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SMART ELECTRICITY MONITORING AND REPORTING USING IOT

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ABSTRACT

The proposed idea is to implement a smart electricity monitoring in home. Whenever there is an earth fault in any appliance, small leakage voltage is supplied to the outer part of appliance. This may tend to affect the appliances as well as affect the human beings. Generally there will be an earthing device which protects the damage of home appliances. In fuse failure indicator the three phases are connected to phase detector and the phase detector is connected to Raspberry Pi circuit. Whenever anyone fuse failed the proposed module indicate the fuse failure and report it to the house owner and to EB office. Another module is Load Management circuit. If any one of the phase crosses the threshold level of Load, this module reports the home owner and automatically turns off that phase. This circuit is usually fixed in the meter box for continuous monitoring the earth, fuse failure, and load consumption in home. Here Raspberry pi is used as a main device for monitoring these modules. It sends the message to EB office through IoT indicating that there is an earth fault and fuse failure in the particular home.

Index terms – Raspberry Pi, Potential Transformer, Current Transformer, LCD display.

1. INTRODUCTION

Day by day the number of Electricity consumers is increasing rapidly. It became a difficult task in handling and maintaining power as per the requirements. Moreover the Electricity is to be conserved as the generation of power is not matched with the demand for the Electricity. Thus the wastage of Electricity must be reduced. The Electricity is one of the resources that is dangerous to be handled and the necessary precautions and safety measures should be taken to avoid the Electrical accidents. In the work presented here, a technique has been developed to detect the Earthing or grounding failure, fuse failure and load monitoring in the electric system, from a remote server automatically using the Android of the cellular phones. The information of the Earth leakage, fuse failure and the information about the load crossing the threshold level can be collected instantly by the Electricity Board office nearer to the area.

1.1 ELECTRICITY

The electrical energy is distributed at 240 volts. This is considered aa standard voltage for electrical appliances in India.

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Electricity flows from the pole through the conductors to the service point where the home\industry wiring system begins. From the service point the power flows to the meter box where normally measuring meters, fuses and relays are mounted.

1.2 HARMFUL NATURE OF ELECTRICITY

Electricity is all around us. Despite its prevalence in our lives, it is often poorly understood and dangerous. According to the Electrical Safety Foundation International, there are more than 30,000 non-fatal shock accidents every year. Electrical safety fatality statistics are harder, but by some estimates at least 600 people die of electrical accidents in the U.S. every year.

Electricity flows from one point to another along the material that will conduct it. One of the better conductive substances for electricity is water, which is about 70 percent of the human body. But even with all of that water inside of our human body, electricity doesn't flow through the human body unobstructed. Much more exposure to electricity can cause cardiac arrest, in addition to other damage and burns. [7] discussed about Improved Particle Swarm Optimization. The fuzzy filter based on particle swarm optimization is used to remove the high density image impulse noise, which occur during the transmission, data acquisition and processing.

2. BLOCK DIAGRAM

The block diagram of the overall methodology for smart electricity monitoring system using internet of things is shown in Figure 1.1. The implementation of load monitoring, earth fault indication and fuse fault detection makes use of potential transformers and phase detectors, which are connected to the input pins of the Raspberry-pi. The output from these devices is connected to Raspberry-pi module in which driver circuit, relay, alarm and ethernet cable is connected to the output pin of the pi module. An android application is developed to control the load and send messages about the earth and fuse failure to the EB office.

