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IOT Based Feeder Protection From Overload and Earth Fault

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Abstract - *The revolution has been brought within the modern world by Internet of Things based technology after its discovery in the field of computer and internet. Thus we can practice the concept of IOT technology in the power system. Today the world is moving fast towards the more operative and well-organized smart grid technology by switching the existing timeworn technology with the new smart grid technology. Hence we can make use of both the technologies in order to make the existing power system more operational and well organised. IOT and smart grid leads to a perfect combination of two expertise which will result in enhancement of the present power structure of India. In adding to that there will be many benefits of using this expertise. Many existing problems that are present in the conventional power grid structure can be solved. The motive of the paper is to improve the sharing out of power in India where problems like load shedding a common situation.*

Key Words: Revolution, Internet of Things, Smart Grid, Power System, Load Shedding.

INTRODUCTION

The revolution has been brought in the modern world by Internet of things based technology after its discovery in the field of computer and internet. Thus we can use the conception of IOT technology within the grid. In electric power distribution, an programmed overload defence system which is a circuit breaker fitted out with a mechanism that can without human intervention closes the breaker after it has been opened up due to a fault. These circuits are mostly prone to the temporary faults such as shorting or overload. With orthodox fuse or circuit breaker, a fault would blow the fuse or open the breaker and thus immobilizes the line till a technician could manually replaces the blown fuse or closes the circuit breaker. But the automated overload protection system can make many pre-programmed efforts in order to re-energize the line. If the fault has been cleared, the circuit breaker of the automated overload protection system will stay closed and power line resumes to function in the normal operation. Today the planet is moving fast towards the more operational and well organised smart grid structure by substituting the present timeworn expertise with the smart grid technology. So we can make use of both the knowledges in order to make the present power system more operational and well organised. Smart grid and IOT will be a picture-perfect combination of two know-hows which will result in enhancement of the present power structure associated with India.

PROBLEM STATEMENT

Protection of the power system is very important concern in the design of electrical power system. We need to protect these electrical power system components from dangerous fault effects. This not only improves the life of the components but also sidesteps unnecessary expenses in frequent replacement of outmoded components. It guarantees continuous power supply in order to assist the needs of the overgrowing economy. This project therefore pursues to project a system based on micro-controller that will shrewdly monitors the faults and prompts a safety measures in order to guard the feeder in the event of power overloading.

Objectives:

The main intent of this paper is to design and implement a system with the support of microcontroller and other peripheral devices to look after power transformer**.** To achieve this the following work must be done.

a) Design and build an over current relay using microcontroller and a current sensor
b) Development, examination and calibration of the current sensor.
c) Development of the ADC program to convert the analogue sensor output to equivalent digital form within the microcontroller.
d) Development of LCD program in order to display the sensed levels.
e) Enhancement of warning (audio and visual) plus relay control system program.
f) Over current protection counter to earth faults.
g) Automatic reclosing
h) Relay co-ordination for earth fault relays.

EXISTING SYSTEM

In Existing system, the load current is increasing in nature so it will directly influence to the consumers equipment and utility side customers. The equipment connected in consumer side will be ruin due to over current flows in the

circuit. No specific controller is installed in a power lines for the tenacity of fault recognition. The existing system was not able to detect the faults like short circuit of feeders, feeder overloading and earth faults because of probabilities of collapsing the equipment due to extra large over load current.

