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Design and Development of Automatic Lubrication System using IOT

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ABSTRACT: - The integration of Internet of Things (IoT) technology into lubrication systems has revolutionized maintenance practices in industrial settings. This abstract explores the capabilities and benefits of IoT-based automatic lubrication systems. By employing sensors and connected devices, these systems enable real-time monitoring and control of lubrication levels, thereby ensuring optimal performance of machinery. Through data collection and analysis, potential failures can be predicted and prevented, leading to reduced downtime and maintenance costs. Remote monitoring and control via a web-based interface facilitate convenient management of lubrication processes. Moreover, the interoperability of IoT-based lubrication systems with other IoT platforms, such as predictive maintenance systems, enhances overall machine performance and further minimizes downtime. This abstract underscore the efficiency, cost-effectiveness, and predictive maintenance capabilities offered by IoT-based automatic lubrication systems, positioning them as integral components in modern industrial maintenance strategies.

Keyword: - Lubrication, Machinery, Interoperability

INTRODUCTION:

The integration of Internet of Things (IoT) technology into industrial processes has led to significant advancements in efficiency, cost-effectiveness, and predictive maintenance strategies. One such innovation is the IoT-based automatic lubrication system, which revolutionizes traditional lubrication practices in machinery maintenance.
Understanding the importance of studying these systems is crucial in navigating the evolving landscape of industrial maintenance practices.

Effective lubrication is essential for the smooth operation and longevity of machinery in various industrial sectors, including manufacturing, transportation, and energy production. However, traditional manual or timer-based lubrication systems often fall short in ensuring optimal lubrication levels, leading to increased wear and tear, potential machinery failures, and costly downtime. Recognizing these challenges, researchers and industry professionals have turned to IoT-based solutions to address these issues comprehensively.

The IoT-based automatic lubrication system offers a paradigm shift in maintenance practices by enabling real-time monitoring and control of lubrication levels. By utilizing sensors and connected devices, these systems gather crucial data on lubrication usage and machine performance, allowing for precise adjustments and timely interventions.
Moreover, the ability to predict and prevent potential failures through data analysis empowers maintenance teams to proactively address maintenance issues before they escalate, significantly reducing downtime and associated costs.

Furthermore, the integration of IoT-based lubrication systems with other IoT platforms, such as predictive maintenance systems, amplifies their impact on optimizing machine performance and minimizing downtime. This interconnected approach not only enhances operational efficiency but also lays the groundwork for predictive maintenance strategies, where maintenance activities are scheduled based on actual equipment condition rather than predetermined schedules.

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Given the transformative potential of IoT-based automatic lubrication systems in industrial maintenance, studying these systems becomes imperative. This research aims to delve into their functionalities, benefits, and practical implications, contributing to the ongoing discourse on enhancing industrial operational efficiency and maintenance practices. By exploring the intersection of IoT technology and machinery maintenance, this study seeks to empower industries with actionable insights for embracing innovation and driving sustainable productivity.

LITERATURE REVIEW

Goyal D, **Chaudhary A**, **Dang RK**, **Pabla BS**, **Dhami SS**, Condition Monitoring of Rotating Machines, Condition monitoring of rotating machines, fault detection, Temperature monitoring is to check the variables with regard to tolerances, and alarms, after an alarm is triggered the operator then has to take the appropriate actions.

Mujahid, A. and Dickert, F.L., Monitoring automotive oil degradation: analytical tools and onboard sensing technologies s Analytical and bioanalytica l chemistry, degradation of engine oil due to mechanical and operating conditions. The concentration of contamination in lubricant is inversely proportional with absorbance value where the voltage is decreases as the mileage increased at a certain sampling.

Raposo, **H.**, **Farinha**, J.T., **Ferreira**, **L. and Galar**, **D**, **Public Transport**, **pp.1-22**, Dimensioning ng reserve bus fleet using life cycle cost models and condition based/predictive maintenance e: a case study the oil degradation and the prediction of the next value for one relevant oil variable, estimated through the mean time between failures and the mean time to repair ratios. Through the use of econometric models.

Electronic Wings, **Sensors and Module**, **2019.** sensors and Modules, maintenance e policy of the whole fleet, in particular, condition based maintenance e using a motor oil degradation analysis. estimated through the mean time between failures and the mean time to repair ratios.

Zhu, **J.**, **He**, **D.**, **& Bechhoefe r**, **E.** Survey of lubrication oil condition monitoring, diagnostics, and prognostics techniques and systems. Journal of chemical science and technology, lubrication oil conditioning g and monitoring. existing lubrication oil condition monitoring solutions and their characteristics along with the classification and evaluation of each technique.

