Microcontroller Based Detection and Protection of Induction Motor

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Abstract - *This adventure proposes a ultramodern approach to mechanical robotization and blame checking, with a center on the critical part played by acceptance machines in different businesses. Mechanical robotization is introductory for guaranteeing exact and exact operations. The proposed frame for observing the parameters of acceptance machines is grounded on microcontroller communication conventions, which guarantees secure and cost-effective information communication in mechanical settings. Parameters similar as current, voltage, and temperature are introductory for the control frame of acceptance machines, as they directly affect their prosecution. In any case, keeping up control over these parameters amid ceaseless operation postures challenges. The microcontroller frame is employed to collect and store information, as well as produce control signals to begin or halt the acceptance machine. The frame also identifies and screens different excrescencies similar as overvoltage, overcurrent, and overtemperature.*

Keywords *Microcontroller, Induction Motor, Current, Temperature, Voltage.*

1.INTRODUCTION

In previous days DC machines were habitually employed for mechanical operations. A huge number of machines are being employed for common purposes in our terrain from family tackle to machine bias in mechanical services. The electric machine is presently a essential source of control in multitudinous businesses. The work and prosecution needed for these machines are wide- ranging. With the invention of AC acceptance machines that have advanced generally prosecution traits over DC machines, mechanical robotization is being astronomically fulfilled with it. essential benefits of the IM are its unvarying quality, moo regard, and ease of generation with acknowledgment to by and by employed altitudinous in general prosecution vehicles be that as it may it's long hauls a extraordinary bargain more worrisome to control. Acceptance machines are the most extreme astronomically employed machines for domestic tackle, acceptance control, and robotization; along these lines, they may be vigorous, dependable, and durable. Acceptance machine naturally endures from under voltage, over-voltage, and overheating. Due to this electrical blame, the winding of the machine gets warmed which causes division disappointment and as a result decreases the presence time of the machine. When the Acceptance machine conveys way better voltage than is estimated at that point the acceptance machine begins to ended up overheated.

1.1 Block Diagram
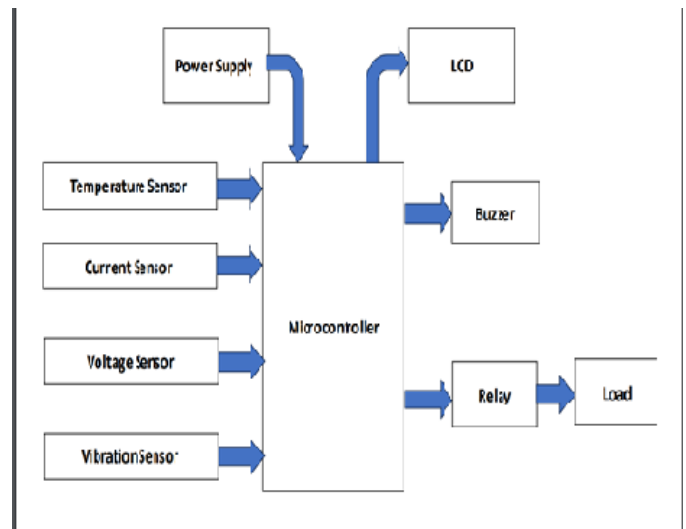
Working

This frame defenses four implicit excrescencies over current, voltage dissonances, temperature rise, and vibration detect or blunders. However, one of four conditions will execute, If any of these excrescencies happen.

still, the microcontroller will trip the control circuit exercising a hand- off, If there's an overcurrent in the machine. The blame will be shown on the screen.

still, a buzzer will sound to demonstrate the blame, If there's a voltage rise or drop. The blame will also be shown on the screen.

still, a cooling addict will be legislated to avoid overheating, If the temperature rises. The temperature will be shown on the screen.

still, a buzzer will sound to alarm the customer nearly the vibration, If any climate are honored in the machine. The blame will be shown on the screen.

