Motor MaintenanceIndicator

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Abstract—In today's developing world it is very time consuming task to check and identify the efficient working, smooth functioning & maintenance requirement of each and every motor used in an industry or any place where large quantity of motors are used. It is not only difficult to determine the exact time at which the motor maintenance should be executed, but also difficult to predict if there is any kind of fault arising in the motor. As time is very important concept for a developing country like India, we have designed a Kit, which will make us notified about the exact time at which the maintenance of the motor is to be executed. The above process will be completed by sensing four parameters such as temperature, Vibration, Current, Speed and Power factor and comparing it with preset values on the microcontroller. If any of the four values crosses the threshold, then there will be an indication with the help of Alarm, Led or with a notification on smart phone.

Keywords—time saving, motor maintenance, notify, indicator, threshold

1. INTRODUCTION

A Motor Maintenance Indicator is a device or system that is used to monitor the condition of a motor and provide information about its maintenance requirements. This can include monitoring various aspects of the motor such as Temperature, Vibration, Speed, Current, Voltage, Powerfactor. By monitoring these factors, the indicator can provide early warning of potential problems with the motor, allowing maintenance staff to take corrective action before a breakdown occurs. Motor Maintenance Indicator can be simple or complex, depending on the application and the level of monitoring required. They can range from basic sensors that monitor temperature or vibration to sophisticated systems that incorporate multiple sensors and use advanced algorithms to analyze data and predict equipment failures. Motor Maintenance Indicator are important in ensuring that motors operate efficiently and reliably, while minimizing downtime and maintenance costs. They are commonly used in a range of applications, including industrial and commercial machinery, and transportation vehicles such as cars and trucks. The importance of motor maintenance indicators can be summarized as follows: **Preventive maintenance**: Motor maintenance indicators allow for preventive maintenance, which helps identify potential problems before they become serious issues. Regular maintenance can help prevent unexpected breakdowns and extend the life of the motor and the system it powers. **Cost savings**: Motor maintenance indicators can save costs in the long run by preventing breakdowns and reducing the need for costly repairs or replacements. By detecting issues early on, repairs can be made before they turn into more significant problems that require more expensive repairs. **Improved efficiency**: Regular maintenance can help keep motors operating at optimal efficiency, reducing energy consumption and lowering operating costs. **Safety**: Faulty motors can be a safety hazard, causing fires, electrical shocks, and other accidents. Motor maintenance indicators can help prevent such incidents by alerting maintenance personnel to potential issues**. Compliance**: Certain industries have specific regulations regarding motor maintenance. A motor maintenance indicator can help ensure compliance with these regulations, avoiding costly fines or legal issues. In summary, motor maintenance indicators are essential tools for maintaining the efficiency, safety, and longevity of motorized systems. Regular maintenance is critical to prevent costly breakdowns and ensuring compliance with industry regulations, and motor maintenance indicators help facilitate this process. Overall, Motor Maintenance Indicator are an important tool for ensuring the reliable and efficient operation of mechanical equipment, and they play a crucial role in maintaining productivity and reducing costs in a variety of industries.

2. Prototype Design Description and Implementation

This section discusses in detail the research methodology employed in this study. The employed methodology consists of three distinct steps. Each of these steps are further discussed in subsequent sections

Design Description of Motor Maintenance Indicator

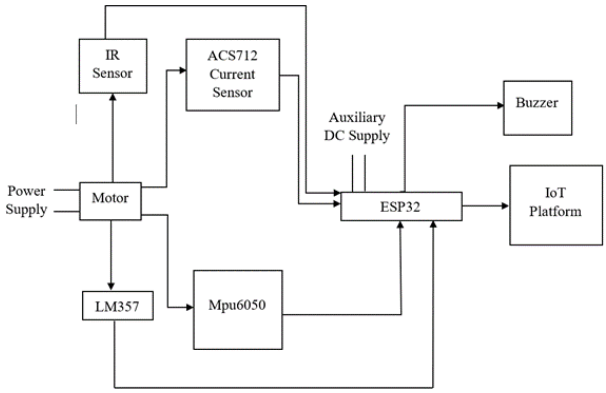


Fig.1.Block Diagram of Motor Maintenance Indicator

Description: In the above block diagram, ESP 32 is provided with the 5V supply using Adapter to turn ON the KIT which comprises of all the sensors connected to it. After powering the KIT, Supply to the motor is turned ON and the motor start rotating in a particular direction. As shown in the figure, IR Proximity sensor is used to measure the speed of the rotating shaft, LM 35 is used to measure the temperature of the motor, ACS712 Sensor is used to measure the current flowing through the motor, MPU 6050 is used to measure the vibration of the motor. The output of all these sensors is given to the ESP 32 which compares all this values with a standard value of the respective parameters, if any of these parameters goes above the threshold value that is set, then the buzzer will buzz and notify the nearby operator. But if the operator is away from the machine then message will pop-up in the operator phone and he will get notify that there is some issue in the motor and these values are transferred to cloud.

