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Design, Modeling and Testing Of Over Current Relay for Power System Protection

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Abstract*:* In the present scenario of technological revolution it has been observed that every application products are impacted with multiple functions. The design is also moving forward the miniature architecture; all this properties can be achieved in a product by using programmable device The electrical engineering and its applications are the oldest streams of engineering. In the present scenario all the electrical protection systems are based on electro mechanical devices. Though these systems are quit reliable and cheaper. It has certain disadvantages. The multifunctional is out of question. Recently, the technical revolution made embedded technology cheaper, so that it can be applied to all the fields. The Over current Relay is one of the relays, which basically designed to protect the power distribution line against earth fault in a particular zone.

Keywords— Transformer, rectifier, comparator, relay, buzzer driver and resistive load.

I.INTRODUCTION

This relay is working on the principle of current sensing .There is a special type of current sensor used to sample current. The output of both the current transformer is converted into dc voltage and compared with a reference voltage correspond to set point current value. when the line draw a current more than the required specified rating than the comparator output get set and drive a latch. The bi-stable latch is designed by 555IC which send a signal to the relay driver to trip the circuit.

II. BLOCK DIAGRAM AND CIRCUIT DIAGRAME DESCRIPTION

The system is designed for a 12V,1ampere, 200 rpm DC motor using ATMEGA 16A microcontroller programmed using the software AVR STUDIO-4 and SINAPROG. The project needs a L293D motor driver for controlling the speed of the DC motor. ACS712 current sensor is used to measure the current flows through the motor and gives the value of current to the microcontroller. Similarly speed sensor counts the number of rotations per minute and gives the value as input to microcontroller. Also 16X4 LCD displays the measured values and limit values entered in program and 128X64 graphical LCD shows the graphs by taking the respective values.

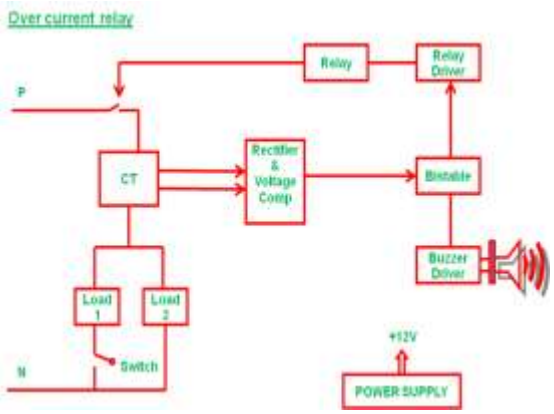

Figure 1 Block diagram of over current relay

regulator through capacitor with respect to GND and thus a fixed o/p is obtained. The o/p of the IC regulator (7805 & 7812) is given to the LED for indication purpose through resistor. Due to the forward bias of the LED, the LED glows ON state, and the o/p are obtained from the pin no-3

The o/p of the bridge rectifier is given as input to the IC

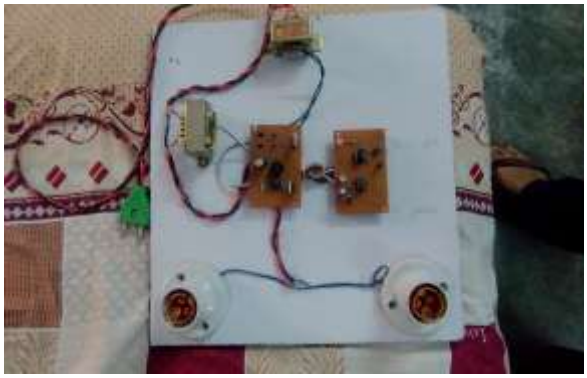

Figure 2 Model picture of over current relay

III.METHEDOLOGY

The total project consists of five sections i.e

A. Power Supply.
B. Comparator.
C. Not gate.
D. Bi-stable.
E. Relay Driver.

A. Power supply:-

Circuit connection: - In this we are using Transformer (9-0-9) v / 1mA, IC 7805 & 7812, diodes IN 4007, LED & resistors.

Here 230V, 50 Hz ac signal is given as input to the primary of the transformer and the secondary of the transformer is given to the bridge rectification diode. The o/p of the bridge rectifier is given as i/p to the IC regulator (7805 &7812) through capacitor (1000mf/35v). The o/p of the IC regulator is given to the LED through resistors.

Circuit Explanations: - When ac signal is given to the primary of the transformer, due to the magnetic effect of the coil magnetic flux is induced in the coil (primary) and transfer to the secondary coil of the transformer due to the transformer action."

During the +ve cycle of the ac signal the diodes D2 & D4 conduct due to the forward bias of the diodes and diodes D1 & D3 does not conduct due to the reversed bias of the diodes. Similarly during the –ve cycle of the ac signal the diodes D1 & D3 conduct due to the forward bias of the diodes and the diodes D2 & D4 does not conduct due to reversed bias of the diodes. The output of the bridge rectifier is not a power dc along with rippled ac is also present. To overcome this effect, a capacitor is connected to the o/p of the diodes (D2 & D3). Which removes the unwanted ac signal and thus a pure dc is obtained. Here we need a fixed voltage, that's for we are using IC regulators (7805 & 7812)."Voltage regulation is a circuit that supplies a constant voltage regardless of changes in load current." This IC's are designed as fixed voltage regulators and with adequate heat sinking can deliver output current in excess of 1A..

