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Smart Circuit Breaker

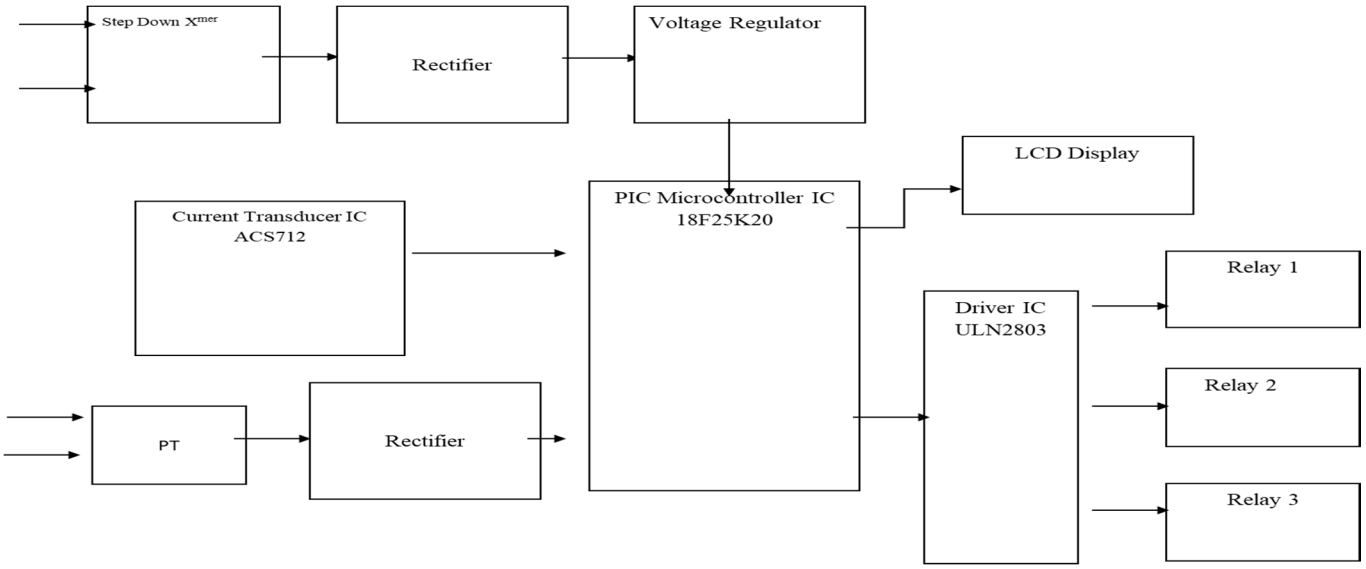
Ankit Aloni[1], Prof. Vishal Mehtre[2], Yashashwi Raj[3]
[1, 2, 3]*Bharati Vidhyapeeth College of Engineering Pune*

***Abstract:** This project is to supply single phase home appliances. This project is used for an alternative for MCB. MCB is fault current protective device which trip on fault current which flows in the circuit. MCB are based on the thermal bimetallic trip mechanism which is very slow and tripping time is based upon percentage of overloads MCB having bimetallic trip which gets derated after some mechanical operation and cause unwanted tripping. All the above faults will be overcome by smart circuit breakers which provide all types of protection such as overload, under voltage, high temperature and short circuit protection, this type of protection is necessary because, now days all, appliance such as LCD, Air conditioner, Refrigerator, etc consist of electronic circuitry which is voltage sensitive and get damage at voltage fluctuation. This project also monitors and display fault on LCD and stores the data for further action. Smart circuit breaker is fast acting and sense relay as fast as possible and trips the relay within 100msec. than MCB which takes 1000msec. to 1600msec. In addition to that LM 35 temperature sensor is also interface to microcontroller by if temperature exceed 550C microcontroller will trip the relay. The intention to use temperature sensor is to detect fire hazard in domestic purpose as well as commercial purpose.*

