A NOVEL WIRELESS MULTIFUNCTIONAL ELECTRONIC CURRENT TRANSFORMER BASED ON ZIGBEE-BASED COMMUNICATION

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I. ABSTRACT

Overhead and underground power line monitoring is an essential infrastructure for advanced operation in the smart grid. In the present world the power line monitoring is very difficult. This drawback can be easily overcome with the help of embedded technology. The main theme of this application is to measure the temperature, voltage and current by using sensors and displaying on the concerned display device. In this application total two sections are implemented one is transmitter section and another one is receiver section. In the transmitter section three sensors are interfaced to the LPC2148 controller and this controller is responsible for entire manipulations and the updated condition is displayed on the LCD and the same status is transmitted to the receiver section by using zigbee communication and is displayed on the pc which is on the receiver section.

Keywords: *- Microcontroller (LPC2148), Current, Voltage and Temperature sensor, Zigbee etc.*

II. INTRODUCTION

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.

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 monitoring system integrates a ZIGBEE 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 receiver section, so that we can monitor all parameters from PC which contain ZIGBEE receiver.

III. BLOCK DIAGRAM

Transmitter Section:

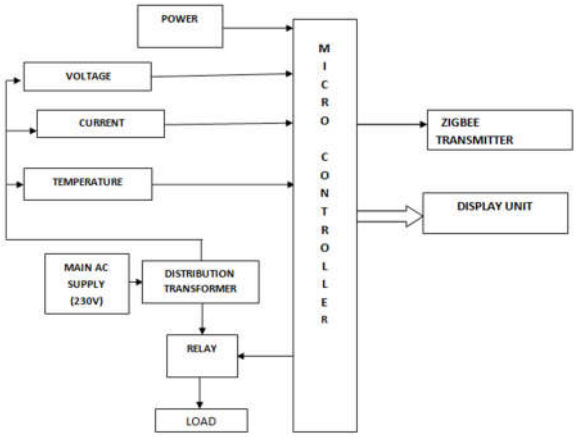

Fig (3.1) System block diagram

Receiver Section:

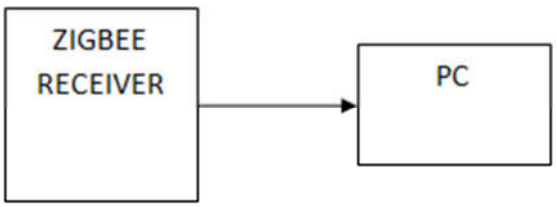

Fig (3.2) Block Diagram of Receiver

SYSTEM OVERVIEW

Power Supply:

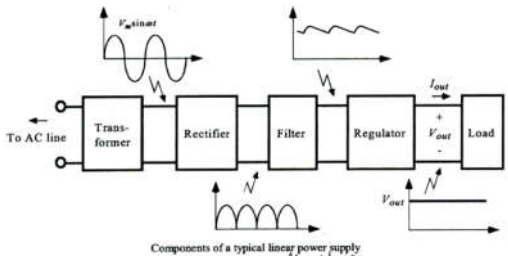

Fig (3.3) Block diagram of power supply

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 (3.4) 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 (3.5) 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 (3.6) 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.

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. 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:

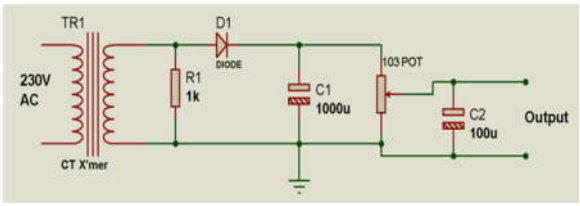

Fig (3.7) Current sensor circuit

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.

ZIGBEE: Zigbee is new wireless technology guided by IEEE 802.15.4 Personal Area Network standard. It is primarily designed for the wide ranging controlling applications and to replace the existing non-standard technologies. It currently operates in 868MHz band at a data

rate of 20Kbps in Europe, 914MHz band at 40kbps in USA, and the 2.4GHz ISM bands Worldwide at a maximum data-rate of 250kbps.

IV. RESULTS

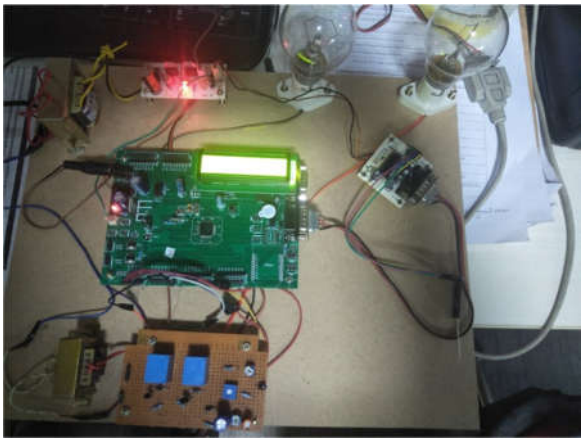

Fig (5.1) System Hardware

Fig (5.2) Parameters are shows in LCD display

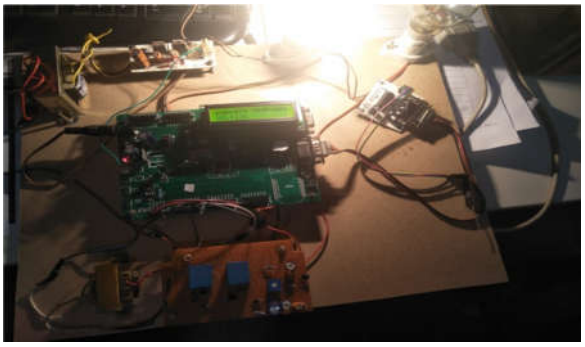

Fig (5.3) Hardware with Bulb ON

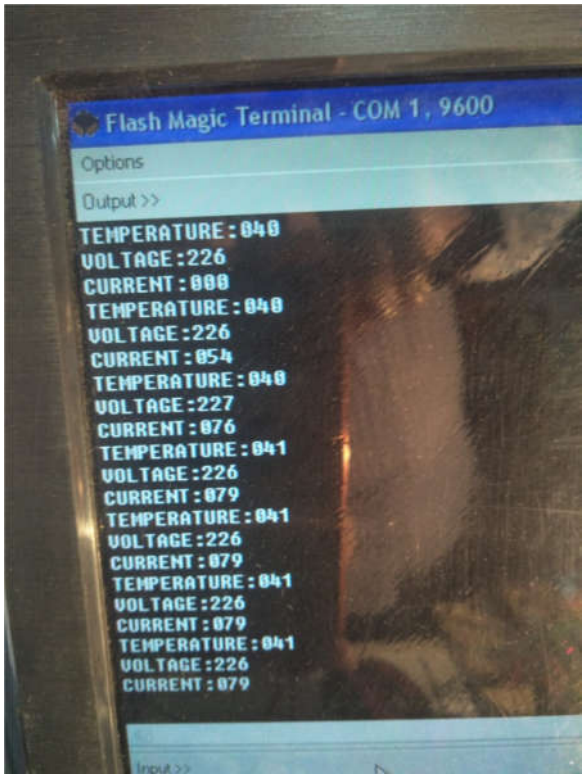

Fig (5.4) Parameters are display on PC

V. CONCLUSION & FUTURE SCOPE

ZIGBEE based novel electronic current transformer for power transformer was designed, implemented and tested. A ZIGBEE module is added to this system to periodically receive and display on PC so we can monitor all parameters from PC which contain ZIGBEE receiver.

The future scope of this system is we can use IOT technology to monitor the supply parameters.

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