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Implementation of A GSM Based Electrical Protection Scheme for Distribution Transformer Using Micro Controller

Shabeer Mulla[1], Sandesh H J[1], Gnanesh A M[1], Vijaya Kumar[1], Praveen Sebastian[2]

BE Students, Department of Electrical Engineering, BNM Institute of Technology, Bangalore, India[1]

Assistant Professor, Department of Electrical Engineering, BNM Institute of Technology, Bangalore, India [2]

ABSTRACT: The demand on the electric power for the household, commercial and industrial loads is on the increase. In addition, the management of electric distribution system is becoming more complex. Lack of information at the base station regarding status of the distribution network has been identified as the major bottleneck to its effective monitoring and control. The proposed system is a microcontroller-based protection of electric distribution system for the purpose of effective monitoring and control of distribution system. A powerful GSM networking is designed to send data from Distribution side to the Sub-station . In general, the proposed design is developed for the user to easily recognize the distribution transformer is safe or unsafe and the distribution line, which is suffered by fault. The ultimate objective is to monitor the distribution line status continuously and hence to guard the fault of distribution line due to the constraints such as overvoltage, under voltage, Single Line to Ground (SLG) and overload faults. If any of these faults occurs then a message will be sent to designed controlling unit or substation.

KEYWORDS: Current transformer, distribution transformer, relay, microcontroller based protection,GSM,voltage circuit, auto transformer, Renesas controller.

I.INTRODUCTION

In today's lifestyle, technology has become very dependable in many ways thereby simplifying day-to-day life. Home automation, utility meters, appliances, security systems, card readers, and building controls are some of the areas where plenty of research in the use of technology is widely taking place. Along with hardware, the use of software has become very important thereby simplifying tasks, reducing size of equipment and hence cutting down on cost of the equipment.

Protection system's main function is to clear faults from the power system at high speed to ensure safety, minimize equipment damage and maintain power system stability. Protection of power system requires an understanding of system faults,their detection,and safe isolation of the faulted device .By taking an inventory of all the essential electrical loads and doing a basic electrical load evaluation,an idea regarding how much power our system needs to produce has been obtained[1].The power fluctuation situations were also analyzed,that means what voltage minimum or maximum that get from the A.C supply mains has been considered[3].The proposed system is a microcontroller based one and a messaging platform using GSM also implemented in it very effectively.

II.DESCRIPTION

Single-Line-to-Ground Fault (SLG)

A short circuit between one line and ground, very often caused by physical contact, for example due to lightning or other common means results to Single-Line-to-Ground Fault. The single line to ground fault can occur in any of the three phases[4]. However, it is sufficient to analyse only one of the cases.

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Voltage Dip

Low voltage is a relative term, the definition varying by context. Different definitions are used in transmission and distribution line, and in the electronics industry [1]. Electrical safety codes define "low voltage" circuits that are exempt from the protection required at higher voltages. These definitions vary by country and specific codes. Lower voltage is defined as incoming line voltage at the point of use which is smaller than the IEEE standard values or limits specified by Country's supply authorities/smaller than the voltage ratings of the connected equipment[4]. Lower voltage is considered a safety hazard by all industry standards and can cause premature failure of connected equipment. Devices could be damaged by lower line voltage.

Over Voltage

Over voltage is defined as incoming line voltage at the point of use which is greater than the Supply authoritiy's mandated legal limits; and/or greater than the voltage ratings of the connected equipment. Overvoltage is considered a safety hazard by all industry standards and can cause premature failure equipment. Overvoltage has been a widely known industry problem for many years, but is not generally understood by many who have to deal with it. Power companies have been unable to control it adequately. Overvoltage occurs most often during severe cold winter weather for the following reasons like inadequate size of power distribution systems,slow reaction time for power company's distribution systems to regulate voltage during extreme load variations or abrupt reduction of loads.

III.PROPOSED SYSTEM MODEL AND ASSUMPTIONS

Many embedded systems have substantially different designs according to their function and utilities [2].In this proposed system, structured modular design concept is adopted and the system is mainly composed of a single microcontroller, auto transformer, voltage circuit and current transformer, relay, and GSM module.It is shown in figure 1.The microcontroller located at the canter of the block diagram forms the control unit of the entire system. The micro controller used was Renesas micro controllerEmbedded within the microcontroller is a program that helps the microcontroller to take the action based on the outputs provided by the sensors.

