NOVEL WIRELESS MULTIFUNCTIONAL ELECTRONIC CURRENT TRANSFORMER BASED ON IOT

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I. ABSTRACT

The novel electronic current transformer (ECT), which is based on the Hall current transformer (HCT), and a wireless transmission system. The novel ECT is aimed to be used in measuring supply line parameters, and the design of the wireless communication makes ECTs more flexible for current measurements at different current levels in power systems.

The paper presents monitoring operation of distribution transformer. The system principally monitors electrical parameters such as voltage and current. The main goal of this project is to develop a newly equipped well designed prototype for consumers to provide secured power. The innovation of this system is controlling mechanism implementation. If the parameters exceed their predefined values then system will sends intimation to the user. Here we are using IOT technology, so that the supply line parameters are send to the web server, by using IOT technology we can monitor supply line parameters from anywhere.

Keywords: - Microcontroller, current, voltage and temperature sensor, GPRS etc.

II. INTRODUCTION

Internet of Things (IOT) is a concept that encompasses various objects and methods of communication to exchange information. Today IoT is more a descriptive term of a vision that everything should be connected to internet. The IoT allow objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduce human intervention.

This project presents design and implementation of a embedded system to monitor operation of a distribution transformer like load currents, voltages and ambient temperatures. The proposed on-line monitoring system integrates a GPRS Modem, with stand alone single chip microcontroller and sensor

packages. It is installed at the distribution transformer site and the above mentioned parameters are recorded using inbuilt analog to digital converter (ADC) of the microcontroller. The acquired parameters are processed and recorded in the system memory. If there is any abnormality or an emergency situation is occurs then system will sends data and alert signal to the web server, so that we can monitor all parameters from anywhere by using IOT.

III. BLOCK DIAGRAM

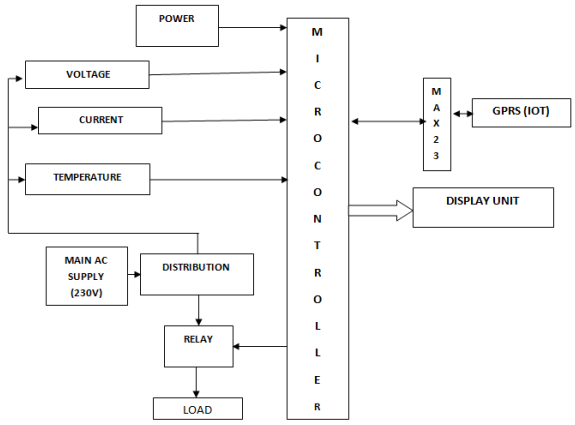
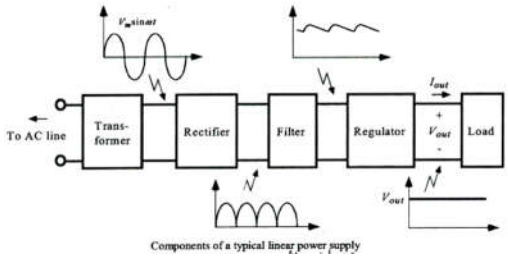


Fig (3.1) System block diagram

SYSTEM OVERVIEW

Power Supply:



Fig(3.2) Block diagram of power supply

This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

Microcontroller:

Fig(3.3) LPC2148 IC

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

The microcontroller is the final decision making body on the system. The logic is developed and then the program is burned inside the microcontroller and the other peripherals are

accessed via microcontroller only. The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high-performance and very low power consumption. In this system controller is the most important part. The microcontroller is fundamental piece of this undertaking, so we utilized LPC2148 microcontroller for controlling all gadgets. LPC2148 is an ARM7TDMI-S based superior 32-bit RISC Microcontroller with Thumb augmentations 512KB on-chip Flash ROM with In-System Programming (ISP) and In-Application Programming (IAP), 32KB RAM, Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, one with full modem interface.

MAX 232:

The microcontroller can communicate with the serial devices using its single Serial Port. The logic levels at which this serial port operates is TTL logics. But some of the serial devices operate at RS 232 Logic levels. For example PC and GSM etc. So in order to communicate the Microcontroller with either GSM modem or PC, a mismatch between the Logic levels occurs. In order to avoid this mismatch, in other words to match the Logic levels, a Serial driver is used. And MAX 232 is a Serial Line Driver used to establish communication between microcontroller and PC (or GSM).

