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Motorized Circuit Breaker by using Arduino

Dr. Mrs. D. A. Tamboli[1], Prashant S. Shiraskar[2], Harshvardhan R. Shinde[3], Abhishek S, Sutar[5], Onkar S. Adhatrao[5]
Head of Department, Department of Electrical Engineering[1]
Students, Department of Electrical Engineering[2,3,4,5]
SVERI's College of Engineering, Gopalpur, Pandharpur, Maharashtra, India

Abstract: *Circuit breakers are the primary devices for the protection and switching operations of electrical systems. B. If the building burns down or the control panel is damaged by exposure to direct impact from an electrical short circuit or overload, to limit these risks: It is necessary to take more advanced measures such as B. Intelligent and fast reacting circuit breaker. Protect your system from overloads and short circuits through this project. The concept of electronic circuit breakers came to the fore when it was discovered that traditional circuit breakers such as MCBs take a long time to trip. Therefore, it is very important for sensitive loads to activate the trigger mechanism as soon as possible, preferably immediately. Electronic circuit breakers are based on the voltage drop across a series element (usually a low value resistor) proportional to the load current. This voltage is detected and converted to direct current. It is then compared to a preset voltage by a level comparator and produces an output that drives a relay through the Arduino Uno to trigger the load. Since such solid-state switches will inevitably fail in the event of an accidental short circuit, it is preferable to use relays instead of solid-state switches. This project is very fast and overcomes the shortcomings of thermal circuit breakers. In this project, a motorized circuit breaker is built based on an Arduino and the necessary sensors, so you can print the voltage and current results with the help of current and voltage sensors and an LCD. In a short circuit condition, the current is very high and the voltage is almost zero. The Arduino receives these values from the sensors and compares them to thresholds to make the correct decisions to protect the system from damage. The same principle applies. to increase the load limit. Additionally, this project can be extended by using a current transformer (CT) for galvanic isolation between mains and control circuits. The use of power electronics devices such as high-power transistors enables faster operation compared to conventional ones.*

Keywords: circuit breaker, over load protecter

I. INTRODUCTION

Electronic circuit breakers primarily consist of an automatically operated switch controlled by feedback from the load. This is based on the fact that the switch will automatically close if too much current is drawn by the consumer or if an overload causes too much current to flow through the line. This switch is a relay-like electromechanical switch controlled by a microcontroller through a current sensing element such as a resistor.

This ultra-fast electronic circuit breaker device uses a series resistor to detect when the current exceeds a set value (due to overload). This voltage is sensed and compared to a preset voltage by an op amp to generate an output that drives a relay that trips the load within milliseconds.

Based on the current measurement principle, the tripping time is very short. In the event of an anomaly, the voltage drop increases sharply and trips the load. This project is to build a circuit breaker that senses overload current (via a series resistor) and isolates the power supply from the load accordingly.

II. IMPORTANCEOFCIRCUIT BREAKER AND PROTECTION

Circuit breakers and protection systems play an important role in electrical systems by ensuring safety, preventing damage to equipment and minimizing the risk of electrical hazards.

It protects against overloads and short circuits and interrupts the flow of electricity to prevent damage to electrical components and cables.

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- Device protection: Circuit breakers protect electrical equipment from damage due to faults and abnormal conditions.
- Personal Security: Circuit breakers increase personal safety by preventing electrical shock and injury.

In the event of a fault or malfunction, a circuit breaker interrupts the flow of current, reducing the risk of electric shock to anyone working on the circuit or coming into contact with the faulty equipment.

Fire protection: Electrical faults such as short circuits and overloads can cause excessive heat generation and fire. Circuit breakers detect these faults and interrupt the flow of current, preventing heat build-up and reducing the risk of electrical fires.

Overall, circuit breakers and protection systems are essential to the reliable and safe operation of electrical systems.

