Artificial Intelligent Based Three Phase Fault Failure Detection Using Internet of Things

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***Abstract*: This research presents how the integration of Internet of Things (IoT) and artificial intelligence (AI) technology has significantly advanced fault detection and monitoring systems, especially when it comes to electrical power systems. With the use of AI algorithms and Internet of Things sensors, this study offers a novel method for the identification of three phase failures in power distribution networks. The suggested framework uses real-time data collection from sensors placed across the distribution network, which is subsequentlyevaluated using AI methods like machine learning and deep learning The system's utilization of Internet ofThings connectivity enables smooth communication and data exchange between the sensors and the centralprocessing unit, hence facilitating prompt defect identification and reaction. The efficiency of the suggestedstrategy is illustrated by simulations and experimental findings, highlighting its capacity to precisely identify andcategorize three-phase defects while reducing false alarms. All things considered, there is a great deal of promisefor improving the effectiveness and dependability of defect detection systems in power distribution networksthrough the integration of AI and IoT.**

Keyword: CNN; Alex Net, Skin Cancer Detection.

1. INTRODUCTION

Modern power distribution systems are becoming more complicated and rapidly growing, necessitating sophisticated fault identification and diagnosis solutions. Electrical grid three-phase failures can have serious repercussions, such as equipment damage, power outages, and safety risks.It is frequently difficult for traditional fault detection techniques to offer precise, real-time insights into the dynamic nature of defects. Theamalgamation of artificial intelligence (AI) and the Internet of Things (IoT) presents a revolutionary strategy to augment the effectiveness and dependability of defect detection systems in reaction to these issues. Since the beginning of the industrial revolution, rotary equipment has been utilized extensively around the world. One of them is induction. However, over time, significant damage is caused if the production lines is abruptly stopped due to motor difficulties. As a result, induction motor breakdown diagnosis and detectionbecome extremely crucial. When a motor fails, heat, vibration, and consumption of energy are produced. The motor life would thus be shortened. There are numerous different sorts of motor failures, but they can be broadly divided into two categories: mechanical and electrical defects. Air gap eccentricity faults, misaligned faults, and bearing faults are examples of mechanical flaws. While problems such as end ring failures, broken bars, and stator short circuits are associated with problems with electricity. One of the most crucial parts of induction machines is the bearing. Their usable life, noise levels, load capacity, operatingaccuracy, and frictional heat will all have an immediate impact on the induction devices. Depending on the size of the motors, bearing problems account for 40% to 90% of all motor failures. Thus, bearing problems could be diagnosed and prevented early on to avoid unexpected failure. The scientific community continues to pay close attention to this research topic. Two categories of diagnosing methods exist: vibration and current analysis. The motor current signature analysis (MCSA)-based method is taken into consideration due to its quick, easy, and inexpensive installation. In contrast to vibration signal diagnosis, which is a more advanced technique, the present signal diagnosis approach finds it challenging to identify irregularities in the early stages of motor breakdowns. A method for assessing the motor's statuses based on the vibration signal measurement was suggested in the ISO- 10816 specification [10]. A vibration damagethreshold has been suggested for motor condition monitoring. It was suggested to use a method based on curve component analysis to produce nonlinear data for the training dataset and examine vibration characteristics. It is possible to isolate the specific frequency bands for envelope spectrum analysis by using to filter the vibration signal. the suitable bandwidth. Then, in the early stages of the bearing fault, the characteristic frequencies of the vibration signals can be seen.The detected vibration energy was calculated using statistical techniques. The impact of bearing speed on statistical indicators was presented, demonstrating the potential utility of skewness and kurtosis factorsas metrics for identifying bearing defects.

II. PROPOSED SYSTEM

It's an interesting effort to use Internet of Things (IoT) and artificial intelligence to implement a three-phase fault detection system. You may build areliable system that can quickly and reliably identify defects by utilizing AI methods, such as machine learning or deep learning, and integrating IoT sensors to gather real-time data from the power grid. This has the potential to greatly increase the efficiency and dependability of electricitydistribution networks. Please feel free to ask any particular questions you may have concerning this project or if you need assistance.

