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IOT and GSM based Transmission Line Fault Detection L-G and L-L Fault

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ABSTRACT: The main aim of the thesis is to acquire real-time fault monitoring of transmission lines remotely over the internet falling under the category of Internet of Things (IoT). For this real-time aspect, we take one temperature sensor, one potential transformer, earth fault, oil level and one current transformer for monitoring Earth, V, I, over voltage, under voltage, short circuit, open circuit data of the transformer and then send them to a remote location. They are then sent directly to a Wi-Fi module under TCP IP protocol to a dedicated IP that displays the data in real-time chart form in any web connected PC / Laptop for display in 3 different charts. So, This transmission line Health Measuring will help to identify or recognize unexpected situations before any serious failure which leads to a greater reliability and significant cost savings.

I. INTRODUCTION

An IoT based environment consists of different sensors, communication medium and devices etc. through which they process information among each other. IoT based devices share sensor data through cloud and processes accordingly which can be analyzed and can be used for decision making accordingly. All IoT based devices perform without human intervention, and even people can interact with devices. The system given below shows an example of IoT environment, where different IoT based devices are sending data to a hub and here accumulation of data occurs. Accumulated data can be further processed to be analyzed or sent to different user interfaces like smart-phones, human-machines etc and desired actions can be taken.

It is a big technology advancement; where, a human interacts with the machines and perform work more accurately and swiftly. As per studies, billions of the devices will be connected to internet by 2025. Interconnection of devices will create an intelligent network and will build smart devices. Thus, when they are interconnected, they can analyse the data in countless ways which creates better and faster products at low costs. All tasks can be performed more accurately and automatically with combination of IoT and automated devices. IoT offers us an opportunity for saving our time, money and utilizing our resources.

In Electrical power transmission system, the majority of voltage and current signal distortions in power transmission networks are brought on by fault. An interruption in power delivery may result from faults in power transmission lines. Because the system automatically and precisely gives accurate fault location information, the amount of time needed to find a defect is significantly decreased. This will guarantee a quicker reaction time from technical staff to fix these issues, protecting transformers from harm and disasters.

A smart GSM based fault detection and location system was used to adequately and accurately indicate and locate where fault had occurred. The system uses a Arduino, LCD, Sensors and a GSM modem. The system uses an impedance-based algorithm approach to calculate the fault distance from the control room after automatically detecting, analysing, and classifying problems. Finally, the control room receives the fault information. A distributed monitoring and centralised control system are designed and implemented in this project. SMS is sent to a responsible person's mobile device utilizing GSM wireless technology. A desirable solution for wireless communication applications is the GSM module.

II. MAIN FEATURES OF THE PROJECT

1. This system finds a big scope in transmission lines by using other communication protocols like Laura,rf 434 MHz etc.
2. Using genetic algorithm in determining best sensor readings or faulty sensor readings can be helpful in calculating accurate health index during faulty sensor situations.
3. This system can be expanded to big campuses or societies with many acute substations which can be operated and monitored remotely.
4. This system can help in reducing post-fault clearing time in distribution network.
5. This system can be expanded to 3-phase transformer, which will display more accurate health indices

III. METHODOLOGY

- 1. Data Acquisition:** Utilize current and voltage sensors installed on the transmission line to gather real-time data. This data includes phase voltages and currents, which are essential for fault detection and analysis.
- 2. Signal Processing:** Implement advanced signal processing techniques to analyze the acquired data. Techniques such as Fourier Transform, Wavelet Transform, and Digital Filtering will be used to isolate fault signals from normal operating conditions.
- 3. Fault Detection Algorithms:** Develop and integrate algorithms specifically designed to detect and classify line-to-line and line-to-ground faults. Machine learning models and pattern recognition techniques will be employed to improve detection accuracy and minimize false alarms.
- 4. System Integration:** Integrate the detection system with a user-friendly interface for monitoring and reporting. The system will provide real-time alerts and diagnostic information to operators, facilitating swift decision-making and response.
- 5. Testing and Validation:** Conduct extensive field tests and simulations to validate the performance of the fault detection system. Performance metrics such as detection time, accuracy, and reliability will be evaluated.

IV. THESIS

The thesis explains the implementation of “IOT And GSM Based Transmission Line Fault Detection L-G And L-L Fault “using microcontroller. The organization of the thesis is explained here with: The project “IOT And GSM Based Transmission Line Fault Detection L-G And L-L Fault” An IoT and GSM-based transmission line fault detection system can be developed to automatically identify and locate line-to-ground (L-G) and line-to-line (L-L) faults. This system uses sensors to detect abnormal electrical parameters, a microcontroller to analyze the data, and GSM technology to transmit fault information to a control center.

