iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** IV **Month of publication:** April 2021

DOI: https://doi.org/10.22214/ijraset.2021.33987

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue IV Apr 2021- Available at www.ijraset.com

Microcontroller Based Over-Current Relay

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***Abstract:** This report presents the design and construction of overcorrect and directional over current relays with ground fault protection for the protection of three-phase sub transmission and distribution systems, using a 16-bit microprocessor, the Intel 8096BH. The relay obtains the system currents at the rate of 12 samples per cycle and estimates the fundamental-frequency components of the current signals using discrete Fourier transform techniques. In the case of the directional over current relay, the direction of the current flow is identified to determine whether the fault current is flowing into its protected zone. For this purpose, several internally stored voltage vectors, corresponding to the different directional element settings, are synchronized accurately with the system voltage and used to determine the direction of the power flow. Facilities to change relay characteristics, the time dial and plug settings are provided. The user can also set the relay as an instantaneous over current relay. The desired operating characteristics are achieved by direct curve data storage in the memory.*
The report presents a hardware model of Micro controller based over current and Differential Relay. The relay can be used to sense faults in transmission line based on analog to digital conversion of the 3 phase current and simultaneously issuing a trip signal if the actual line current is greater than set reference value. The proposed model can also be implemented as Differential relay, which often find their application in transformers protection. The model uses various analog devices for conversion purposes and displays the current values as sensed by the micro controller

I. INTRODUCTION

Power System protection is an important aspect of design of power system. As far as faults in power system are concerned, majority of faults are line ground faults and detecting such faults and removing them can be easily done with the help of numerical relay. Nowadays a spurt is seen usage of Numerical relays over conventional Electro mechanical relays, with an added advantage of low cost and improved flexibility. The model uses current transformer to sense the AC line current and converts it into DC using a precision rectifier. The sensed current is then fed to the Analog to Digital port of microcontroller via I to V converter. The signal so obtained is compared with reference value stored in EEPROM of microcontroller. Subsequently the relay signal can be issued to the circuit breaker if the sensed value exceeds set reference. The model presented here can also be used as a Differential relay in case of transformer

II. SCOPE OF PROJECT

From this experimental kit we can perform following experiments which are part of MSBTE's Diploma in Electrical Engineering Syllabus.

A. Demonstration of working of MCB, MCCB and identification of different parts and their function.
B. Plot current (i) Vs. time (t) characteristics of a fuse (Kitkat/HRC)
C. Study and understand the function and operation of microprocessor based over current relay.

III. LITERATURE REVIEW

In the past few years, various researchers have proposed approaches for adjusting the over current relay's setting and used various relays for the protection of devices. Some of the conventional techniques among them are discussed in this section:
The paper presented an over current relay and evaluated its performance by considering TMS320F2812 DSP. Operation time, execution time, memory capacity usage, and transient analysis are the parameters taken for the analysis of the proposed system
In paper, the author proposed a technique of functional structure to enhance the effectiveness of over current relays. It was shown in this paper that only pick-up current was utilized by the adaptive relay which acts as the fault detector; the time curve of the primary device and pick-up current were used to compute the time operation. Consequently, the adaptive relay imitates the dynamics of the device so that fast back up time operation can be achieved.
The author in proposed a multifunction numerical relay (MNR) to shield the system from over current, over voltage or under-voltage and over frequency or under-frequency. This relay functions as a directional relay.
The paper, presented the effect of DGs on power system protection and adaptive over current protection's utilization for addressing such issues.

In paper author had suggested a few novel AI schemes for detecting the faults in systems. The author presented the research work in islanding detection, demerits, merits and control algorithms in this paper. From the author's point of view, there was possibility for further research in the islanding research area in distribution systems.

