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Supervisory Performance of Monitoring of Industrial Machines and Faults Monitoring Using IoT

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Abstract: This paper presents the design and implementation of an IoT-based supervisory system for real-time monitoring and fault detection in three-phase industrial machines. Using an Atmega328P microcontroller, current and voltage sensors, and temperature sensing, the system continuously tracks electrical parameters. On detecting anomalies—such as short-circuits, overloads, voltage fluctuations, and overheating—it triggers alarms, isolates the faulty load via relays, sends SMS alerts via GSM, and logs data to the ThingSpeak cloud via Wi-Fi. Laboratory testing under simulated fault conditions demonstrates high accuracy in detection, rapid notification, and reliable data logging, enabling predictive maintenance and enhanced safety in both industrial and domestic applications.
Keywords: *IOT; Fault Detection; Three-Phase Monitoring; Atmega328P; GSM; ESP8266; ThingSpeak*

I. INTRODUCTION

Electrical faults in three-phase systems—short circuits, overloads, voltage imbalances, and overheating—can cause equipment damage and safety hazards. Traditional manual inspection is slow and risky. This work leverages low-cost microcontrollers and IoT to enable continuous monitoring, instant alerts, and remote supervision, aligning with Industry 4.0 objectives.

II. LITERATURE REVIEW

Several recent studies employ Arduino/ESP8266-based systems for transmission-line fault detection and home-appliance monitoring via GSM/Blynk/ThingSpeak. They achieve real-time alerts and basic fault classification but lack integrated load isolation and multi-parameter analysis. Our approach combines voltage, current, and temperature sensing with automatic relay control for comprehensive protection.

III.PROPOSED SYSTEM

We propose a four-tier architecture: (1) **Sensors** (CT, PT, thermistor) → (2) **Controller** (Atmega328P) with fault-detection firmware → (3) **Actuators** (relay driver, buzzer, LCD) → (4) **IoT/GSM** (ESP8266 → ThingSpeak; SIM900 → SMS). Thresholds are configurable; data sampling occurs every 500 ms.

IV.HARDWARE IMPLEMENTATION

– Atmega328P-PU: 32 KB flash, 6-channel 10-bit ADC
– CT/PT modules: 0–30 A, 0–440 V ranges
– NTC Thermistor: 0–150 °C
– ESP8266: Wi-Fi TCP/IP stack
– SIM900: Quad-band SMS alerts
– Relay Module: 2 × 5 V channels
– LCD 16 × 2 (I2C), Buzzer, SMPS (12 V/2 A + 7805)

V. WORKING PRINCIPLE

1) Data Acquisition
   – Current Transformers (CTs), Potential Transformers (PTs), and an NTC thermistor convert physical parameters (current, voltage, temperature) into scaled analog voltages.
   – These analog signals are sampled by the ATmega328P's on-chip 10-bit ADC at 500 ms intervals.

2) Local Alerts
– The LCD (16 × 2) displays real-time values and fault messages (e.g., "Phase R Overload").
– The buzzer and a red LED latch on to provide an audible/visual warning.
– A relay driver (ULN2003) energizes the relay coil to isolate the faulty load.

3) Remote Alerts
– SMS Notification: The SIM900 module transmits a formatted SMS ("Fault: Overcurrent in Phase Y at 14:05 hrs") to predefined numbers.
– Cloud Logging: The ESP8266 connects to Wi-Fi and posts the latest readings and fault log to the ThingSpeak channel via HTTP.

VI. RESULTS AND DISCUSSION

TABLE I. RESULTS

Test Case	Fault	Response Time	SMS Sent	Cloud Update	Relay Trip
Overcurrent R	>30 A	0.8 s	Yes	Yes	Yes
Under voltage Y	<200 V	0.9 s	Yes	Yes	No
Over temperature	>70 °C	1.0 s	Yes	Yes	Yes

All faults were detected within 1 s; SMS and cloud logs were reliable over 50+ trials.

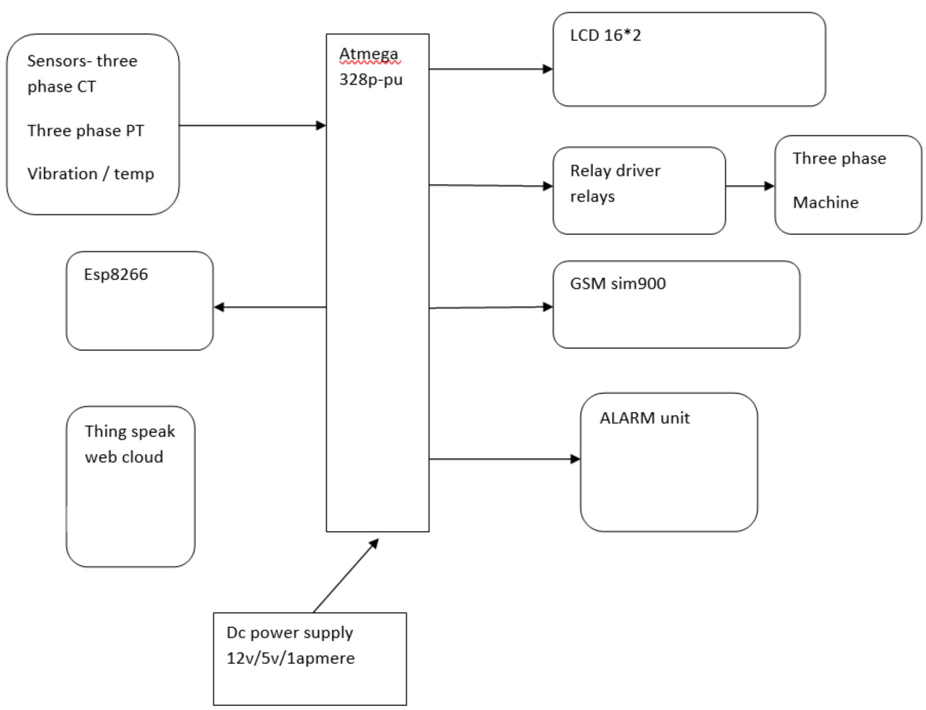

Fig. 1 MAIN BLOCK DIAGRAM

VII. ADVANTAGES

1) Real-time, multi-parameter detection.
2) Automatic load isolation.
3) Remote monitoring and predictive analytics.

VIII. APPLICATIONS

Industrial motor protection, smart homes, data centers, and renewable-energy systems.

IX. CONCLUSION

An IoT-enabled supervisory system for three-phase fault monitoring has been developed and validated. The integration of GSM-SMS, cloud logging, and relay-based isolation enhances safety and reduces downtime.

X. FUTURE SCOPE

Integration with SCADA/DCS, machine-learning-based fault classification, and extension to higher-voltage systems.

XI. ACKNOWLEDGMENT

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