of the system and helps to understand the flow of information and control signals between different parts of the system.

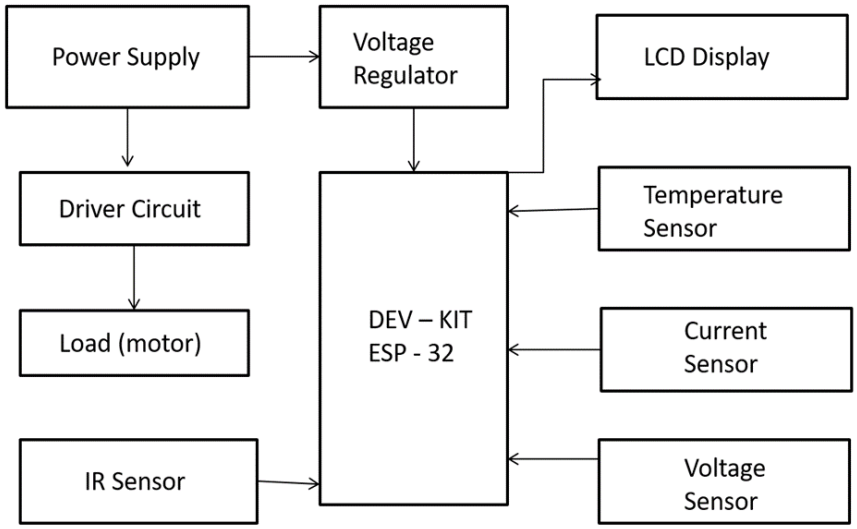

Fig. 1: Block Diagram

In the case of the above project, the block diagram shows the major hardware components like power supply, sensors, LCD display, motor, a driver circuit, and ESP32. It also indicates how these components are connected and how they interact with each other to monitor and protect the DC motor.

2.2 Hardware

Hardware is major part of this system though the software programming is also important. The main component is ESP32. Various sensors for particular applications are used, for temperature measurement and protection against overloading LM35 temperature sensor is used, for current measurement and protection against overcurrent ACS712 Hall current sensor is used and for the voltage measurement voltage sensor is used.

Hardware configuration and interfacing is shown in the Fig - 2.

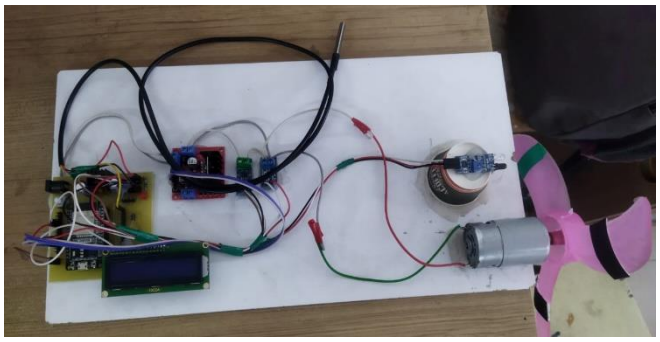

Fig 2: Hardware Interfacing with ESP32

2.3 Results

Real time values of the various parameters like voltage, current, temperature, and speed in the application are shown in Fig – 3.

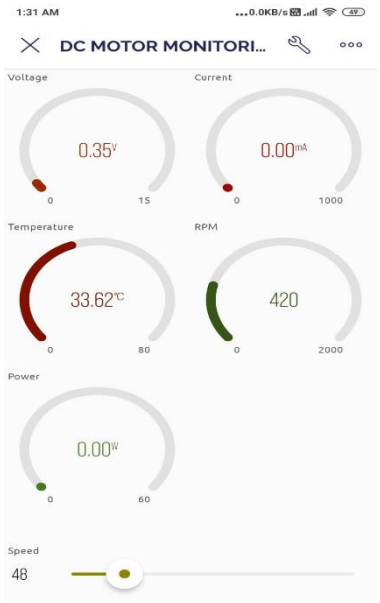

Fig 3: Real Time values of Various Parameters

As we can see, real time values of various parameters in the application screen. Thus, we can continuously monitor the DC motor. Also there is a button provided so we can easily turn on/off the motor from application. The value of speed {in rpm} and the scroll bar for controlling the speed of DC motor is shown in the Fig – 3.

3: CONCLUSION

In conclusion, the presented system for the protection, control, and monitoring of DC motors provides an effective solution for industrial automation processes. With the use of various sensors such as the current, voltage, temperature, and IR sensors, real-time values of various parameters can be monitored and controlled wirelessly through an app. This system ensures the prevention of faults like short circuits and thermal overload that can cause damage to the motor and result in a significant loss for the company.

The system's design allows for continuous monitoring of the motor's condition, providing alerts and notifications to the user if any parameter deviates from the set limits. This feature ensures timely action can be taken before any severe damage occurs, saving time and cost for the company. The use of the ESP32 module, which supports Wi-Fi and Bluetooth connectivity, adds to the system's convenience, reducing the need for manual monitoring and providing real-time data from any location.

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