Jakoby, **B.**, **Scherer**, **M.**, **Buskies**, **M.**, **& Eisenschm id**, **H**, an automotive engine oil viscosity sensor, Evaluate oil condition with the help of sensors, the condition of automotive engine oil, the oil's viscosity is one of the most important parameters. Using micro-acoustic viscosity sensors, an oil-viscosity measurement can be performed on-board.

Kalyani Mandekar 1 , Purva Apte2 , Ketki Chaudhari 3 , Minza Ansar, iot based transformer parameter monitoring, concentrating on temperature of transformer and viscosity of oil. In this system temperature and viscosity monitoring and control action is performed based on the AVR microcontroller

COMPONENTS

1. Node MCU ESP 8266
2. Buzzer
3. Lcd screen 20x4
4. I2c module
5. Ds18b20 temp sensor
6. R35 diaphragm pump
7. Solenoid valve 8. Relay module

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9. 10K Potentiometer
10. 7805 Voltage regulator IC
11. 6-inch PCB
12. Male to Female header pin
13. IN4007 Diode
14. Power Supply (10 Amp 12v)
15. Rocker Switch
16. Power adapter
17. Female Adapter Socket
18. Heat Sink

IMPLIMENTATION

To implement the temperature-controlled lubrication system, begin by setting up a temperature sensor, such as the LM35 or DS18B20, connecting it to an Arduino board. For the LM35, connect Vcc to 5V, GND to GND, and the output to an analog input pin (e.g., A0). For the DS18B20, connect Vcc to 5V, GND to GND, and the data pin to a digital pin (e.g., D2), using a 4.7kΩ pull-up resistor between the data pin and Vcc. Write an Arduino program to read the temperature and control a relay based on a set threshold of 40°C. The code should include libraries for the sensor, read the temperature, and activate the relay when the temperature exceeds the threshold, running the pump for a specified period.

Next, connect the relay module to the Arduino, linking Vcc to 5V, GND to GND, and the input pin to a digital pin (e.g., D3). Connect the relay's output to the pump's power supply circuit. Then, connect the pump and control valve, ensuring the valve directs the lubricant flow to the designated points on the workpiece. Assemble all components securely, ensuring the temperature sensor is properly positioned near or on the workpiece. Power the system, upload the Arduino code, and monitor temperature readings via the Serial Monitor. Test the system by artificially raising the workpiece temperature to verify the pump's activation when exceeding 40°C. Adjust the code for temperature threshold and pump run time as needed. Regular maintenance, such as checking connections and recalibrating the sensor, is essential to ensure accurate readings and efficient operation. This setup ensures the workpiece remains at optimal temperature, enhancing operational efficiency and longevity.

METHODS

The IoT-based lubrication system represents a significant advancement in the field of machinery maintenance, particularly in ensuring optimal lubrication levels and timely interventions. Here's a detailed explanation of its key features:

1. Real-Time Monitoring and Control of Lubricating Oil Level:

The IoT-based lubrication system employs sensors and connected devices to continuously monitor the level of lubricating oil in the reservoir. These sensors are strategically placed within the reservoir to provide accurate readings of the oil level. The real-time monitoring capability allows maintenance personnel to have instant visibility into the lubricant status, ensuring that the

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machinery is adequately lubricated at all times.

2. Alert System for Low Oil Level in Tank:

In the event of a low oil level in the tank, the IoT-based lubrication system triggers an alert system to notify maintenance personnel. This alert can be configured to send notifications through various channels such as email, SMS, or a dedicated dashboard. The timely alert ensures that immediate action can be taken to replenish the lubricant, preventing potential machinery damage or downtime due to inadequate lubrication.

3.Mobile Notifications After Every Lubricating Process:

After each lubricating process is completed, the IoT-based lubrication system sends mobile notifications to designated personnel or maintenance teams. These notifications serve as confirmation that the lubrication task has been successfully carried out and provide real-time updates on the maintenance activities. Mobile notifications ensure that all stakeholders are informed of the lubrication status, regardless of their location, facilitating seamless communication and collaboration within the maintenance workflow.

Overall, the combination of real-time monitoring, alert systems for low oil levels, and mobile notifications enhances the efficiency and effectiveness of machinery maintenance with the IoT-based lubrication system. By leveraging advanced technology and connectivity, maintenance teams can proactively manage lubrication tasks, minimize downtime, and extend the lifespan of critical machinery components.

WORKING MODEL

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PROBLEMS

Traditional manual or timer-based lubrication systems pose significant risks of both under and over-lubrication to machine parts, which can lead to equipment failures, prolonged downtime, and escalated maintenance expenses.
Moreover, the absence of real-time monitoring and control exacerbates these challenges by hindering the timely detection of potential failures and the implementation of preventive measures. This limited visibility into lubrication system performance leaves maintenance personnel in the dark, often only becoming aware of issues after they escalate into breakdowns or failures. Consequently, without the capacity to anticipate and mitigate potential failures, businesses face substantial production losses and unanticipated maintenance expenses, ultimately diminishing profitability. Additionally, the lack of integration between lubrication systems and other maintenance frameworks fosters inefficient maintenance practices and further inflates operational costs.