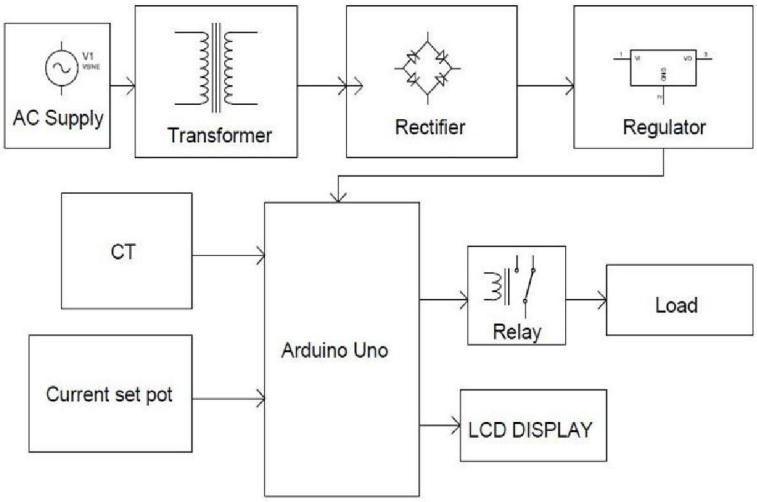

Figure: Block diagram

Motorized circuit breaker by using Arduino is an advanced, more effective and reliable circuit breaker. This circuit breaker is different from the conventional circuit breakers such as the miniature circuit breaker that makes use of the temperature nature and property of thermal bimetallic strip, to trip off when there is an overload or short circuit. The motorized circuit breaker makes use of comparators, series elements depending on the appliances on which they are to be installed, Arduino and some other devices to perform its fast-tripping process. TheArduino based circuit breaker is developed by the R.I Sudjoko and Hartono (2021). They have designed more efficient and sensitive circuit breaker as compared to conventional circuit breaker. From their experimental data, they are concluded that Arduino based circuit breaker is takes less time for its operation as compared to conventional circuit breaker.

III. PROPOSED WORK

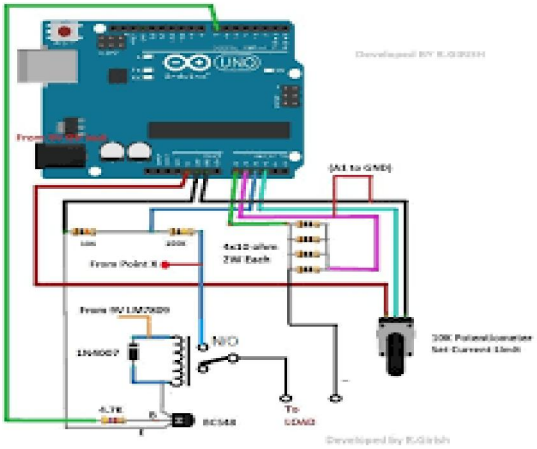

Figure: Schematic Diagram

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- The main power supply is given directly to load and step down transformer.
- 230 volt is Step down to 12v and then we use diodes which are act like a rectifier to convert ac to dc and passed through 7805 regulators to get 5v supply for Arduino
- Capacitor filters are used to remove the ripples to get pure constant 5v dc voltage.
- In this project, we are protecting our circuit from over load current. As load increases then device get OFF otherwise it remains in its original state.
- For that, we are using Relay. Load connected with relay. If there is single load then circuit works properly.
- If load increases then current rating increases that current is sensed by current sensor and sensor gives the signal to the Arduino.
- Arduino compared overload current value with current value which is set in Arduino, after comparing the values of currents Arduino gives signal to the relay.
- If value is less than the set value then relay gives continue supply to the load, if not then relay trip the load from supply.
- After that process the values of current for both conditions are displayed on the display

III. RESULT

The tripping circuit is able to switch ON and OFF the system loads when there is an over current or overload. The timed relay circuit with the Arduino worked satisfactorily within 1µsecs. The LED to indicate when there is an overload with the tripping process worked satisfactorily. When the system loads are off, the reset switch is off and then pushed on, to activate the single load on, after the overload is eliminated.

IV. CONCLUSION

With this system, the load is immediately turned off in the event of an overload. This system had significant advantages over traditional long trip time circuit breakers. It takes about 0.023 seconds for the circuit breaker to break the circuit. Device protection and control play a very important role today. In order to avoid power outages, a high-speed response circuit breaker that achieves smoother operation with higher failure detection accuracy and breaking time accuracy than conventional models are used. Extensive experimentation to build the required circuit yielded successful results. Electronic circuit breakers have proven to be very useful circuits for sensitive loads. The main advantage of this circuit is the short total trip time compared to traditional circuit breakers. The experiment was successful and saved energy. Further research is underway to improve resilience and trip time.

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