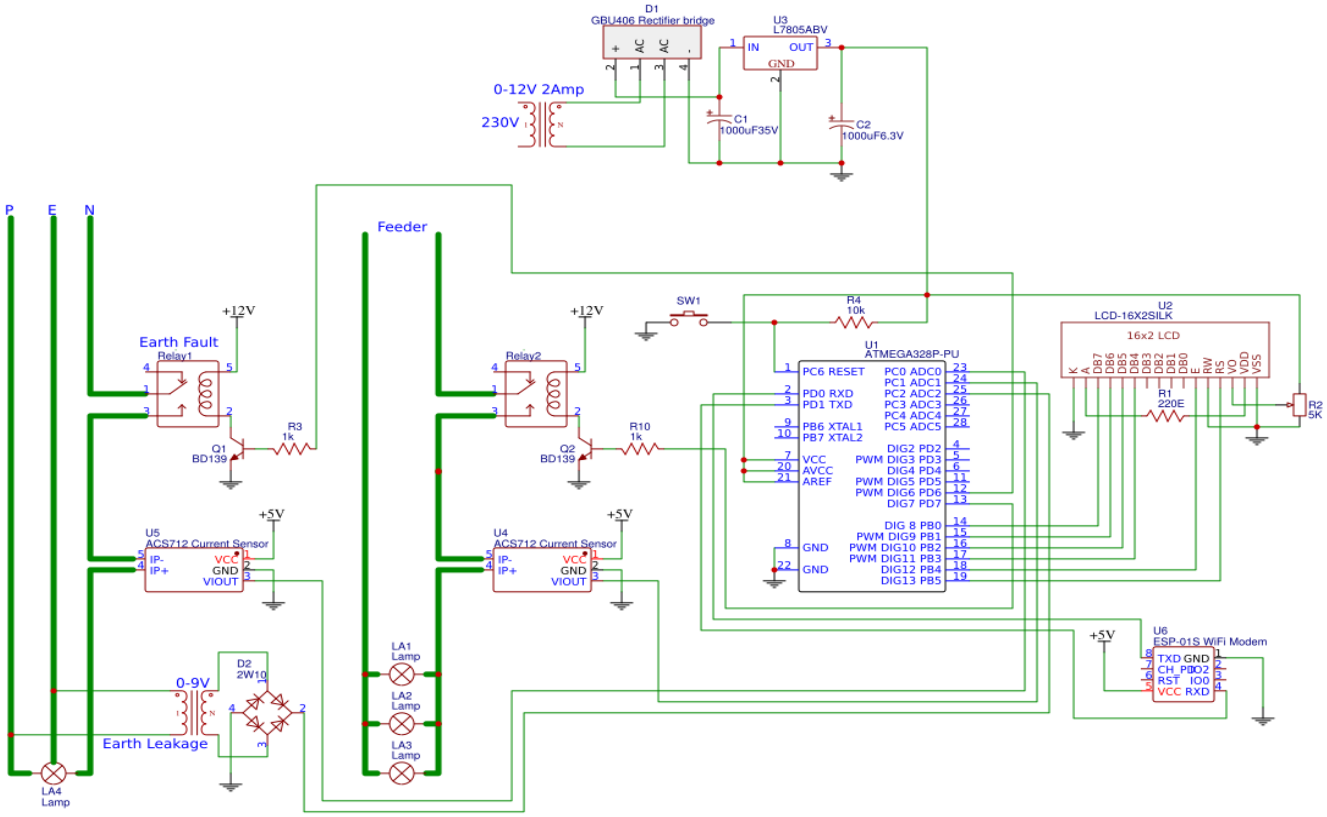
PROPOSED SYSTEM

In order to overcome the circumstances like overloading of feeders or short circuit in feeders which we discussed in last paragraph, we have planned a simple prototype model of Feeder Protection in the event of Overload plus Earth Fault Relay in order to prove the conception in detail. In our project we have used current sensors with feeders in series in order to intellect the fault like short circuit condition or over load condition. After detecting the fault, our micro-controller will send signals to overload unit for tripping the relay instantaneously. It also sends message with the help IOT module by marking out the position when earth fault or overload is sensed.

CIRCUIT DESCRIPTION

The diagram shows the complete circuit implementation of the proposed system "IOT Based Feeder Protection System". The system consists of a microcontroller used to control whole system.

In this system Atmega328P microcontroller was used which will act as the brain of the system and controls the hardware of the system. This microcontroller and other components in the circuit require power supply for their functionality. The microcontroller works on regulated 5V DC supply. To fulfill this power requirement of the circuit we have designed power supply entity which provides 12V and regulated 5V power supply as per the requirement of the circuit component. To design power supply unit step down transformer is used. mains supply of 230V is applied to primary of this transformer and at secondary side it gives stepped down supply of 12V. Since circuit components require DC supply, bridge rectifier circuit is designed using 4 diodes to convert the AC supply to the DC. The obtained 12V AC supply from the secondary of the transformer is fed to the rectifier circuit and DC supply is obtained at its output terminal. Microcontroller requires regulated 5V supply, to get this voltage supply we are using a LM-7805 voltage regulator IC. This IC has 3 terminals V_{in}, GND and V_{out}. To V_{in} terminal of regulator IC 12V supply is applied, the GND terminal of IC is associated with the ground voltage supply and at the output terminal i.e. V_{out} terminal of IC we get regulated 5V supply. Two parallel connected capacitors are also used in the power supply unit. These capacitors act as filters for complete elimination of the ripple from the supply.