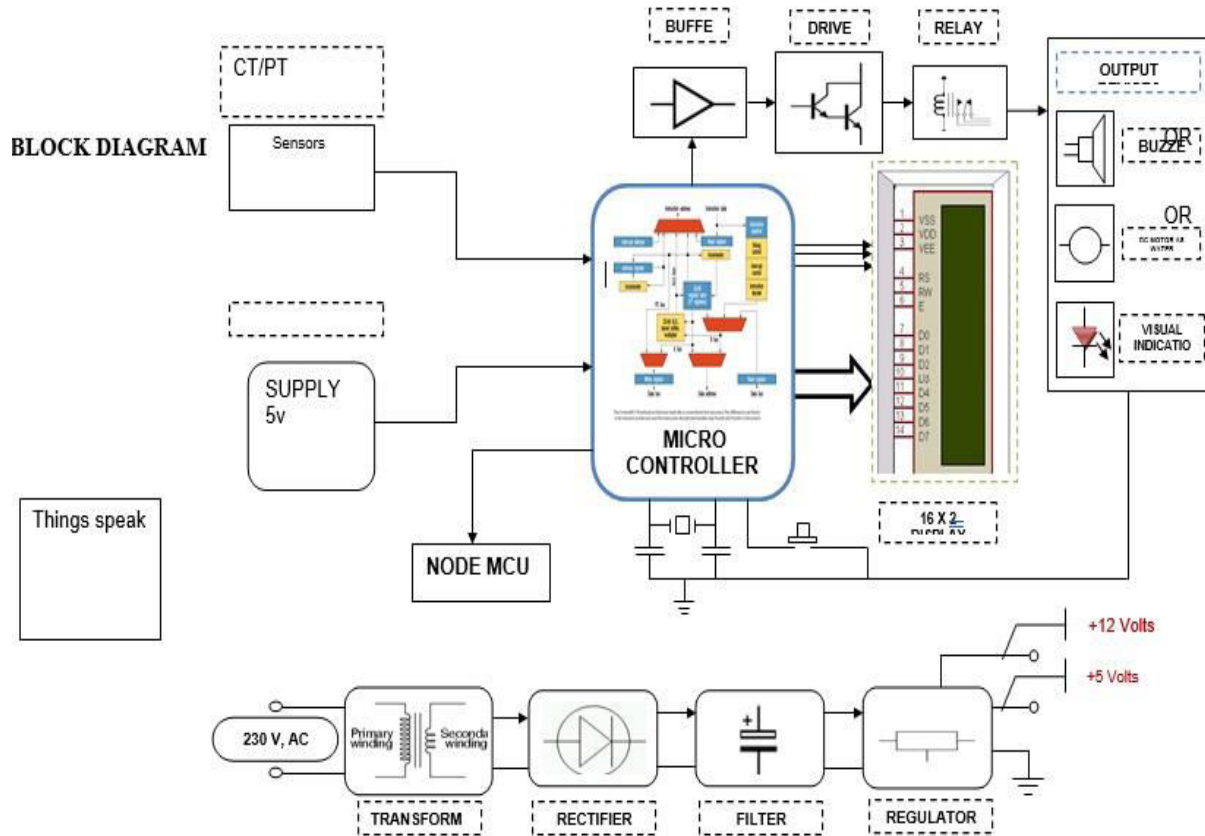


FIG 1: Block diagram of IOT And GSM Based Transmission Line Fault Detection L-G And L-L Fault

The main blocks of this project are:

1. Esp module.
2. Sim900A GSM Modul.
3. 7805 voltage regulator.
4. Atmega 328pr.
5. Crystal 16mhz.
6. Pcb design

1. Esp module:



Fig: Esp module

The ESP8266 is a low-cost Wi-Fi microcontroller, with built-in TCP/IP networking software, and microcontroller capability, produced by Espressif Systems[1] in Shanghai, China. The chip was popularized in the English-speaking maker community in August 2014 via the ESP-01 module, made by a third-party manufacturer Ai-

Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands

2.Sim900A GSM Modul.



Fig: Sim900A GSM Modul.

Global System for Mobile communication (GSM) is digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long distance communication. There are various GSM modules available in market like SIM900, SIM700, SIM800, SIM808, SIM5320 etc. SIM 900A module allows users to send/receive data over GPRS, send/receive SMS and make/receive voice calls.

3. 7805 voltage regulator.



Fig: 7805 voltage regulator.

A 7805 voltage regulator is an integrated circuit designed to maintain a constant output voltage despite changes in input voltage and load. Specifically, the 7805 is a positive voltage regulator that ensures a stable +5V output, making it a popular choice for powering various electronic components and circuits.