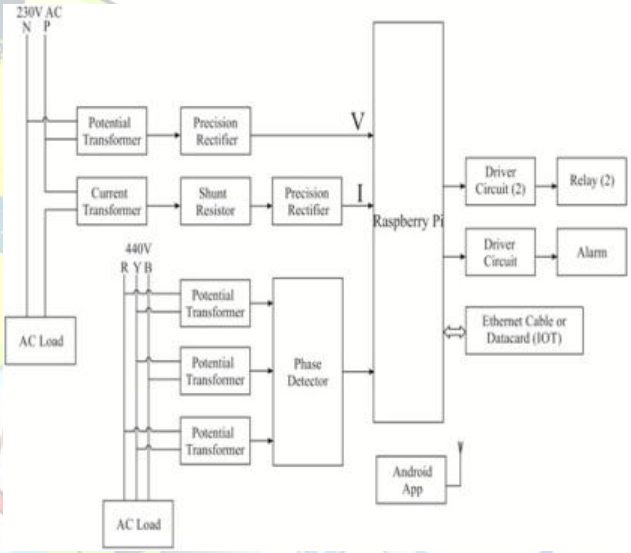

Figure 1.1 Block Diagram

3. EARTH FAULT DETECTOR

Whenever there is an earth fault in home, the phase and neutral gets reversed and only a small leakage voltage is supplied to the home meters. During earth fault there will be supply of current to home appliances but with a small leakage voltage. This may tend to affect the appliances as there will be insufficient voltage supplied to all the home appliances. Generally there will be an earthing device to prevent the damage of home appliances. The house owners will not be aware of the earth

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fault, hence earth fault detector circuit detects and indicates the earth fault and sends the message to the house owner and EB office through IoT. The circuit diagram of the earth fault detector is shown in the Figure 1.2.

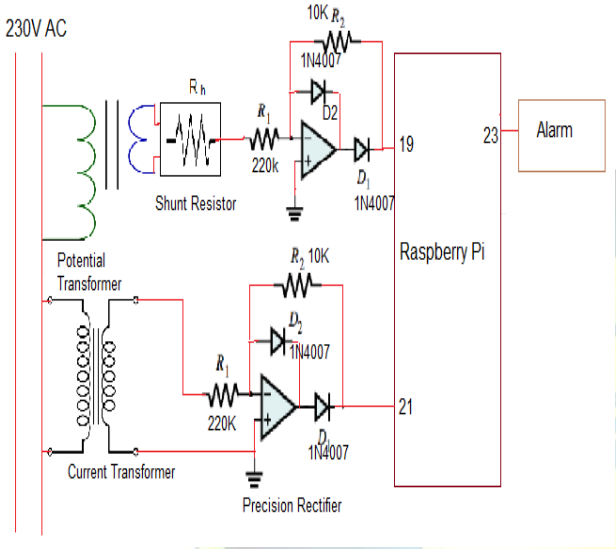

Figure 1.2 Earth Fault Detector

3.1 VOLTAGE MEASUREMENT

The circuit diagram of voltage transformer is shown in Figure 1.3. The voltage measurement circuit is designed to monitor the supply voltage. The supply voltage that has to be monitored is step down by the (0-6) V potential transformer and the step down voltage is rectified by the precision rectifier. The precision rectifier is designed with an operational amplifier in order to have a circuit behaving like an ideal diode or rectifier.

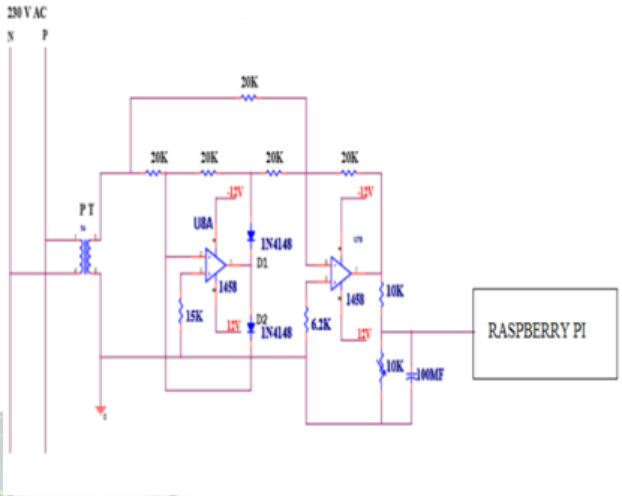

Figure 1.3 Voltage Measurement

When the input voltage is negative, there is a negative voltage on the diode, too. So it works like an open circuit, there is no current in the load and the output voltage is zero. When the input is positive, it is amplified by the operational amplifier and it turns the diode on. The presence of current in the load and because of the feedback, the output voltage is equal to the output.

In this case, when the input is greater than zero, D2 is ON and D1 is OFF, so the output is zero. When the input is less than zero, D2 is OFF and D1 is ON, and the output is same as the input with an amplification of $-R_2/R_1$. The full-wave rectifier operates by producing an inverted half-wave-rectified signal and then adding that signal at double amplitude to the original signal in the summing amplifier. The result is a reversal of the selected polarity of the input signal.