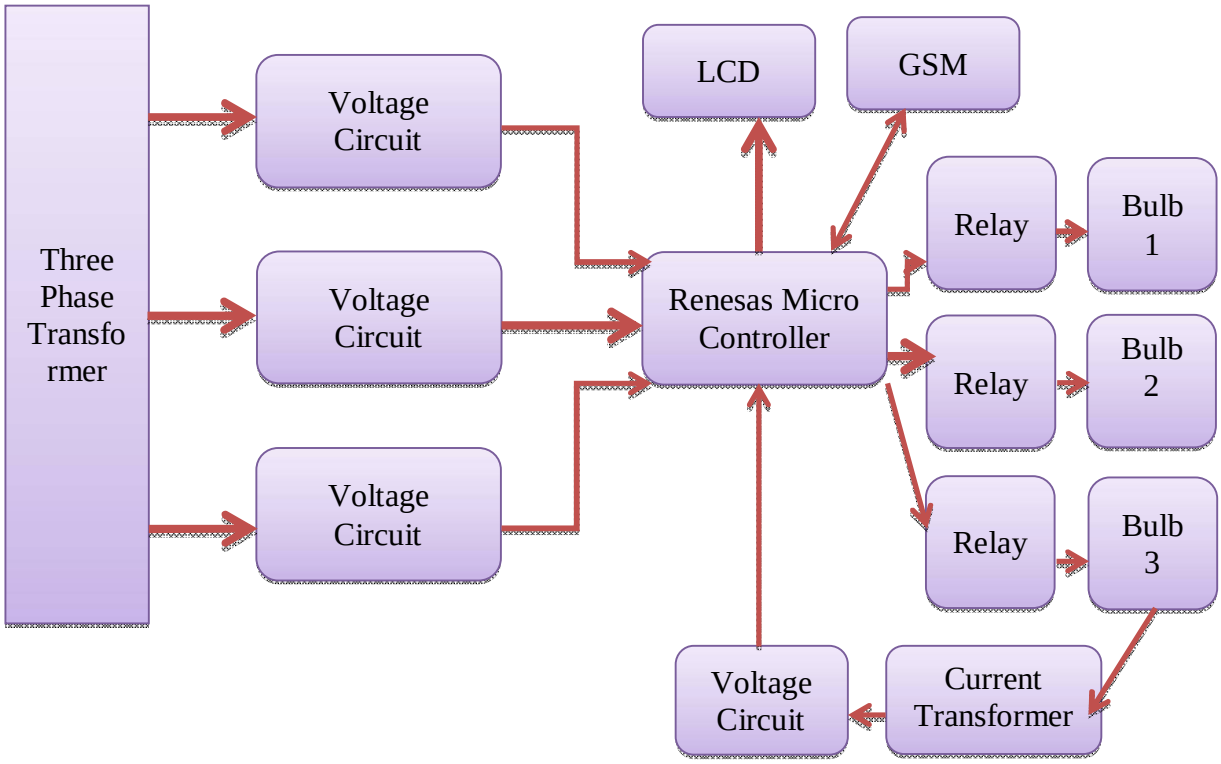

Figure 1:Block diagram of protection of distribution system

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In this proposed method, three transformers are used to demonstrate three phase lines, three blubs are used as load.The output of the transformer is given to voltage circuit, which is then connected to the ADC.if the voltage crosses the threshold value then it is indicated via GSM.On the other hand, if overload condition is detected, through the voltage circuit connected to the current Transformer (CT),alert is sent through the GSM.The bulb can be turned off through the help of GSM.Here to show overload condition bulb of high wattage rating i.e. 100W is used ,whereas normal voltage is shown by connecting bulb of wattage 40W.SLG is demonstrated using short circuit.The LCD is utilized to demonstrate the working of the entire unit.