***Keywords:** Circuit Breaker, LCD, MCB, Relay, Sensor*

I. INTRODUCTION

A fault in electrical instrumentality is outlined as a defect in its electric circuit because of that this is amused from the supposed path. Faults are usually caused by mechanical failure, accidents, excessive internal and external stresses etc. The fault resistance being low, the fault currents are comparatively high. During the faults, the ability flow is amused towards the fault and therefore the provide to the neighboring zone is affected. Voltages become unbalanced. it's necessary to notice the fault as early as doable that's why a kit is being created exploitation microcontroller to form its method quicker. it'll notice following four major faults and can offer trip signal to relay. The four faults detected by the model are: below voltage Over voltage, Short-circuit, Overload and hot temperature. This project is intended to pack up the ability provide once any higher than fault occur. standard breaker like MCB supported thermal electrical device lever mechanism. it's terribly slow and therefore the trip time depends upon the share of overload. In this project potential electrical device is employed to sense the input voltage across the load and current electrical device is employed to sense this within the circuit and offers command to microcontroller to trip the relay if voltage varies inside set vary. The idea of good breaker came into focus realizing that standard breaker like MCB takes longer time to trip, thus sensitive device injury and therefore it's important to activate the tripping mechanism at the shortest doable time, preferred instant. This project is extraordinarily quick and overcome the drawbacks of the thermal sort.

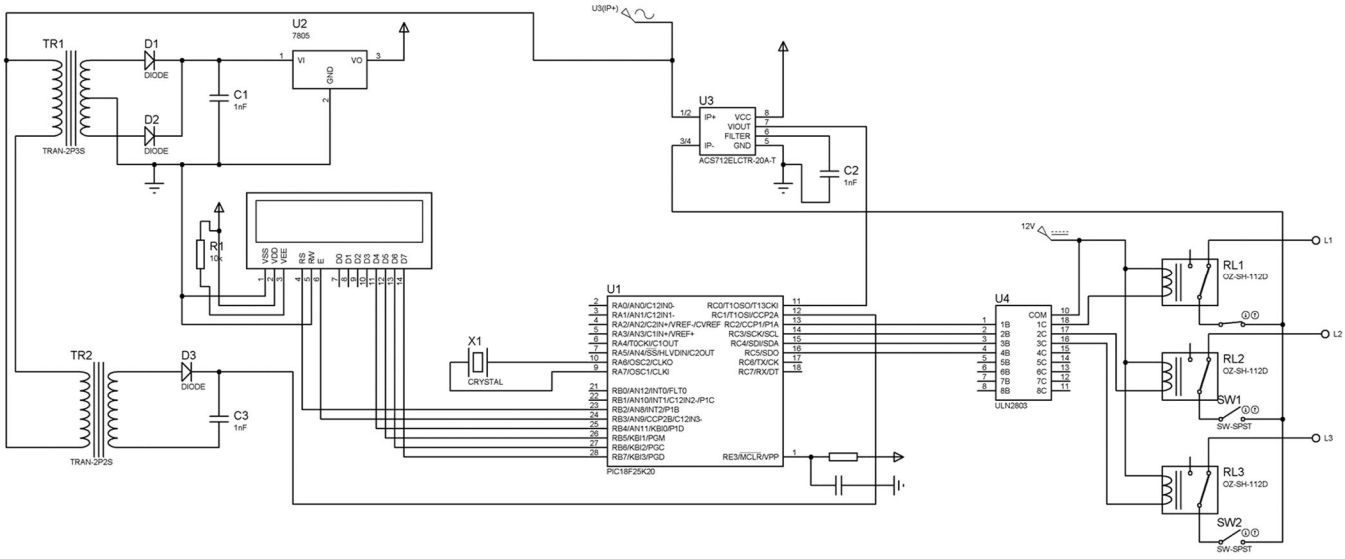


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II. CONSTRUCTION & DESCRIPTION OF HARDWARE MODEL

A. The concept of the device designed is that it's wont to detect the type of fault and supply its protection that has occurred in an exceedingly single phase home system.
B. By using PIC Microcontroller, the fault is detected by the designed circuit and it also displays on the LCD screen.
C. Except for that, relay circuit is additionally attached thereto so as to save lots of the system from being damaged by disconnecting the faulty circuit from the system.
D. The 230/12V step down transformer converted into 12V dc and is given to transformer
E. the present transducer and potential transformer is connected to microcontroller to watch this within the circuit and input voltage across the load respectively
F. The program fed into microcontroller will compare the sign of current transducer and potential transformer and can compare with the given set range of import, if the input is above or below the range of set value, the microcontroller will send a symptom to the relay to trip the circuit and also send a parallel signal to the LCD to display the kind of fault that has occurred.
G. Thus we finally obtain the tripping additionally as display of the fault at same time.