1000pf and 100pf capacitors are used for that purpose and connected at input and output sideways of voltage regulator IC respectively. This obtained regulated supply of 5V is provided to pin number 7 i.e. VDD pins, 20 and 21 of the microcontroller IC. Pin number 8 and 22 of the controller IC are allied with the ground. To reset the controller in any condition if required a reset switch is connected to pin number 1 which is reset pin of the controller. By resetting, it puts the microcontroller into a well-known state in such a way that the execution of program starts from 0 address of program memory. All microcontrollers encompass a clock or an oscillator in order to operate Clock is make available by connecting microcontroller with the external timing devices. The instructions are executed by bringing it from the memory and afterwards decoding it. The procedure takes few clock cycles well known as instruction cycles. To obtain these instruction cycles a crystal oscillator is allied with the micro-controller. This crystal oscillator includes a 16MHz quartz crystal and two 33pf capacitors connected to the pin number 9 and 10 i.e. PB6 (TOSC 1) and PB7 (TOSC 2) of the controller IC.

The system is designed to defend the feeder from overload and over current in the load as well as to monitor and protect the earth fault. For this we have used 3 lamps asload for the system. These are associated to feeder lines. To measure the load current we have interfaced a current sensor ACS712 in series with the feeder lines and loads. The output of this sensor is of analog form. The sensor output is provided to the microcontroller. For this the V_{out} pin of sensor is linked to pin 24 of the controller IC for process.

A relay is interfaced with the microcontroller through a transistor which is used to disconnect the load when the system obtains overload connected to feeder lines. The relay output is connected to the feeder lines for the purpose of tripping.

To check earth fault we have connected a Lamp as load to the mains three phase supply. When the voltage between phase line of the mains supply and earth is 230V then the earthing of the supply is perfect. But if the voltage goes low then earthing of the mains supply is leaked and it is detected that earth fault is occurred in the system. To monitor this we are using a 9V transformer along with bridge rectifier. The bridge rectifier output is provided to pin number 25 of the microcontroller for comparison. Also to measure the current of this load another current sensor is interfaced with supply mains and output of which is delivered to the microcontroller. The V_{out} pin of this sensor is attached to the pin 23 of micro-controller. One more relay is practiced in order to trip this load from the supply when the fault is occurred in the system. This relay interfaced with the microcontroller through a transistor and connected to the pin number 12 of the controller IC. The relay output is given to this mains supply to trip the load from the supply.

The system consists of 16x2 LCD display, which is used to display the readings of the load current by the current sensor. This LCD display is interfaced in the 4 bit mode with the microcontroller. In 4-bit mode. This mode therefore saves four pins of the controller distinct 8-bit mode. In the case of 4-bit mode simply 4 bit data is sent to the LCD. Since 8-bit micro-controller comprises data in 8-bit form so we can divide data into 2 nibbles. First higher 4-bits are sent to LCD and after lower 4-bits. D4, D5, D6, D7 data pins of the LCD are incorporated within the 4-bit mode. D1, D2, D3, D4 remains empty. Least significant bit is D4 and highest significant bit is D7. Port-PB first 4 bits (PB5, PB4, PB3, PB2) of the controller IC are used to send 4-bit data and commands to LCD. These four Pins(PB5,PB4,PB3,PB2) are Connected to four pins of LCD (D4,D5,D6,D7). Port-PB1 pin no 15 is connected to RS (register select) pin of LCD. Port-PB0 pin no 14 is linked to E (Enable) pin of 16x2 LCD. The hardware of the system includes a Wi-Fi module which is interfaced with the microcontroller is used to transmit all the data wirelessly to the internet. This Wi-Fi module is interfaced with the microcontroller. The transmitter terminal of the Wi-Fi module is linked with the receiver terminal of micro-controller whereas the receiver terminal is linked to the transmitter terminal.