2. Flowchart
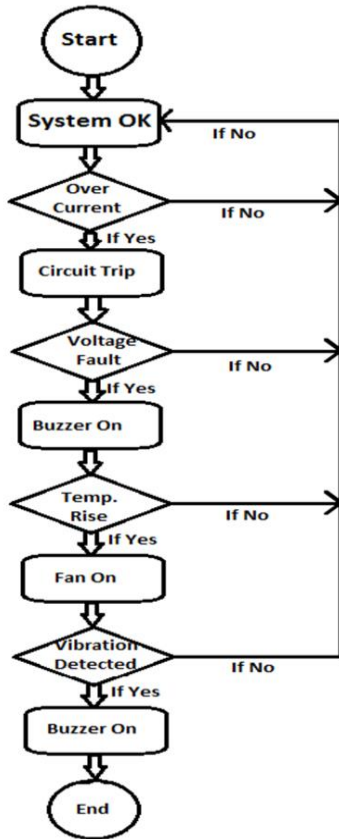
3. Main Component Used In Circuit

1. Atmega328

2. Current sensor ACS 712

3. Temperature sensor LM35

4. Vibration Sensor Module

5. Single phase Induction motor

6. Relay

7. Buzzer

8. TV Display(16 × 2)

9. Motor

10. 16 mhz crystal

4. Description of above component:

4.1 Atmega 328:
The ATmega328 is a microcontroller planned by Atmel in the mega AVR family. It has an 8- bit RISC processor center with a acclimated Harvard design. The details incorporate 32 KB ISP band memory with read- while- write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general- purpose I/ O lines, 32 general- purpose working registers, 3 adaptable

timekeeper/ counters with compare modes, outside and outdoors hinders, periodical programmable USART, a byte-acquainted 2- line diurnal interface, SPI serial port, and a 6-channel 10- bit A/ D motor.

4.2 Current sensor ACS 712
ACS712 offers exact and reasonable AC or DC detecting arrangements for marketable, mechanical, and communication fabrics. It's applicable for different operations similar as machine control, mound position and administration, switched- mode control inventories, and overcurrent blame protection.

4.3 Temperature sensor lm35
The LM35 arrangement is a gather of delicacy integrated-circuit temperature detectors. These detectors have a straightly relative yield voltage to the Celsius(Centigrade) temperature.

4.4 Vibration Sensor Module
This module highlights an portable potentiometer, a vibration detector, and a LM393 comparator chip to deliver an portable motorized yield grounded on the sum of vibration.

4.5 Single phase Induction motor
An electrical machine is an electromechanical contrivance that changes over electrical vitality into mechanical vitality. Single- phase machines are straightforward in development, cheap, solid, and simple to repair and maintain.

4.6 Relay
A hand- off is an electrically worked switch. multitudinous transfers use an electromagnet to mechanically work a switch. Be that as it may, other working norms are too employed, similar as solid state transfers. Transfers are employed when it's essential to control a circuit by a partitioned low power flag or when one flag needs to control different circuits

4.7 Buzzer
A buzzer or beeper is a contrivance that produces an able of being heard sound to flag or demonstrate commodity. It can be either electromechanical, piezoelectric or mechanical. The buzzer's essential work is to change over an sound flag into a sound.

4.8 LCD Display
Liquid Crystal Display is used for display the measured readings and if fault occur it also show on LCD. 16×2 LCD is used in circuit. It having 16 character and 2 rows.

4.9 12 V Transformer
A transformer is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits. Transformers are used to change AC voltage levels, such transformers being termed step-up or

step-down type to increase or decrease voltage level, respectively.

4.10 16mhz crystal

The 16 MHz crystal is a type of crystal oscillator that generates a signal with a nominal frequency of 16 megahertz (MHz). The frequency is expressed in kilohertz (kHz) for frequencies less than 1.0 MHz and in megahertz (MHz) for frequencies of 1.0 MHz and above. Frequencies may be specified to seven significant figures.