III. CIRCUIT DIAGRAM AND COMPONENTS

The Components used are as follows:

A. Transformer 230/12V
B. Rectifier
C. Voltage Regulator IC 7805
D. PIC Microcontroller 18F25K20
E. Current Transducer ACS712
F. Potential Transformer
G. LCD Display
H. Driver IC ULN2803
I. S.P.D.T Relay
J. Crystal Oscillator
K. Filter
L. Temperature Sensor LM35
M. Resistor
N. Filter Capacitor
O. Ceramic Capacitor
P. Toggle Switches
Q. LED Light

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IV. WORKING

Smart circuit breaker operates during conditions like under voltage, overvoltage, overload, short circuit on singe phase supply system. In this, 230/12V step down transformer is used for energizing the control circuit. The control circuit consists of PIC microcontroller for controlling the whole operation of the circuit breaker. The 12V output given by the step-down transformer is converted into pulsating dc by using a rectifier and constant 12V supply is given to regulator IC

This regulator IC will regulate this 12V supply and give constant 5V supply to microcontroller IC to energize it. Since PIC microcontroller is used LCD display can directly be connected to it as PIC microcontroller generate constant +5V supply for energizes LCD and have inbuilt ADC conversion. Here potential transformer is used to monitor input voltage across the load and accordingly give command to microcontroller to trip the relay .If the input voltage is less than 200V then potential transformer will sense low voltage and give command to microcontroller to trip the relay.

Similarly if the voltage is greater than 260V then potential transformer will sense high voltage and then give command to microcontroller to trip the relay.After the delay of 15 second microcontroller will monitor whether it is still low voltage or high voltage and turn ON relay accordingly .Microcontroller will monitor this continuously and if it is still in fault condition then microcontroller will display fault on LCD display and keep relay tripped position.

Here current transducer is used to monitor current in the circuit. If the current in the circuit is more than 0.8 ampere then CT will sense the high current and give command to microcontroller to trip the relay. Similarly in this also after the delay of 20second microcontroller will monitor weather it is still in overload condition and trip relay accordingly .Microcontroller will do this 2 times and if it is still in overload condition then microcontroller will trip relay permanently until the fault is not cleared. The 3 S.P.D.T relay is used as electromagnetic switch which switch ON and OFF as command given by microcontroller for design of this hardware .This relay have ability to work at 20 ampere. Microcontroller is giving constant 5V supply but relay is energize at 12V supply , hence to supply 12V, relay is interface to microcontroller through driver IC

The Driver IC used for this purpose is ULN2803 through which 8 relays can be interfaced to microcontroller. In addition to that temperature sensor is interface to microcontroller by which if temperature exceeded a 550C microcontroller will trip relay. The intention to used temperature sensor is to detect fire hazard in domestic as well as in commercial uses.

The Toggle switches is used to disconnect load from supply for any maintenance purpose.

V. RESULT TESTING AND ANALYSIS

1) Testing is done for under voltage, over voltage, over load, high temp.
2) For Testing under voltage and over voltage condition, single phase autotransformer is used for varying the input voltage
3) For Testing overload condition, three lamp of 200watt each are used.
4) Hence by use of above equipment following test is analysed :-

A. Initial Condition

Initially under normal condition when no fault is occurs LCD will display “ALL OK” and rated voltage will flow across the load, as shown in fig.