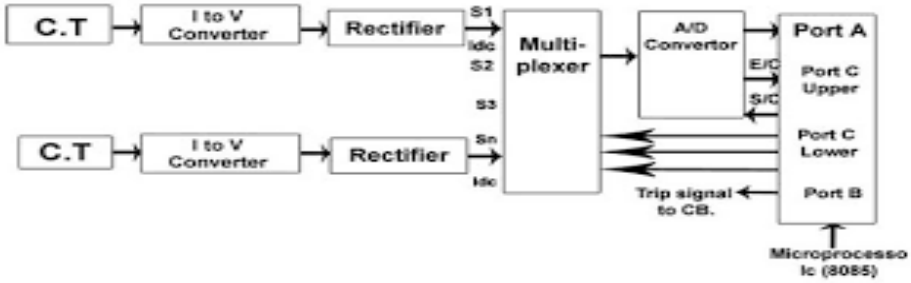
In, the author designed an electrical protection relay by utilizing microprocessors. This model was designed in order to guard electrical equipment while different fault situations. A variety of safety mechanisms such as current unbalance protection, instantaneous earth fault and over-current protection, earth fault and over current protection based on IDMT and thermal overload protection.

In paper, a new method was proposed for the concurrent setting of distance relays and DORs.

The paper discussed the over current relay's modeling for the IDMT type utilizing DSP board TMS320F2812.

The paper aimed to design an over current relay in the MATLAB SIMULINK.

A. Block Diagram



B. Components

1) 10k potentiometer
2) LCD 16by 2 line
3) Atmega328p microcontroller
4) 7805 voltage regulator
5) Acs12 current sensor
6) Capacitor

Components and specifications

10k potentiometer	Mounting diameter 6mm Shaft diameter 5mm Shaft length 12mm
LCD 16by 2 line display	Height 2cm,widhth 2cm, 5volt dc
Atmega328p microcontroller	Height 5cm, width 10cm Weight 45
7805 voltage regulator	Mounting Style - Through hole, Maximum Operating Temp - 150 c, Dropout voltage (Max) - 2.5v @ 1A
Acs12 current sensor	Supply voltage 4.5v to 5.5v DC Measure current range 20A Sensitivity 100mV/A
Capacitor	Capacitance 220uF Maximum operating temp +105c Minimum operating temp -55c Ripple current 850mA

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C. Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

Fig of potentiometer

D. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position,

Controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

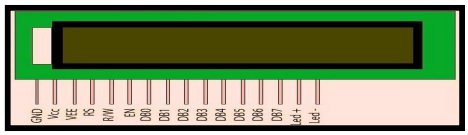


Fig of LCD display

E. Microcontroller

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. In the context of the internet of things, microcontrollers are an economical and popular means of data collection, sensing and actuating the physical world as edge devices.

Fig of microcontroller

F. 7805 Voltage Regulator

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output.

The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage level

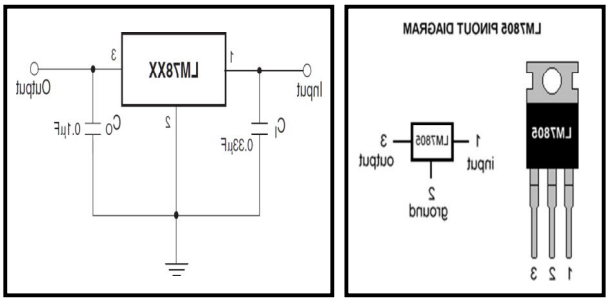


Fig of 7805 voltage regulator

G. Current Sensor

Measuring a voltage in any system is a “passive” activity as it can be done easily at any point in the system without affecting the system performance. However, current measurement is “intrusive” as it demands insertion of some type of sensor which introduces a risk of affecting system performance.

Current measurement is of vital importance in many power and instrumentation systems. Traditionally, current sensing was primarily for circuit protection and control. However, with the advancement in technology, current sensing has emerged as a method to monitor and enhance performance.