Then the rectified output voltage is adjusted to 0-5V with the help of variable resistor VR_1 and the ripples are filtered out by the C_1 capacitor. After filtration the

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corresponding DC voltage is given to ADC or other related circuit.

4. FUSE FAILURE INDICATOR

All three phases of the power supply are connected to the potential transformer which converts 230 voltage supply to 9 voltage supply. The potential transformer outputs are in turn connected to the phase detector. Whenever any of these three phases fail, it is indicated in the LCD display. The circuit diagram of the fuse failure indicator is shown in the Figure 1.4

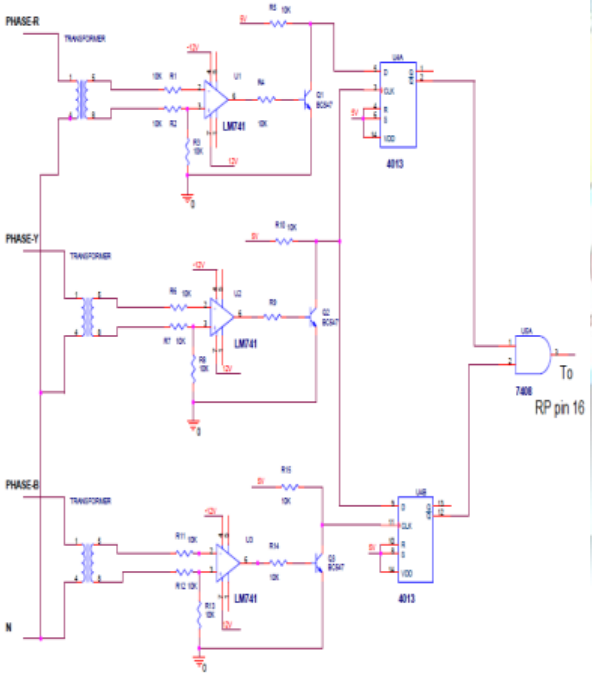

Figure 1.4 Fuse Failure Indicator

5. LOAD MANAGEMENT

Load management, also known as demand side management, is the process of balancing the electricity supply on the network with the electrical load by adjusting or controlling the load rather than the power station output. This can be achieved by direct intervention of the utility in real time, by the use of frequency sensitive relays triggering the circuit breaker, by time clocks, or by using special tariffs to influence consumer behaviour. Load management allows utilities to reduce demand for electricity during peak usage times, which can, in turn, reduce costs by eliminating the need for peaking power plants. Load management can also help in reducing harmful emissions, since peaking plants or backup generators are often dirtier and less efficient than base load power plants.

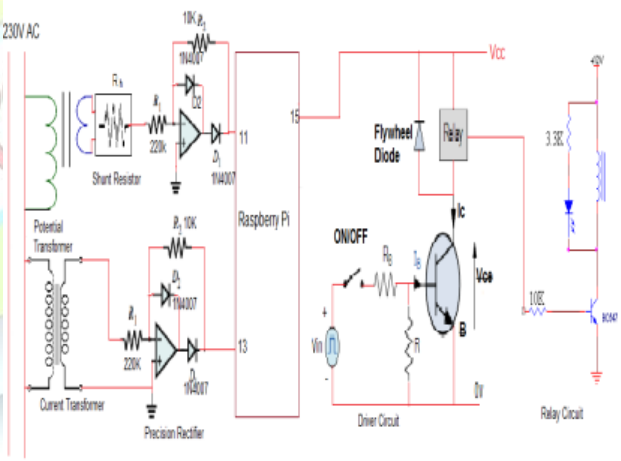

Figure 1.5 Load Management

5.1 CURRENT MEASUREMENT

The current measurement circuit is shown in the Figure 1.6. It is designed to monitor the supply current. The current that has to be monitored is step down by the current

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transformer. The step down current is converted into voltage with the help of shunt resistor. Then the converted voltage is rectified by the precision rectifier.