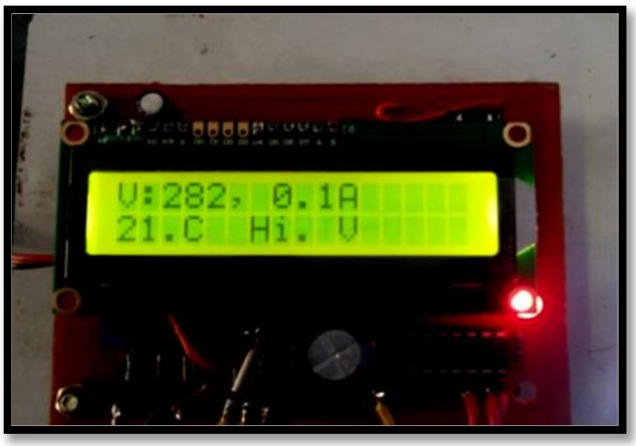
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B. When Under Voltage Occurs

Whenever the under-voltage scenario occurs which is below 200V the microcontroller will sense low voltage and will trip the relay and at the same time LCD will display "Low V' and after the delay of 15-sec microcontroller will again check if the fault is gone or not. if the fault is gone it will display ALL OK otherwise it will display " TRIP-V"

C. When Over Voltage Occurs

whenever the under-voltage scenario occurs which is above 260V the microcontroller will sense over-voltage and will trip the relay and at the same time LCD will display "High V' and after the delay of 15-sec microcontroller will again check if the fault is gone or not. if the fault is gone it will display ALL OK otherwise it will display " TRIP-V"





D. When Overload Occurs

whenever the overload scenario occurs which means the current exceeds above 0.8A the microcontroller will sense over-voltage and will trip the relay and at the same time LCD will display "High A' and after the delay of 15-sec microcontroller will again check if the fault is gone or not. if the fault is gone it will display ALL OK otherwise it will display " TRIP-A".







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E. When High Temperature Occurs

whenever the high Temperature scenario occurs which means the temperature has exceed 55 C the microcontroller will sense the rise in temperature and will trip the relay and at the same time LCD will display "High Temp' and after the delay of 15-sec microcontroller will again check if the fault is gone or not. if the fault is gone it will display ALL OK otherwise it will display "Hi Temp".



VI. FEATURES

A. Quick Operation i.e. within 100ms
B. Multiple Fault Protection
C. Monitoring as well as Controlling Device
D. Fault data saving
E. High Accuracy

VII. ADVANTAGES

A. Fast Acting

It has tripping time of 100msec which is less than MCB (1000 to 1600msec)

B. Auto Reset Circuit

Microcontroller constantly monitors and gives command to switch ON and OFF the relay automatically.

C. Long Life

The life of this circuit breaker is much longer than MCB as there no mechanical contact.

D. No Mechanical Part

It does not have any mechanical part such as bimetallic strip and coil, hence it has high accuracy.

VIII. CONCLUSION

A. One of the primary objectives of an engineer is to endeavor to deliver the best product or most efficient service at the lowest cost to the end user. The system has been tested and was found to meet the expected result.
B. This project is designed in form of hardware for protecting single phase home appliance against any fault such as under voltage, over voltage, overload, and high temperature.
C. The automatic tripping as well as reset of the circuit is achieved through this project.
D. This project is much more accurate and reliable and fast acting then conventional circuit breaker like MCB and can be used up to rating more than 30 ampere.

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IX. FUTURE SCOPES

A. It also can be used for Protecting Three phase supply Equipments in Industry by using some extra components.
B. It can be modified by using GSM Module.
C. It may be connecting with home security system.
D. By using Power Electronic Application, Voltage Fluctuation can be maintaining to rated voltage
E. It can also be used for Earth Fault protection, hence eliminating ELCB (Earth Leakage circuit Breaker)

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Biographies



Has completed his master in electrical engineering (power systems) from Bharati Vidyapeeth (deemed to be university) college of engineering, Pune.
He is currently working as assistant professor in department of electrical engineering. He has an industrial experience of about 2 years in Suzlon power. As engineer in power evacuation department and has an teaching experience of more than 5 years. His area of interest is renewable sources of energy specially wind and solar with its analysis, optimization and power quality.

