

Development of Energy Management for Residence using ARDUINO and ZIGBEE

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Abstract— This project implemented the design of energy management system using Arduino UNO board. The design is based on ZigBee Tarang and Arduino UNO board. Home appliances are connected to the Arduino controller and it will get communicate wirelessly using ZigBee transmitter and ZigBee receiver. This project presents the design and implementation of energy management system that can control home appliances. This system is mainly designed to protect the home appliances from overvoltage and overcurrent. The design is based on Arduino UNO board and the home appliances are connected to the Arduino board via relay driver IC (ULN2003A) and relays. This is the wireless communication between the transmitter and receiver using ZigBee and the Arduino UNO board.

Key words: ZigBee Tarang, Arduino controller, Remote control, Energy-saving

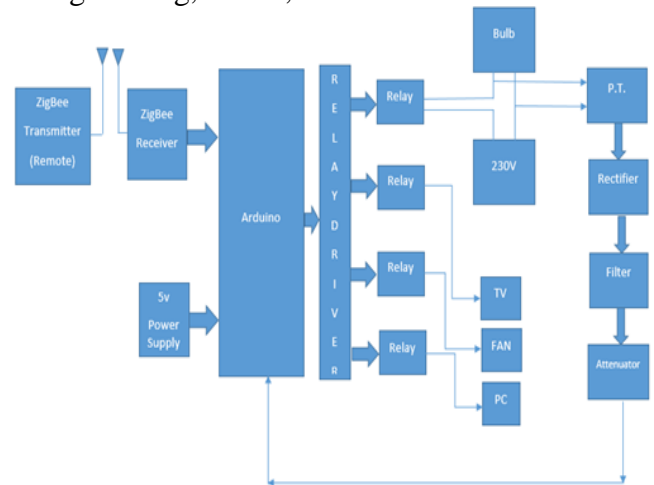


Fig. 1: Block Diagram

I. INTRODUCTION

Currently, many countries are moving away from traditional energy sources like fossil fuel and instead, moving toward the alternative energy sources like solar energy, hydraulic potential energy, wind kinetic energy, biomass, etc. Unfortunately, these alternative energy sources require large investment. These systems are mostly used in industrial area than the residential area because of the high capital required. Therefore in order to encourage the residential area to be aware of energy saving, this project is implemented as an effective and low-cost method. Most of energy usage in a house is from AC system and the rest are from electrical appliances. Block diagram was mentioned [1]. How works the ZigBee module was proposed. [2]. Architecture of residence to implement the system was proposed [3]. How ZigBee transmitter and receiver communicate with each other was proposed [4]. The output ports and power outlets allows user to control the home appliances using ZigBee remote. However, the previous energy management systems do not allow a user to get a chance to reduce power consumption of home appliances. In this paper, we propose more efficient ENERGY MANAGEMENT SYSTEM based on Arduino and ZigBee Tarang and ZigBee remote controls. To implement the proposed system, an automatic standby power break down is carried out with two ZigBee tarang transceiver modules used for serial communication.

II. HARDWARE IMPLEMENTATION

A. Power Supply for Arduino UNO

In this section we describes the +5V DC power supply. The power supply section is the most important in our project. It should supply constant 5v output for working of Arduino board and ZigBee Tarang. A 0-12 step down transformer is used to converts high voltage mains supply to low voltage dc supply.

The primary wires of this transformer is connected in to main supply. One switch & fuse used for protection from overload condition and short circuit. The secondary wires is connected to the bridge circuit which is built by using of diodes to convert 12V AC to 12V DC voltage. The capacitors are used for filtering the output from 12V DC supply, which are also +5V, by using regulator IC 7805.

B. Arduino Uno

An Arduino is an open source microcontroller. The Arduino designed on the basis of 8-bit Atmel AVR microcontroller or 32-bit Atmel AVR microcontroller. The arduino has 6 analog input pins and 14 digital I/O pins. Arduino provides easy way to student to implement their own project ideas easily. We burn the code in Arduino easily by USB cable, Arduino is compatible with both USB and RS 232. The Arduino programs written in C and C++. The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it

features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts.

C. Level Converter Max232

The MAX 232 is used as level converter, and it translate RS 232 to TTL and vice versa. It is the most well-known type of integrated circuit.

D. Tarang P20

Tarang ZigBee is the wireless module it has low power and it used for the serial data communication this module of ZigBee is used in many industrial sectors Tarang used as transceivers in our project. This module of Tarang in our project connect to Arduino board with the help of level converter MAX232

III. SOFTWARE IMPLEMENTATION

A. Arduino IDE

The Arduino IDE (Integrated Development Environment) software where use for programming of Arduino. This software also use for the burn code in the Arduino board.

