

# Motor Protection System Using Vibration and Temperature Sensors

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**Abstract:** *This paper presents a smart motor protection system designed using vibration and temperature sensors for monitoring the operating condition of electrical motors. Industrial motors are often damaged due to overheating and excessive vibration, which may lead to mechanical failure and increased maintenance cost. The proposed system uses an Arduino Uno microcontroller to continuously monitor motor temperature using an LM35 temperature sensor and abnormal vibration using an SW-420 vibration sensor. When the sensed values exceed predefined safety limits, the system automatically disconnects the motor through a relay module and activates a buzzer warning system. An LCD display is used to show real-time sensor values and motor status. Experimental results demonstrate that the system effectively protects the motor from thermal and mechanical damage. The proposed system is low-cost, reliable, and suitable for industrial and domestic motor protection applications.*

**Keywords:** Arduino Uno, Motor Protection, LM35 Sensor, Vibration Sensor, Relay Module, Automation

## I. INTRODUCTION

Electric motors are widely used in industries, agriculture, household appliances, and automation systems. Continuous operation of motors under abnormal conditions such as overheating and excessive vibration can reduce efficiency and damage motor components. Motor overheating mainly occurs due to overload conditions, poor ventilation, and excessive current flow. Similarly, abnormal vibration may occur because of bearing faults, shaft misalignment, or mechanical imbalance.

Traditional motor protection methods are often expensive and require manual monitoring. Therefore, there is a need for an automatic and low-cost motor protection system capable of continuously monitoring motor health parameters. In this paper, a smart motor protection system using temperature and vibration sensors is proposed. The system automatically detects abnormal operating conditions and disconnects the motor supply to prevent severe damage.

The proposed system is based on an Arduino Uno microcontroller that processes data from sensors and controls the relay operation. The system provides real-time monitoring and warning indications using an LCD display and buzzer.

## II. LITERATURE REVIEW

Author	Method Used	Limitation
Sharma et al.	Temperature monitoring system	No vibration detection
Kumar et al.	IoT-based motor monitoring	High implementation cost
Patel et al.	Relay-based protection	Manual reset required
Singh et al.	Wireless motor protection	Complex circuit design



From the literature review, it is observed that many systems monitor only one parameter. The proposed system combines both temperature and vibration monitoring for better protection.

### III. PROPOSED METHODOLOGY

The proposed motor protection system continuously monitors motor temperature and vibration conditions using dedicated sensors. The temperature sensor LM35 measures motor temperature, while the SW-420 vibration sensor detects abnormal vibrations.

The Arduino Uno reads sensor values and compares them with predefined threshold values. If the temperature exceeds 45°C or abnormal vibration is detected, the controller immediately switches OFF the motor through a relay module. Simultaneously, the buzzer turns ON to provide an alert indication. The LCD display shows sensor readings and motor status continuously.

#### Working Procedure

- Sensors continuously monitor motor condition.
- Arduino processes sensor data.
- If values are within safe limits, motor remains ON.
- If temperature or vibration exceeds threshold:
- Relay disconnects motor
- Buzzer activates
- LCD displays warning message

### IV. HARDWARE COMPONENTS

#### Arduino Uno

Arduino Uno acts as the main controller for processing sensor data and controlling the relay module.

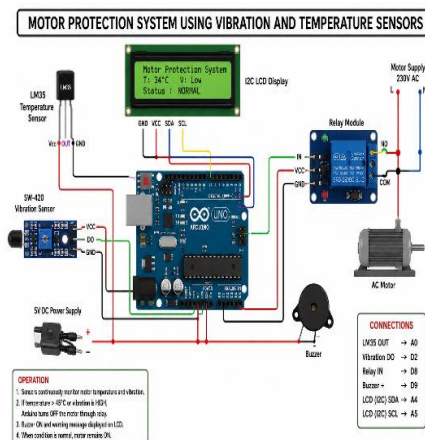
#### LM35 Temperature Sensor

The LM35 sensor measures motor temperature accurately in degree Celsius.

#### SW-420 Vibration Sensor

The vibration sensor detects abnormal mechanical vibrations in the motor.

#### Circuit Diagram Description



#### Relay Module

The relay module disconnects the motor supply during fault conditions.



**Buzzer**

Provides audible warning during abnormal operation.

**LCD Display**

Displays temperature, vibration status, and motor condition.

The LM35 sensor output is connected to the analog input pin of Arduino Uno. The SW-420 vibration sensor output is connected to a digital input pin. The relay module and buzzer are connected to output pins of Arduino. The LCD display is interfaced using I2C communication for displaying system information.

**VI. SOFTWARE IMPLEMENTATION**

The system is programmed using Arduino IDE with Embedded C language. The program continuously reads sensor values and compares them with threshold limits.

**Threshold Conditions**

- Temperature limit: 45°C
- Vibration: High vibration detection

**Control Logic**

- Normal condition → Motor ON
- Fault condition → Motor OFF

The software also updates the LCD display and activates the buzzer during fault conditions.

**VII. RESULTS AND DISCUSSION**

The system was tested under different operating conditions. The results obtained are shown below.

Condition	Temperature	Vibration	Motor Status
Normal	34°C	Low	ON
Overheating	52°C	Low	OFF
High Vibration	37°C	High	OFF

The experimental results show that the proposed system effectively detects abnormal conditions and protects the motor from damage.

**VIII. ADVANTAGES**

- Low-cost implementation
- Automatic motor protection
- Real-time monitoring
- Easy to install

**IX. APPLICATIONS**

- Industrial motor protection
- Water pump monitoring
- Agricultural motor systems

**X. CONCLUSION**

This paper presented a motor protection system using vibration and temperature sensors. The proposed system successfully monitors motor operating conditions and disconnects the motor supply during overheating or abnormal



vibration. The system is simple, economical, and effective for industrial applications. Future improvements may include IoT-based remote monitoring and GSM alert systems.

#### REFERENCES

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