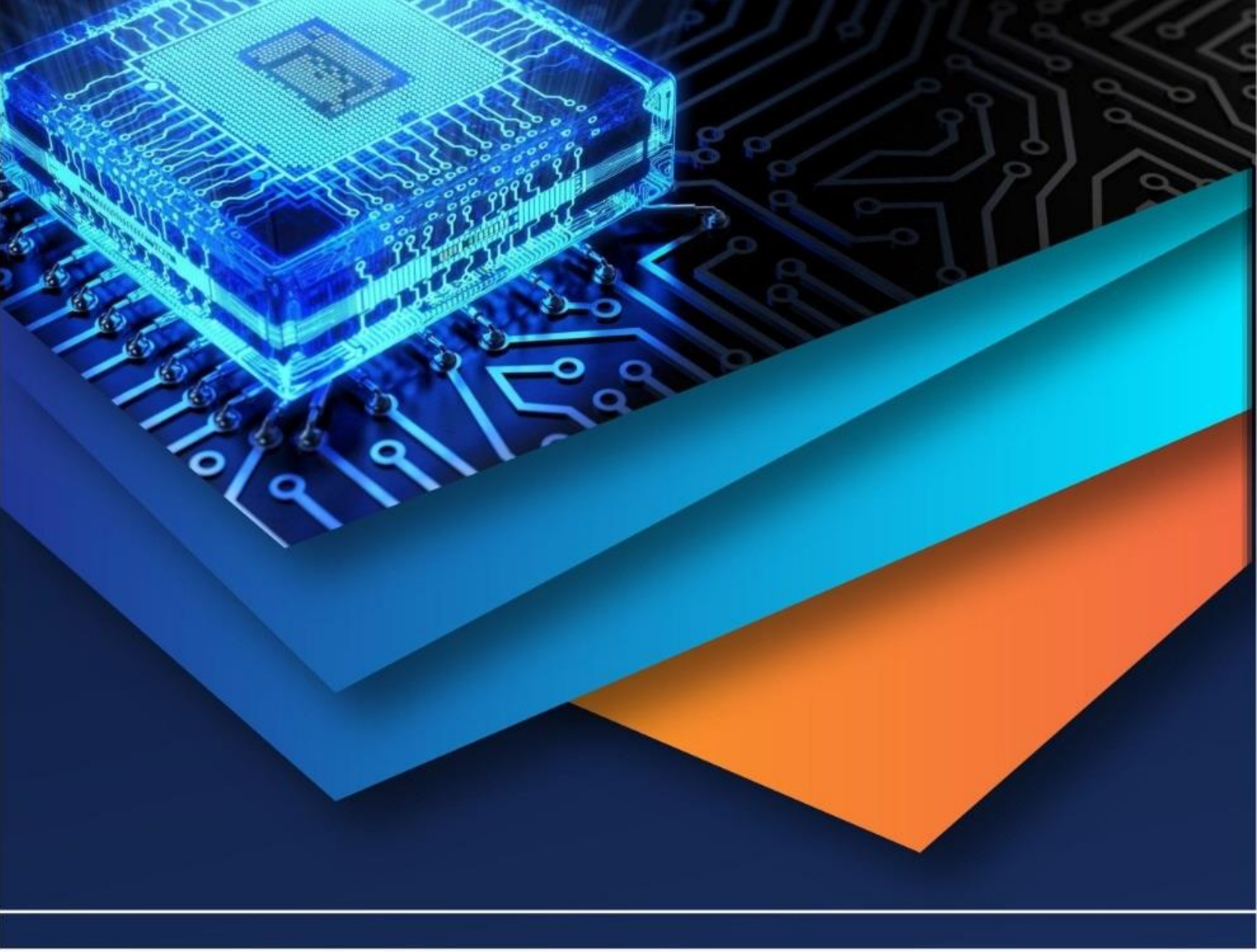


Currently pursuing bachelor of technology degree in electrical engineering from Bharati Vidyapeeth (deemed to be university) college of Engineering, Pune. I have completed my diploma course in electrical stream from Shri Datta Meghe Institute of Polytechnic Nagpur.



Currently pursuing bachelor of technology degree in electrical engineering from Bharati Vidyapeeth (deemed to be university) college of engineering, Pune. he has completed diploma course in electrical stream from Bharati Vidyapeeth Jawaharlal Nehru institute of technology, Pune.

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