5.Advantages

Fault Detection: Microcontrollers can monitor various parameters such as current, voltage, and temperature in real-time, enabling quick detection of faults like overcurrent, overload, and phase imbalance.

Energy Efficiency: By monitoring the motor's performance, microcontrollers can optimize the motor's operation, leading to energy savings and increased efficiency.

Customization: These systems can be programmed to cater to specific motor requirements, making them highly customizable for different applications and industries.

Cost-Effectiveness: While the initial setup might require an investment, in the long run, microcontroller-based systems can save costs by preventing major motor failures and reducing downtime.

Diagnostic Capabilities: Microcontrollers can collect and store data related to motor performance, allowing for detailed diagnostics. This data can be analyzed to predict potential issues and schedule maintenance proactively.

Safety: By swiftly detecting faults and initiating protective measures, these systems enhance overall safety in industrial environments, preventing accidents and equipment damage.

Increased Lifespan: By ensuring that the motor operates within its safe limits and under optimal conditions, these systems can significantly increase the lifespan of the induction motor, reducing the need for frequent replacements.

6. Limitations:

Limited Sensing Range: Microcontrollers rely on sensors to detect motor parameters. The sensing range of these sensors is limited, which might not cover the entire motor, leading to incomplete information.

Response Time: Microcontrollers require some processing time to analyze sensor data and activate protection mechanisms. In critical situations, this delay could lead to motor damage before protection measures are implemented.

Complexity of Motor Systems: Induction motors in real-world applications are often part of complex systems involving various components. Microcontroller-based protection systems might not fully account for all possible interactions within these systems.

Maintenance and Calibration: Sensors and microcontroller-based systems require regular maintenance and calibration to ensure accurate readings and reliable protection. Neglecting this maintenance can compromise the effectiveness of the protection system.

Cost: Implementing a comprehensive microcontroller-based protection system can be expensive, especially for large industrial setups with multiple motors. Cost constraints might limit the extent of protection measures that can be implemented.

Scalability: Adapting microcontroller-based protection systems for different types and sizes of motors, especially in diverse industrial settings, can be challenging. Each motor might require a tailored approach, making scalability a limitation.

7.Applications

- Overcurrent Protection
- Voltage Fluctuation Protection
- Temperature Monitoring
- Phase Imbalance Detection
- Short Circuit Protection
- Stall Detection
- Soft Start and Stop
- Remote Monitoring and Control
- Energy Efficiency
- Diagnostic and Maintenance Information

8.Result:

After Completing and Testing the project we have observed these following results

PARAMETER	CONDITION	RESULT
Over-Current	If Current is greater than 0.65 A	Motor will trip
Over-temperature	If temperature rise above 55°C	Fan will turn on
Vibration	---	Buzzer will turn on
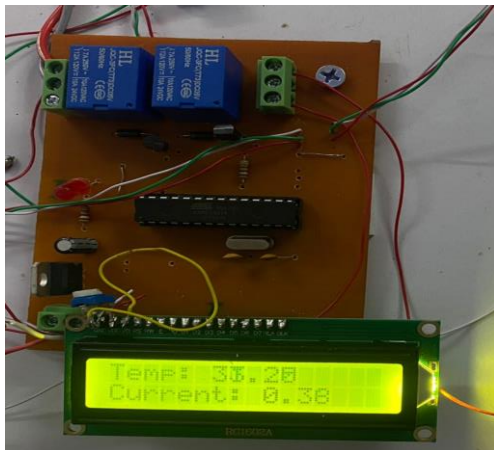
8.CONCLUSIONS

In mechanical settings, acceptance machines are helpless to harm from over-voltage, under voltage ,over-current, and over-temperature conditions. This paper has effectively displayed a reliable, quick, and complete frame for securing acceptance machines. The frame can be executed in any assiduity where machine security is a introductory prerequisite. The offer centers on securing single- phase acceptance machines beneath defective conditions, exercising a microcontroller and hand- off motorist circuit for prosecution.

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