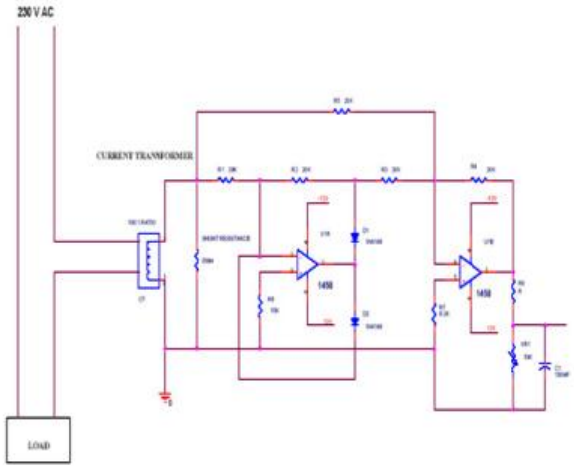

Figure 1.6 Current Measurement

When the wire is connected across the two terminals of DC voltage source such as battery, the source places an electric field across the conductor. The moment contact is made, the free electrons of the conductor are forced to drift towards the positive terminal under the influence of this field. The free electron is therefore the current carrier in a typical solid conductor. For an electric current of 1A rate, 1C of electric charge drifts every second through the imaginary plane through which the conductor passes.

6. CONCLUSION

The proposed system for monitoring earth fault, fuse failure indicator and load management is an automatic system of indication of failures in earthing and fuse and the load monitoring. Without human intervention consumer can directly know the earth and fuse failure. So it is both consumer and power station friendly. This detection circuit works perfectly by interfacing it with Raspberry pi circuit. The software for this proposed work can be developed very easily with the present communication technology, thus protecting the electronic appliances in advance.

REFERENCES

1. Kuzlu M, Pipattanasomporn M and Rahman S (2012) “Hardware Demonstration of a Home Energy Management System for Demand Response Applications”, IEEE Transactions on Smart Grid, Vol. 3, No. 4, pp. 1704–1711.

2. Philip Diefenderfer and Peter Mark Jansson (2014) “Power Sensor Applications in a Load Management Network for a Residential Microgrid”, IEEE Sensors Applications Symposium.

3. Zhi Wu, Xiao-Ping Zhang, Joachimbrandt, Su-Yang Zhoul and Jia-Ning Li (2015) “Three Control Approaches for Optimized Energy Flow With Home Energy Management System”, IEEE Power and Energy Technology Systems Journal, Vol. 2, pp. 2332-7707.

4. Giuseppe Tommaso Costanzo, Guchuan Zhu, Miguel F. Anjos and Gilles Savard (2012) “A System Architecture for Autonomous Demand Side Load

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ISSN 2394-3785 (Online)
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Management in Smart Buildings", IEEE Transactions on Smart Grid, Vol. 3, No. 4, pp. 1949-3053.

5. Yu-Hsiu Lin and Men-Shen Tsai (2015) "An Advanced Home Energy Management System Facilitated by Nonintrusive Load Monitoring With Automated Multi objective Power Scheduling", IEEE Transactions on Smart Grid, Vol. 6, No. 4, pp. 1949-3053.

6. AryadeviRemanideviDevidas, Subeesh T S and ManeeshaVinodini Ramesh (2013) "Design and Implementation of User Interactive Wireless Smart Home Energy Management System", International Conference on Advances in Computing, Communications and Informatics (ICACCI).

7. Christo Ananth, Vivek.T, Selvakumar.S., Sakthi Kannan.S., Sankara Narayanan.D, "Impulse Noise Removal using Improved Particle Swarm Optimization", International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), Volume 3, Issue 4, April 2014,pp 366-370

8. Xu Dong, Wei Hongxing, Wang Tianmiao and ZhengSuibing (2012) "A Smart Metering System for Monitoring Electricity of Building Based on Wireless Network",IEEE 10th International Conference on Industrial Informatics (INDIN), pp. 1935-4576.

9. Qie Sun, Hailong Li, Zhanyu Ma, Chao Wang, Javier Campillo, Qi Zhang, Fredrik Wallin and Jun Guo (2015) "A Comprehensive Review of Smart Energy Meters in Intelligent Energy Networks", IEEE Internet of Things Journal, Vol. 3, No. 4, pp. 2327-4662.

10. Liang Zhou, Joel J. P. C. Rodrigues and Luis M. Oliveira (2012) "QOE-Driven Power Scheduling in Smart Grid: Architecture, Strategy and Methodology", IEEE Communications Magazine, Vol. 50, No. 5, pp. 0163-6804.