Components Description

A. Current Measurement

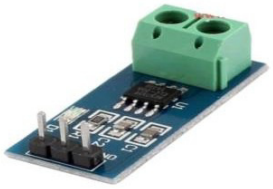


Fig.2.ACS712 Current Sensor

Function: The ACS712 is a Hall-effect current sensor used to monitor DC/AC currents in motors for maintenance purposes. Changes in current drawn can indicate mechanical or electrical issues. This sensor is connected to a microcontroller for data processing and problem indication. It is used to find out power factor of motor.

B. Temperature measurement

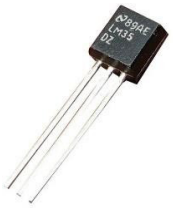


Fig.3.LM35 Temperature Sensor

Function: The LM35 is used in a motor maintenance indicator to measure the temperature of the motor and provide an indication of its health. The LM35 is placed in close proximity to the motor, and its output voltage is connected to an analog input of a microcontroller. Microcontroller can then use the LM35's output voltage to calculate the temperature of the motor in real-time. By monitoring the temperature of the motor over time, the microcontroller can detect trends that indicate possible problems with the motor, such as overheating due to a malfunctioning components.

C. Vibration Measurement

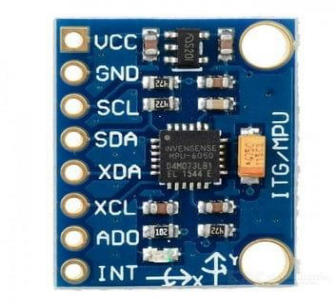


Fig.4.MPU6050 Vibration Sensor

Function: The MPU-6050 sensor measures vibration and motion of motor, to detect wear and tear or other issues. Data from the sensor is analyzed to identify the potential problems, allowing it for preventive maintenance in order to prevent motor failures and downtime. The MPU-6050 is useful for monitoring the health and performance of motors in industrial and commercial settings to ensure long-term efficiency and reliability.

D. Controller function

Fig.5. ESP32

Function: The ESP32 is versatile in Motor Maintenance Indicator (MMI) systems, It acquires and analyzes data from sensors, performing real-time analysis, wireless communication, data storage, providing user interfaces, and optimizing power consumption. It is a powerful tool for motor maintenance, monitoring, and data management.

Wireless Communication: The ESP32's Wi-Fi and Bluetooth features enables the MMI system to connect to a network or the Internet enabling remote monitoring of motor condition and maintenance alerts.

Data storage: The ESP32's flash memory can store motor condition data and trends for predictive maintenance analysis and optimization.

User interface: The ESP32 can provide a user interface (web/mobile) for real-time viewing of motor condition data and makes an alert in MMI system.

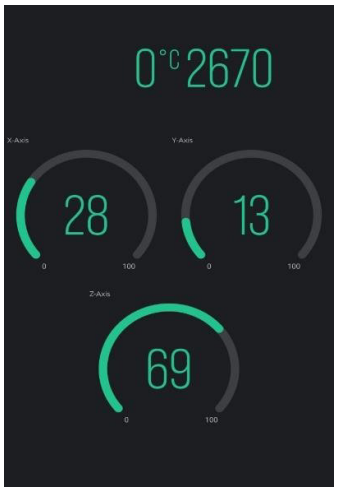
Overall, the ESP32 can be a powerful tool in a Motor Maintenance Indicator system, providing a range of functions related to motor maintenance, monitoring, and data management.

D. Single phase Capacitor Start Motor

Fig.6. Single Phase Capacitor Start Motor

Function: The main function of a single-phase induction motor is to convert electrical energy into mechanical energy. The motor accomplishes this by using the rotating magnetic field created by the stator to induce a current in the rotor (rotating part) of the motor. This current generates a magnetic field in the rotor that interacts with the magnetic field created by the stator, causing the rotor to rotate.

E. Blynk Interface Of our Project



Blynk is a application platform that allows users to control and monitor their connected devices remotely. In the context of motor maintenance indicators, Blynk can be used to create a smart monitoring system that alerts users of potential motor faults and enables them to take corrective actions promptly.

F. Proximity Sensor

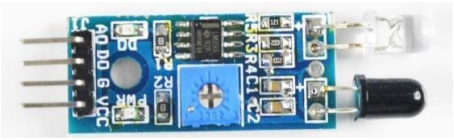


Fig.7. Proximity Sensor

Function: Using a proximity sensor as a speed measure can be particularly useful in motor maintenance, as it can provide real-time data on the motor's speed and can help detect any changes or deviations from the expected speed. This information can be used to identify potential problems before they become major issues, and it can also be used to optimize the motor's performance and efficiency

3. Prototype setup

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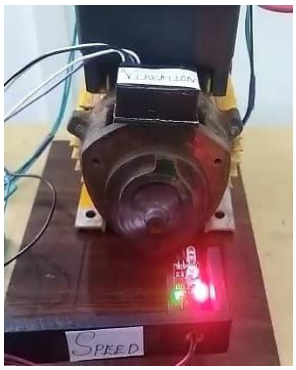

Fig.8. Image of the project

4. Applications of the Project

Manufacturing industry: In manufacturing plants, motors are used in various machines, such as conveyor belts, pumps, and fans. Motor maintenance indicators are used to monitor the health of these motors, including factors like temperature, vibration, and current draw. This information helps maintenance teams to schedule maintenance tasks and avoid unscheduled downtime, which can result in significant production losses.