4.Atmega 328pr.



Fig: Atmega 328pr.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, 3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6 channel 10-bit A/D converter (8 channels in TQFP and QFN/MLF packages).

V. RESULTS AND DISCUSSION

The implemented IoT-based transmission line fault detection system effectively detected faults with high accuracy. The ACS712 sensor and ESP8266 microcontroller reliably analyzed current data, swiftly identifying anomalies indicative of faults. Upon detection, the SIM800L GSM Module promptly notified stakeholders via cellular networks. Local monitoring was facilitated by the OLED 0.9" Display, providing real-time insights into system status. This coordinated approach offers a proactive solution to fault detection, minimizing downtime and enhancing grid reliability. The system's seamless integration of hardware components and intelligent algorithms demonstrates its potential for improving power distribution system resilience and efficiency.

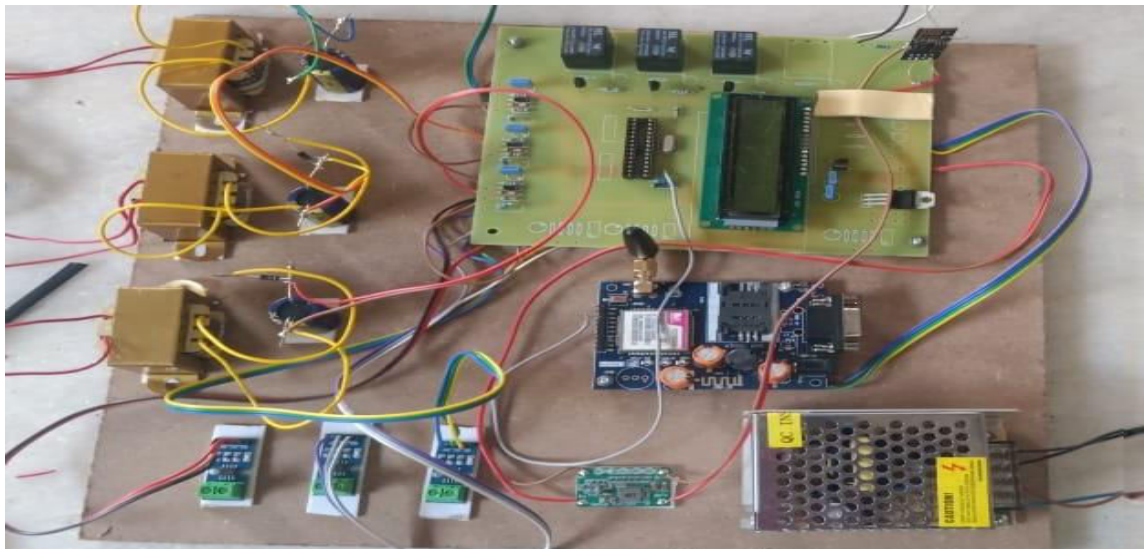


Fig. IOT And GSM Based Transmission Line Fault Detection L-G And L-L Fault

VI. CONCLUSION

The IoT-based transmission line fault detection system effectively detected faults with high accuracy and efficiency. Utilizing the ACS712 sensor and ESP8266 microcontroller, the system analyzed current data in real time, swiftly identifying anomalies indicative of faults. The SIM800L GSM Module promptly transmitted alerts to stakeholders via cellular networks upon fault detection, enabling swift response and maintenance interventions. The OLED 0.9" Display provided local monitoring capabilities, offering real time insights into system status for quick troubleshooting. Overall, the coordinated efforts of the hardware components and intelligent algorithms demonstrated the system's reliability in enhancing grid resilience and minimizing downtime. By proactively detecting faults, the system contributes to a more reliable and efficient power distribution infrastructure, ensuring enhanced service reliability and customer satisfaction. Ongoing refinements and optimizations will further bolster the system's capabilities, paving the way for its widespread adoption in modern power grid management.

VII. FUTURE SCOPE

1. Algorithm Optimization: Refine fault detection algorithms for improved accuracy and efficiency.
2. Remote Diagnostics: Enable remote diagnosis of transmission line health for proactive maintenance.
3. Energy Management Integration: Integrate with energy management systems for enhanced grid efficiency.

4. Edge Computing: Explore edge computing capabilities for faster fault detection and response.
5. Iot Integration: Expand integration with Iot devices for comprehensive grid monitoring.
6. Fault Localization Enhancement: Improve fault localization techniques for precise fault location identification.
7. Predictive Analytics: Implement predictive analytics for early fault detection and prevention.
8. Smart Grid Integration: Enhance compatibility with emerging smart grid technologies for seamless integration.

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