LCD Display: This section is basically meant to show up the status of the project. This project makes use of Liquid Crystal Display to display / prompt for necessary information.

Fig(3.4) LCD Display

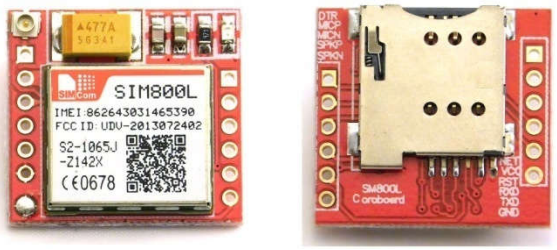
A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given 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.

Temperature sensor: Thermistors are a temperature sensing devise. It is used to sense the temperature. In this project by depends on the value of temperature the exhaust fan will run.

Fig(3.5) Temperature Sensor

The word thermistor is an acronym for thermal resistor, i.e., a temperature sensitive resistor. It is used to detect very small changes in temperature. The variation in temperature is reflected through appreciable variation of the resistance of the device. Thermistors with both negative-temperature-coefficients (NTC) and positive temperature coefficient (PTC) are available, but NTC thermistors are more common. The negative-temperature coefficient means that the resistance increases with the increase in temperature.

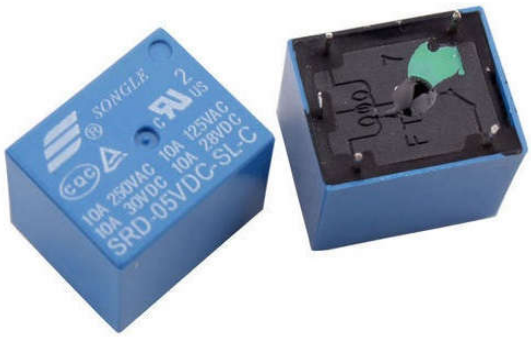
GPRS Module: This section consists of a GPRS modem. The modem will communicate with microcontroller using serial communication. The modem is interfaced to microcontroller using MAX 232, a serial driver. The Global Packet Radio Service is a TDMA based digital wireless network technology that is used for connecting directly to internet. GPRS module will help us to post data in the web page directly.



Fig(3.6) GPRS Module

GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets that are transmitted separately and then reassembled at the receiving end. GPRS supports the world's leading packet-based Internet communication protocols, Internet protocol (IP) and X.25, a protocol that is used mainly in Europe. GPRS enables any existing IP or X.25 application to operate over a GSM cellular connection. Cellular networks with GPRS capabilities are wireless extensions of the Internet and X.25 networks.

Relay Section: This section consists of an interfacing circuitry to switch ON / OFF the system whenever any unhealthy conditions i.e. overload is detected. This circuitry basically consists of a Relay, transistor and a protection diode. A relay is used to drive the 230V devices.

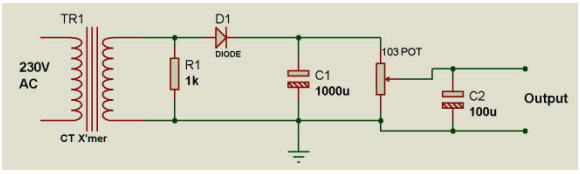


Fig(3.7) Relay

Relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first.

There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

Current and Voltage Sensor:



Fig(3.8) Current sensor circuit

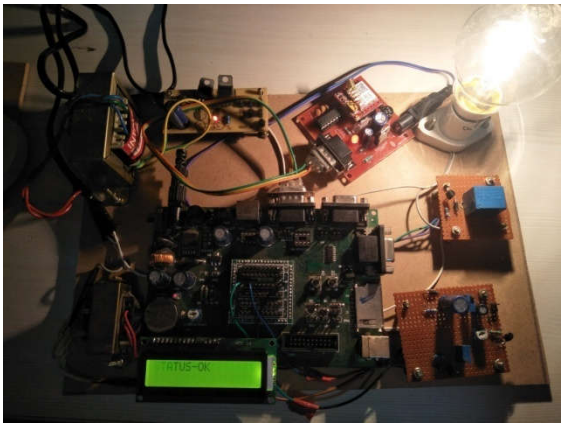
The current sensor is used to measure the current and voltage sensor is used to measure voltage in supply line. The current sensor contains current transformer and rectifier circuit and voltage sensor contains resister circuit.