IV. HARDWARE MODEL AND RESULTS

The hardware model of the proposed system is built and this is shown in figure 2.It consists of the Renesas micro-controller as the main controlling part and three single phase transformer for measuring the voltages in 3 phases thus forming a 3 phase system for demonstration purpose.The over voltage and and under voltage threshold values can be set in the program embedded in the micro controller.The three lamp holders shown in the figure is having three 40 W lamps which will be on during normal operation which indicates the voltage is within the normal deviations.Whenever the voltage crosses the threshold value(over voltage protection) or reduces below the threshold value(under voltage protection)the relay in the particular phase will be tripped and the corresponding lamp will be off.For demonstrating an overload protection we have to replace the 40 W lamp by a 100 W lamp which will be on only when the current is more than the specified threshold value.If the lamp glows which indicates an overload happens.This protection is separate from the over voltage and under voltage protection.A GSM module is also enabled such that the user will be getting a message if any of the mentioned faults happens.

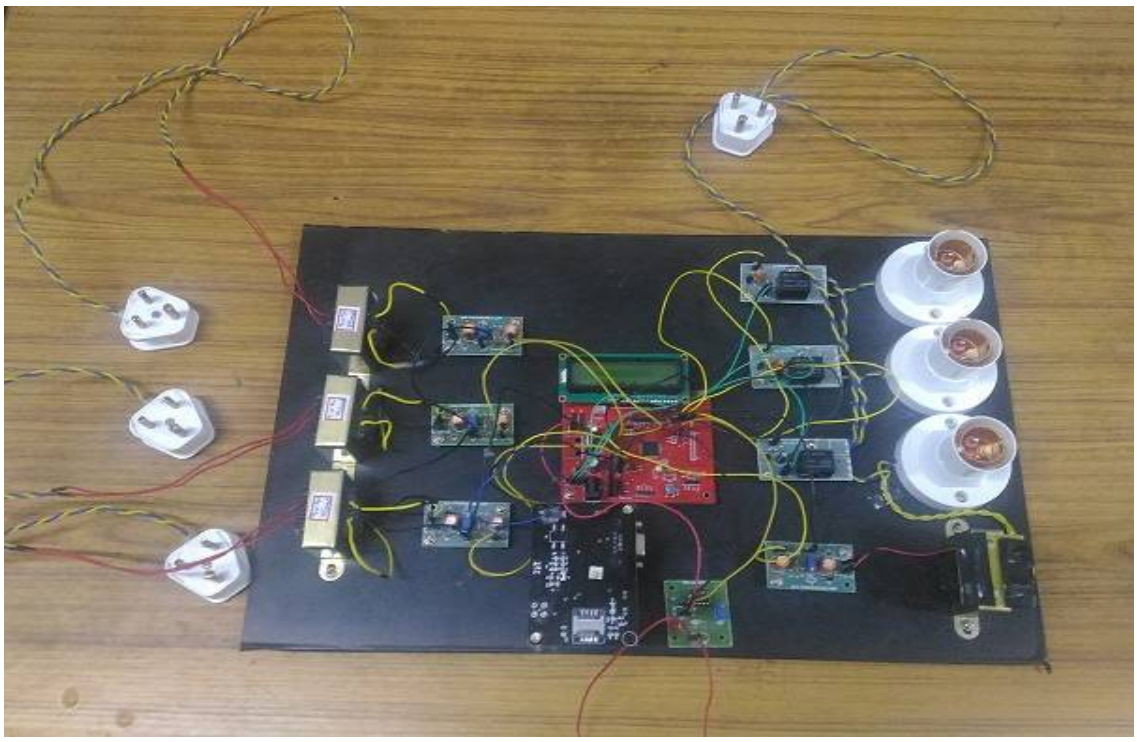

Figure 2:Hardware model of the proposed system

V. CONCLUSION

Microcontroller and GSM based protection system is a reliable technique for monitoring and controlling the electric distribution system, the microcontroller works up to 100C temperature. For long distance data transmission,

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GSM technology is a reliable and robust one. Any kind of fault occurring in the distribution system results the GSM modules to send instant messages automatically to the base station.GSM based microcontroller protection system will serve as a reliable, easy and cost effective solution for monitoring and controlling the electric distribution system.

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