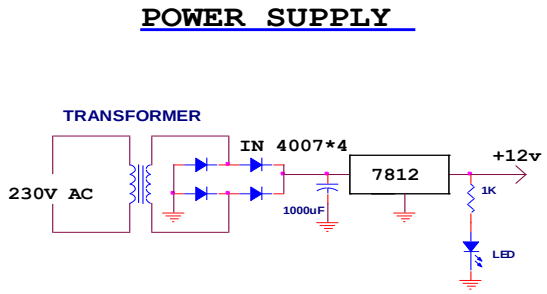

Figure 3 Power supply

B. Comparator

This section is configured with a IC comparator. LM393. .All the components are receiving a common input signal from the signal conditing section. The comparator is designed with Hysterisis, to avoid flecpreation at the equal set value. All the four comparators are set with different reference value, each corresponds to a particular current value. Whenever the input to this comparator from the signal section, gives beyond the set value, then the comparator toggles. As the input is given at the non – inverting terminal as the output of the comparator goes to positive saturation voltage. as the reference voltage are set in a increasing order, When the comparator set for highest value is driven into positive saturation. All the comparator must be driven into saturation. So LEDs connected to the each comparator section indicate the level of current.

C. Not Gate

In digital logic, an **inverter** or **NOT gate** is a logic gate which implements logical negation. The truth table is shown on the right.

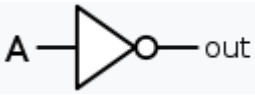

Figure 4

Traditional NOT Gate (Inverter) symbol

INPUT	OUTPUT
A	NOT A
0	1
1	0

The application of the transistors is not limited solely to the amplification of the signals. Through proper design transistors can be used as switches for computers and control applications.

The network of figure-01 (a) can be employed as an inverter in computer logic circuitry. Note that the output voltage Vc is opposite to the applied to the base or input terminal. In addition note the absence of dc supply connected to the base circuit. The only dc source is connected to the collector or output side, and for computer applications is typically equal to the magnitude of the "high" side of the applied signal – in this case 5V.

D. Bi-stable

The latch is the electronics device which stores the state even if the input is withdrawn. So this can be

started as a single memory unit. The latch can be designed in many ways by using a discreet component or flip-flop or a IC known as 555 timer, The Latch designed using 555 timer IC is quite stable.

Ckt Connection:

The Bistable design gas two inputs, one as trigger input to change the state and the other is to reset the output. The input signal is connected to the trigger pin and the threshold is grounded. It means the output of the comparator to which 2/3 Vcc is connected and threshold (ground) is kept at fixed output. When the trigger pin is issued with an input which is less than 1/3 Vcc then automatically the comparators output toggles and hence the flip flop output toggles and the output of the 555 timer IC is set. The output remains in the state until unless the reset input is pulled down to ground.

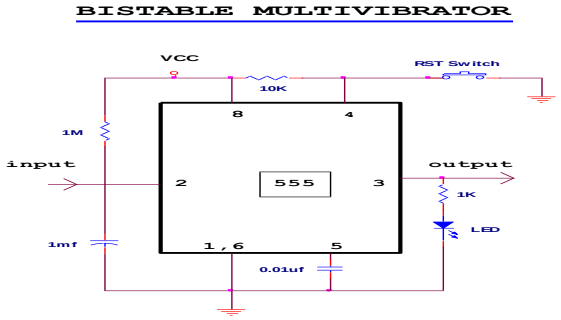

Figure 5 Bistable Multivibrator

E. RELAY DRIVER

Here in this section, to activate/deactivate the load a solid state device is used to drive the load but the load is an AC load for that we have to isolate that for that we have used an opto-isolator (MOC3201) as a driver. It is an electronics device which isolates between input to output, that device is consisting of a LED and a DIAC which is fabricated on a single chip. Whenever a high voltage is given as input to the LED the LED gets forward biased which in turn ON the LED, the light falls on the DIAC which in turn the DIAC thus gets a sufficient current to drive the gate of the TRIAC to make turn ON the LOAD.

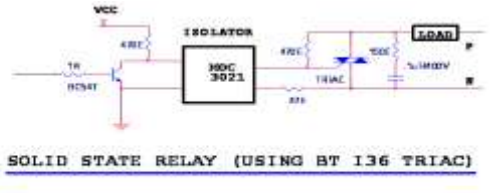

Figure 6 Solid State Relay.

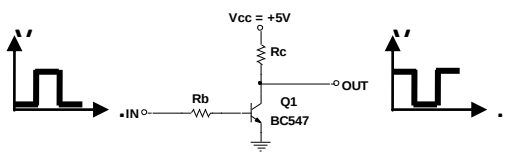

Figure7:-Project Model of measurement, protection, speed control and graphical observation of dc motor

IV. CONCLUSION

This project is working perfectly in the laboratory condition and it can handle a current up to 10A. Adjusting the reference voltage can control the current that is set as maximum current. The relay is tested by putting a bleeder lamp in the line. Also can be expanded to interface with computer and display and record the faults in the computer. Also other Transmission and distribution relays can be incorporated.

V.ACKNOWLEDGEMENT

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