WORKING

For the protection of bus bar from over current situation firstly we need to evaluate the total load current which is running through our bus bar. Here we are using current sensor for measuring the load current and this current sensor output is sent to ADC for converting analog output of current sensor into digital data. Then this ADC output is given to the microcontroller for monitoring purpose. When current increases beyond certain limit , then we will trip the load by using relay. Inside our project, we have used 230V bulb as load. We are going to rise the load by increasing the number of loads ON. When we will ON more number of loads it will cause overload state and then microcontroller will identifies this and trips the total load with the support of relay. In our project, we are using 12v relay for the purpose of tripping. Also, we are using a Wi-Fi modem to transmit all the measured parameters i.e. load current over the internet. This data will be display on the android mobile phone of the user in which the BLYNK application is installed and a project is designed in this application for this system. The resultant leakage current is significantly less than the short circuit current. The earth fault may remain continue for a longer duration and causes considerable damage before if eventually advances into a short circuit and removed from the system under these circumstances ,it is money-spinning to service earth fault relay, which is fundamentally a low setting over current relay and it operates when earth-fault or leak develops. This system is used for the transformer winding connected in star where neutral point is solidly earthed through the impedance. The high impedance type relay is used to meet the scheme for external fault.

In such three phase system, if any of the three phases gets grounded then this will cause current imbalance situation, the vector sum of all three phases will have certain

specific value. If this value exceeds beyond the set value specified on the relay, then the relay will actuate and trip the main circuit. The primary winding of the distribution transformer or any other transformer is premeditated to operate at certain specific current, if the current flowing through that instrument is extra than the rated current, then instantly the System may damage due to over load, with the help of this project we are going to protect the bus bar from over load condition.

Whenever the over current occurred the circuit is going to trip. In order to trip the circuit, we are using one relay which can be controlled through micro-controller. When overload has occurred relay is going to trip the total circuit and buzzer will on in order to indicate the over load condition.The information about fault occurred due to overload condition will be sent on internet for wireless monitoring purpose. To send the data over the internet a Wi-Fi module is used in this system and is interfaced with microcontroller. We use BLYNK platform for data receiving and controlling purpose.

ADVANTAGES

a) Efficient and low cost design.
b) Low power consumption.
c) Real time monitoring.
d) Manually and Automatically operated
e) Accurate time Breaking mechanism

DISADVANTAGES

a) The cost of a microcontroller can get pretty expensive.
b) Programming can also take longer time to accomplish than circuit analysis.
c) Error in the programming is possible

APPLICATIONS

a) This system can be implemented for protecting Busbars in sub stations and generating stations.
b) It can also be used for Industrial appliances protection.
c) For monitoring and regulating the home appliances.

CONCLUSIONS

In our paper, we examine design to achieve control & monitoring of overload condition of feeder lines by measuring the temperature of line. In this project we have designed a system such that it will monitor and control the load constantly and that information is sent to user with the help Wi-Fi module

Today the world is touching more operative and well organised smart grid technology by replacing the current timeworn technology by the smart grid technology. So we can make use of both expertise to make the existing power system more operative and well organised. smart grid and IOT will be a flawless combination of two expertise which will result in upgradation of the current power structure of India. In adding to this there will be so many benefits of using technology ahead. Many existing problems that are present in the conventional power grid structure can be solved through this system. The motive of the paper is to improve the distribution of power in India where problems like load shedding is a common situation arising.

FUTURE SCOPE

Today the world is moving fast towards the more operative and well-organized smart grid technology by switching the current time worn technologies by the smart grid technology. Thus we can make use of both the expertise in order to make the present power system more operative and well organised. smart grid and IOT will be a perfect amalgam of two know-hows which results in improvement of the current power structure of India. In adding to that there are many such benefits of using technology. Many current problems that are present in the existing power grid structure can be solved out. The motive of the paper is to enhance the sharing out of power in India where hitches like load shedding a common situation.

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