Knowing the amount of current being delivered to the load can be useful for wide variety of applications. Current sensing is used in wide range of electronic systems, viz., Battery life indicators and chargers, 4-20 mA systems, over-current protection and supervising circuits, current and voltage regulators, DC/DC converters, ground fault detectors, programmable current sources, linear and switch-mode power supplies, communications devices , automotive power electronics, motor speed controls and overload protection, etc.

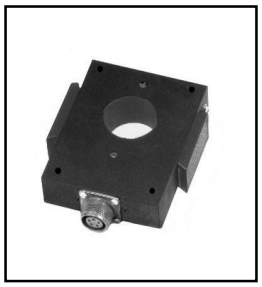


Fig of current sensor

H. Capacitor

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

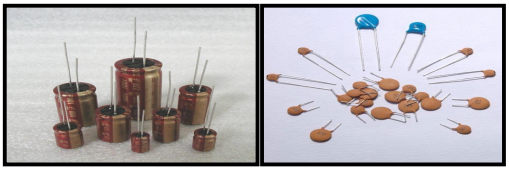


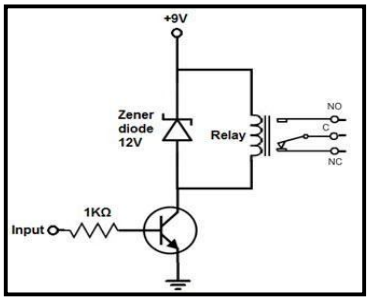
Fig of capacitor

I. Relay

Relays are components that permit a low-power circuit to control signals or to switch high current ON and OFF which should be electrically isolated from controlling circuit.

The Required Components for relay circuit

1) Diode
2) 6-12V Relay
3) 12V Battery or DC Power Supply
4) BC547B Transistor
5) 1K Ohm Resistor
6) Second Input Voltage Source