Power generation industry: Power plants rely on largemotors to generate electricity. Motor maintenance indicators are used to monitor the condition of these motorsand detect any issues before they become critical. Thishelps to avoid costly repairs and prevent power outages. **HVAC industry**: Heating,

ventilation, and airconditioning (HVAC) systems use motors to power fansand pumps. Motor maintenance indicators are used to monitor the condition of these motors and detect any issuesbefore they cause a breakdown. This helps to ensure thatthe HVAC system is running efficiently and reliably.

Transportation industry: Motors are used in various vehicles, such as trains, planes, and ships. Motor maintenance indicators are used to monitor the health of these motors and detect any issues before they cause a breakdown. This helps to ensure that the vehicles are running safely and efficiently

Benefits to business

Increased productivity: By monitoring the health of motors and identifying potential problems early, motor maintenance indicators can help minimize unplanned downtime and equipment failures. This, in turn, increases productivity by ensuring that equipment is operational and available when needed.

Reduced maintenance costs: Regular maintenance and early detection of issues can prevent major breakdowns and reduce the need for expensive repairs. This can lead to significant cost savings in terms of maintenance, repairs, and replacement of equipment.

Improved safety: Faulty motors can be a safety hazard, particularly in industrial settings where heavy equipment is used. Motor maintenance indicators can help identify potential safety hazards early, allowing maintenance teams to take appropriate measures to address the issues and ensure safe operation of equipment.

Enhanced customer satisfaction: Reliable and efficient equipment can enhance customer satisfaction by ensuring timely delivery of products and services.

Competitive advantage: By implementing motor maintenance indicators and proactively addressing potential issues, businesses can differentiate themselves from competitors by offering reliable and efficient services, which can ultimately lead to increased customer loyalty and revenue

4. Conclusion and Future Expansion

Conclusion: By using this Kit on a motor which is not monitored before in an industry, the motor will able to communicate with the operator through the HMI (Human Machine Interface) by monitoring its basic parameters like speed, current, voltage, temperature and vibration, which the operator will find it easy to analyze the health condition of the motor.

By using this Kit, the operator can understand that when to plan the maintenance of the motor. If anyone of the above mentioned parameter of the motor goes beyond the rated limit say, for e.g. Vibration, if vibration's spectrum waveform is greater than the waveform previous than it can be conclude that there is some bearing wear in motor and its maintenance will be planned accordingly and not according to the down time.

The parameters which are monitored in this Kit are uploaded to cloud which will help the operator to compare the parameters time to time.

The operator need not to be check the motor at some intervals. If fault is detected the operator will receive a message and action will be taken on the basis of it.

Future Expansion: Additionally in future the size of the whole circuit will be small and compact and more parameters on the requirement of the industry can be added.

The cost of the whole kit can be reduced.

Provision of a protection system will be integrated in this kit and monitoring and protection will work in synchronism.

The operating range of the kit can be possibly increase to monitor and analyze the parameters of large motors rated above 15KW and according to that the range and type of sensor will also be different.

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REFERENCE

[1] IoT platform for the condition of industrial motor: Published in 2nd International Conference on Communication and Electronics Systems (ICCES 2017) Explore Compliant – Part Number: CFP17AWO-ART, ISBN:978-1-5090-5013-0 by Shyamalal D.

[2] K. M. Carr, "Maintenance: How the Industry is Doing", International Executive Conference on Maintenance Issues, 1987-December-7.

[3] D. Goyal, A. Chaudhary, R. K. Dang, B. S. Pabla and S. S. Dhami, "Condition Monitoring of Rotating Machines: A review," Wold Scientific News, pp. 98-108, 2018.

[4] B. K. N. Rao, Handbook of Condition monitoring, Elsevier, 1996.

[5] P. Asghari, A. M. Rahmani and H. H. S. Javadi,

"Internet of Things applications: A systematic review," Computer Networks, vol. 148, pp. 241-261, 2019.

[6] T. J. Barnish, M. R. Muller and D. J. Kasten, "Motor Maintenance: A Survey of Techniques and Results," in Proceedings of the 1997 ACEEE Summer Study on Energy Efficiency in Industry. American Council for an Energy- Efficient Economy, Washington, DC, 1997.

[7] PK, I. Diah, B. Y. Dewantara and W. M. Utomo, "Healthy Monitoring and Fault Detection Outer Race Bearing in Induction Motor Using Stator Current," International Journal of Integrated Engineering, vol. 11, no.3, 2019.