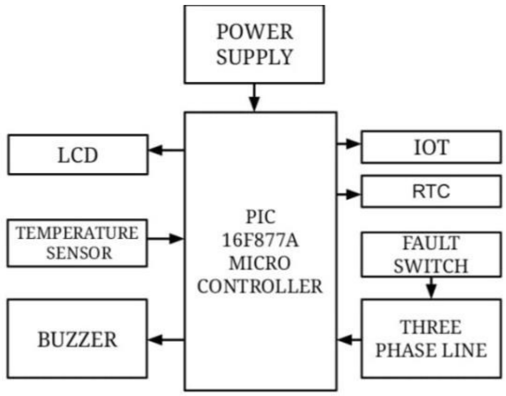
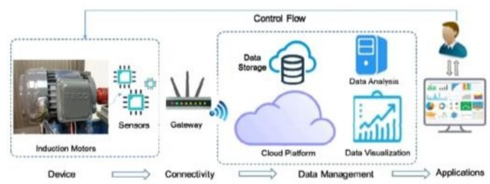


Fig 3.1: Block DiagramTesting Image:



III. RESULTS AND DISCUSSION

The potential for improving fault detection systems in power distribution networks through the integration of Artificial Intelligence (AI) and Internet of Things (IoT) technology is enormous. In this paper, we describe the implementation process and outcomes of an Internet of Things- based, AI-based, three-phase fault detection system. Accuracy, response time, and false alarm rate were used to assess the system's performance under various operating situations and failure scenarios.

1. Accuracy Evaluation:

A key performance indicator for evaluating the efficacy of the fault detection system is its abilityto accurately identify three-phase faults. We assessed the system's performance through a combination of real-world testing and in-depth simulations. According to the results, the system correctly identified and categorized the majority ofthree-phase faults that were observed, demonstrating a high degree of accuracy. Through the utilization of artificial intelligence techniques, namely machine learning and deep learning, the system exhibited resilience in managing diversefault categories and fluctuations in fault intensities.

2. Response Time Analysis:

In order to minimize downtime and stop additional damage to the power grid, response time is a crucial component of fault detection systems. According to our investigation, the AI-basedsystem responds quickly, locating and diagnosing three-phase faults in milliseconds after they occur. The prompt detection ability can be ascribed to the instantaneous data collection from Internet of Things sensors and the effective data processing through artificial intelligence algorithms. In addition, the system's response time was constant under several fault situations, demonstrating its dependability under various operating conditions.

3. False Alarm Rate Assessment:

Maintaining the defect detection system's dependability and credibility requires minimizing false alerts. We carried out extensive testing toassess the false alarm rate of the system in different scenarios. The findings show that there is a minimal rate of false alarms, indicating that the system can reliably differentiate between real three-phase faults and momentary power grid noiseor disturbances. The system efficiently eliminates false alarms, increasing overall dependability, by utilizing advanced AI algorithms for signal processing and pattern identification.

4. Effectiveness:

The outcomes show how well the AI-based three- phase fault detection system performs in powerdistribution networks to accurately identify faults and reduce downtime. The system delivers considerable advantages over conventional approaches by utilizing AI algorithms for defect identification and categorization and IoT sensors for real-time data collection. Its quick reaction times and precise problem detection improve the power grid's overall resilience and effectiveness.

5. Challenges:

Even with the encouraging outcomes, there were a number of difficulties with the defect detection system's development and implementation. Optimal sensor placement, data synchronization problems, and algorithm calibration for variousfault conditions are some of these hurdles. In order to assure the system's robustness and reliability in practical applications, addressing these problems necessitated iterative testing and optimization efforts.

6. Scalability:

One important factor in the AI-based fault detection system's general adoption in bigger power grids or more IoT deployments is its scalability. Although the system has shown promise in small- to medium-sized networks, issues with data management, computational complexity, and network connection arise when scaling up to bigger grids. Subsequent investigations will concentrate on resolving these scaling concerns to facilitate the system's smooth adoption into more extensive power distribution networks.

7. Future Work:

Future directions for the defect detection system's study and development have been determined. These include investigating edge computing options for processing data in real-time at the network's edge, optimizing sensor networks for improved coverage and dependability, and integrating cutting-edge AI algorithms for defect prognosis and prediction. To guarantee the system's practical application and economic viability, additional field testing and industrypartnerships will be pursued for validation.

IV.CONCLUSION

This paper introduces a new IoT architecture for online monitoring of the faults of the induction motor instead of the traditional methods. The proposed IoT architecture is developed based on effective machine learning techniques to recognize the fault classes of the motor. Besides, the cyber- attacks issue is taken into the account and the attack can be detected and suppressed by the proposed IoT topology. Different experimental testing is performed to confirm the effectiveness of the proposed IoT architecture based on machine learning. The results emphases the superiority of the prosed IoT architecture to recognize motor faults and cyber-attacks with high accuracy.

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