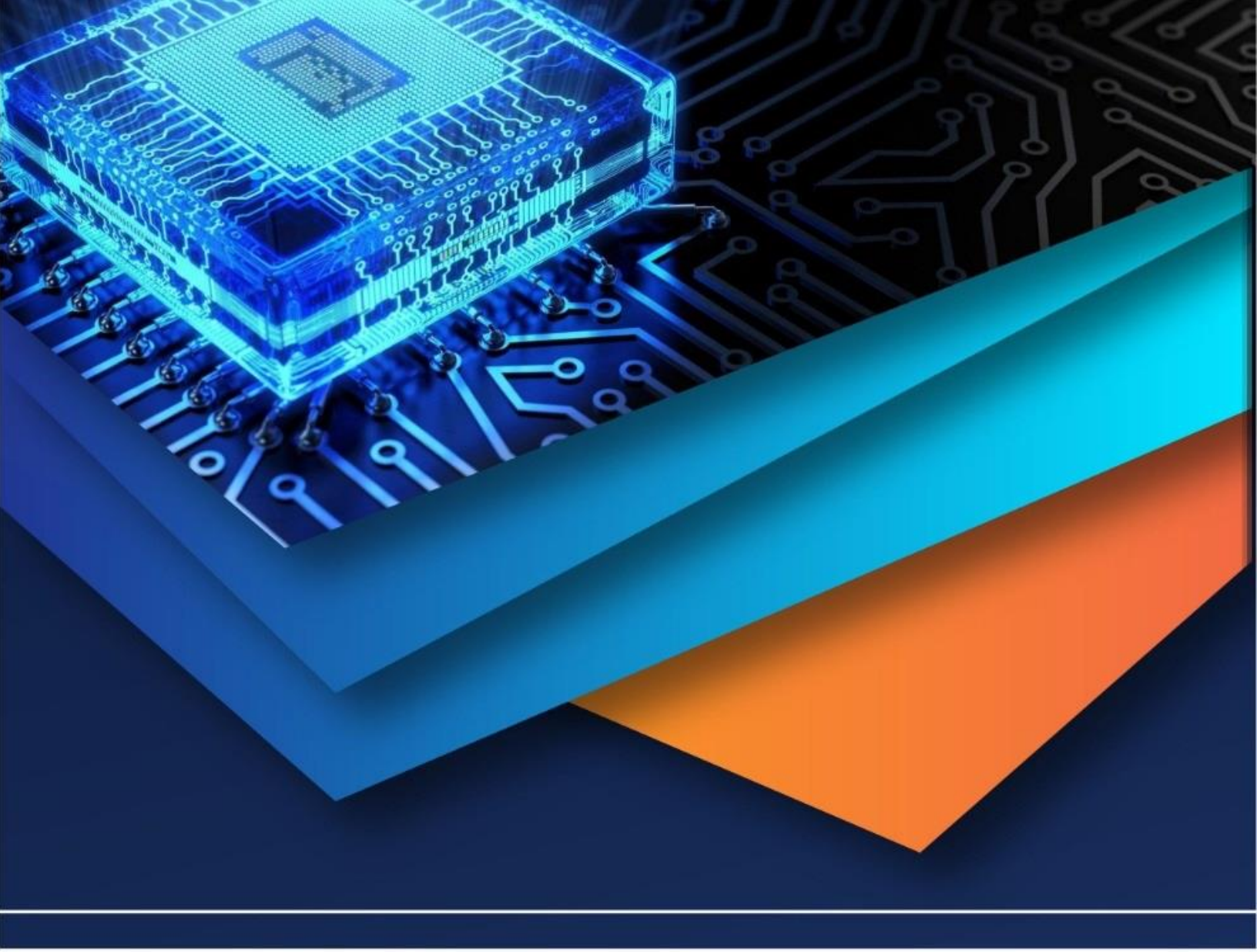
In order to drive the relay, we use transistor and only less power can be possibly used to get the relay driven. Since, transistor is an amplifier so the base lead receives sufficient current to make more current flow from Emitter of Transistor to Collector. If the base once gets power that is sufficient, then the transistor conduct from Emitter to Collector and power the relay.\The Transistor's emitter-to-collector channel will be opened even though no input current or voltage is applied to Base lead of Transistor. Therefore, blocking current flows through relay coil. The emitter-to-collector channel will be opened and allows current to flow through relay's coil if enough current or voltage is applied as input to the base lead. AC or DC Current can be used to power the relay and circuit.

IV. CONCLUSION

The design and the realization of Microcontroller based over current and Differential Relay was done in Proteus and the simulation results carried out were found to be satisfactory. The similar approach can also be done more advanced and fast microcontrollers like Digital Signal Processors (DSP's) for both the applications. It is found that this model can also be adopted to sense the current in all the three phases of the transmission line and in case of transformer. Also this model can be used as a frequency relay by sensing the frequency of the operating voltage and can be useful in case of transformer applications where over fluxing and under fluxing are often observed while switching on

REFERENCES

[1] Ponnle A. A, Omojoyegbe M. O.,"Development of a Low Cost Microcontroller Based Under and Over Voltage Protection Device", International Journal of Scientific Engineering and Technology (ISSN : 2277- 1581) Volume No.3 Issue No.9, pp : 1225- 1229,1 SEPTEMBER ,2014.
[2] S. M Bashi, N. Mariun and A. rafa (2007). 'Power Transformer protection using microcontroller based relay', Journal of applied science, 7(12), pp.1602- 1607.
[3] S. Dharanya, M. Priyanka, R. Rubini and A. Umamakeswari;"Real Time Monitoring and Controlling of Transformers", Journal Of Artificial Intelligence 6(1):33- 422013.
[4] Technical Research Paper ,"Microcontroller based Fault Detector" ,International Journal of Advancements in Research & Technology, Volume 1, Issue 5, October-2012 1 ISSN 2278-7763
[5] Badri Ram and D N Vishwakarma," Power System Protection and switchgear,"2nd Edition, Tata Mcgraw Hill education Pvt Limited



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