RESULT

The proposed IoT-based lubrication system is expected to yield several significant results, ultimately enhancing operational efficiency and maintenance practices across industrial sectors:

1. Improved Machine Performance:
2. By ensuring optimal lubrication levels in real-time and proactively addressing potential failures, the IoT-based lubrication system contributes to improved machine performance. Proper lubrication reduces friction, wear, and heat generation, leading to smoother operation and enhanced overall efficiency of machinery.

2. Reduced Maintenance Costs:

Through predictive maintenance capabilities and timely interventions, the system helps to identify and address maintenance issues before they escalate into costly failures. This proactive approach minimizes unexpected downtime, reduces the need for emergency repairs, and optimizes maintenance schedules, thereby lowering overall maintenance costs.

3. Longer Machine Lifespan:

Effective lubrication management provided by the IoT-based system helps to prolong the lifespan of machinery components. By reducing wear and tear, preventing corrosion, and maintaining proper lubrication levels, the system contributes to extending the operational lifespan of critical machine parts, leading to increased asset longevity.

4. Increased Safety:

Ensuring adequate lubrication is crucial for maintaining safe operating conditions within industrial environments. By preventing potential failures and minimizing operational disruptions, the IoT-based lubrication system enhances workplace safety. Additionally, the system's real-time monitoring capabilities help to identify and mitigate safety risks associated with inadequate lubrication or machinery malfunctions.

5. More Efficient Use of Lubricants:

The precise monitoring and control of lubricant levels facilitated by the IoT-based system promote a more efficient use of lubricants. By applying the appropriate amount of lubrication to different parts of the machine as needed, the system helps to minimize wastage and optimize lubricant usage, leading to cost savings and environmental benefits.

6. Better Integration with Other IoT Systems:

The IoT-based lubrication system is designed to seamlessly integrate with other IoT platforms, such as predictive maintenance systems or manufacturing execution systems. This integration enhances data sharing, analysis, and decision-making capabilities across the entire industrial ecosystem, fostering synergies and maximizing the overall efficiency of interconnected systems.

In conclusion, the expected results of implementing the proposed IoT-based lubrication system include improved machine performance, reduced maintenance costs, longer machine lifespan, increased safety, more efficient use of lubricants, and better integration with other IoT systems. These outcomes collectively contribute to enhancing operational reliability, productivity, and sustainability in industrial environments.

DISCUSSION

The expected results of the proposed IoT-based lubrication system hold significant implications for industrial operations and maintenance practices:

1. Improved Machine Performance:

Enhanced lubrication management directly translates to improved machine performance. By ensuring optimal lubrication levels and reducing friction, wear, and heat generation, machinery operates more smoothly and efficiently, leading to higher productivity and output quality.

2. Reduced Maintenance Costs:

Predictive maintenance capabilities help to identify potential issues before they cause costly failures. By addressing maintenance needs proactively and minimizing unexpected downtime, the system reduces the frequency and magnitude of repairs, thereby lowering overall maintenance expenses.

3. Longer Machine Lifespan:

Effective lubrication plays a critical role in preserving the integrity and longevity of machinery components. By minimizing wear and tear, preventing corrosion, and maintaining proper lubrication levels, the system extends the operational lifespan of critical machine parts, reducing the need for premature replacements and equipment upgrades.

4. Increased Safety:

1. Adequate lubrication is essential for maintaining safe operating conditions within industrial environments. By preventing machinery malfunctions and minimizing operational disruptions, the system enhances workplace safety, reducing the risk of accidents, injuries, and occupational hazards.
2. 5. More Efficient Use of Lubricants:
3. Precise monitoring and control of lubricant usage optimize the utilization of resources. By applying the appropriate amount of lubrication to different machine parts as needed, the system minimizes wastage, reduces environmental impact, and lowers lubricant procurement and disposal costs.

6. Better Integration with Other IoT Systems:

Seamless integration with other IoT platforms facilitates enhanced data sharing, analysis, and decision-making across the industrial ecosystem. By connecting with predictive maintenance systems, manufacturing execution systems, and other IoT-enabled solutions, the lubrication system leverages synergies, maximizes operational efficiency, and supports holistic optimization of industrial processes.

The significance of these expected results lies in their collective contribution to improving operational reliability, productivity, and sustainability in industrial settings. By addressing key challenges related to machine performance, maintenance costs, safety, resource efficiency, and system integration, the proposed IoT-based lubrication system offers transformative benefits that can drive competitive advantage and long-term success for industrial enterprises.

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