IV. IMPLEMENTATION

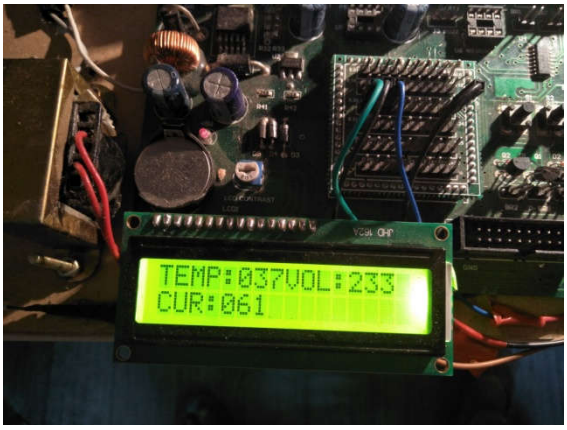
In this system we are designed power supply section to provide +12V DC as well as +5V DC. The main device is microcontroller board, to operate it requires +12V so we directly connected to the 12V supply. The GPRS module requires 12V and sensors are requires 5V.

In the proposed system the microcontroller is main part of this project, so we used LPC2148 microcontroller for controlling all devices. LPC2148 is an ARM7 processor based microcontroller. For indication of status of the project we used LCD display. The LCD display is 16x2 alphanumeric type display. Here we used IOT technology for monitoring the power line parameters on the web server, for accessing web server we are used GPRS Module. In this system we are using current sensor and voltage sensor for measuring supply line parameters. We have to interface all modules to the microcontroller. The GPRS module is connected to UART0. The voltage sensor is P0.28, and current sensor is connected to P0.29 pin of microcontroller. The LCD display is connected to the port1 P1.16 to P1.21 of microcontroller. The coding of microcontroller is written in embedded C language, for writing and compilation of code we used keil µvision3 software.

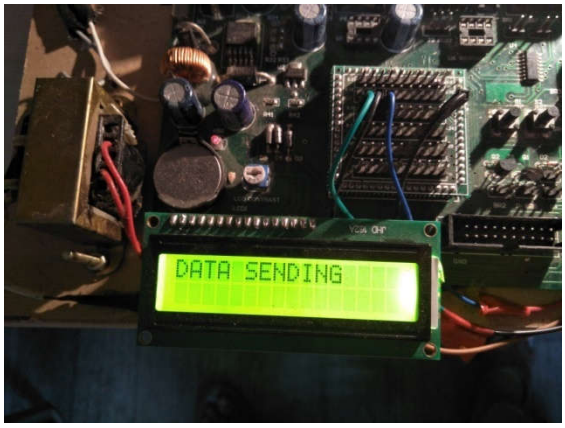
V. RESULTS



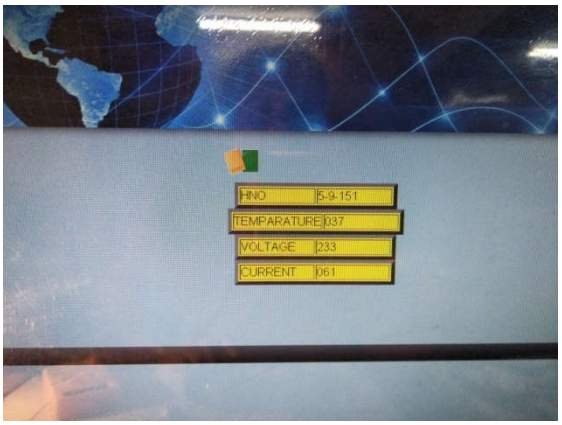
Fig(5.1) System Hardware



Fig(5.2) Parameters are shows on LCD display



Fig(5.3) Sending parameters to the web server



Fig(5.4) Parameters are display on web server

VI. CONCLUSION

The system of electricity distribution is the delivery of electricity from generating power plants to end users. Distribution system network carries electricity by the transmission system and delivers its load centers. Thus, it is very essential to have high efficiency, high reliability and high service quality in a distribution system.

An IOT based novel electronic current transformer for power transformer was designed, implemented and tested. A server module can be added to this system to periodically receive and display on web server so we can monitor all parameters from anywhere in the world. Also this system will gives alert intimation when any of the parameter is exceeded above predefined value.

VII . REFERENCES

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Author profile

Tati Ruchika was born on September 28 1995, completed her graduation in electronics and communications engineering from CMR Institute of Technology. Currently, she is pursuing her M.Tech in Embedded systems from St.Martins Engineering College. Her areas of interest include data analyzing and communication system.

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