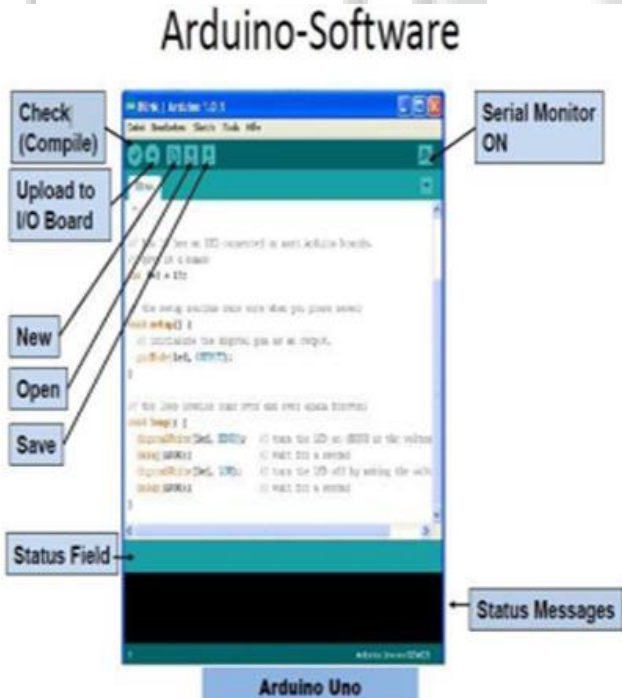
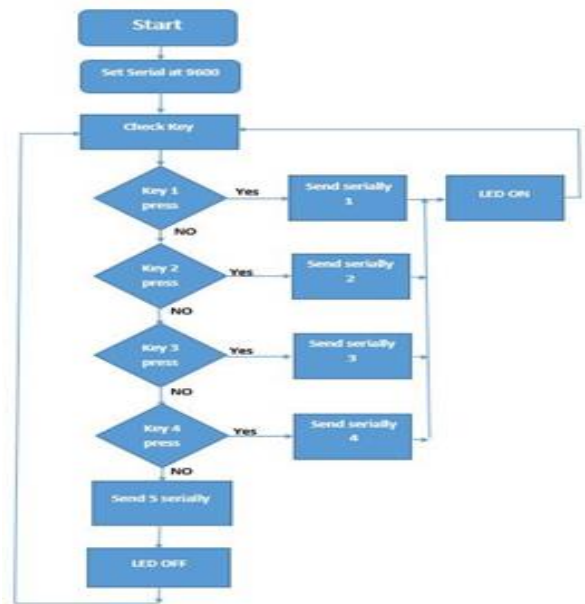


Fig. 2: Arduino IDE

IV. FLOW CHART

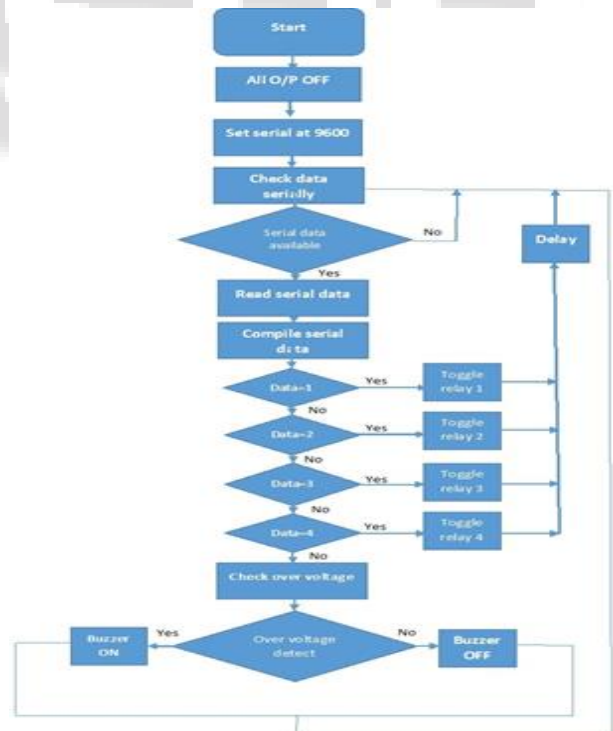
A. Transmitter



Flow Chart No.:1-Transmitter

According to flow chart check the transmitted data from the transmitter to receiver. If press key 1 then send data 1 to receiver. Same as like press key 2 send data 2,press key 3 send data 3 and press key 4 send data 4. When no any key press then no data transmit from transmitter to receiver.

B. Receiver



Flow Chart No.:2-Receiver

In above flow chart we check data is available or not, when data is available relay will be ON. This condition is check for all relay connected in circuit. Whenever over voltage is detected then BUZZER connected to that pin will be ON to indicate.

V. RESULT AND CONCLUSION

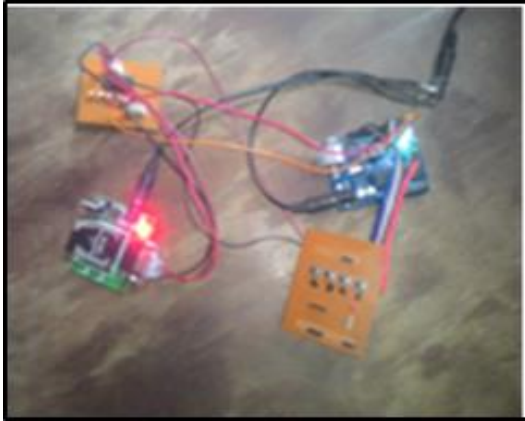


Image No .1: Transmitter



Image No. 2: Receiver

In this project, we have concluded that, the energy management of any home appliances can be controlled using ZigBbee Tarang module with Arduino UNO microcontroller. This system is provided with provision for protection of home appliances against sever effects of over voltage, over current and short circuit and increases life of devices. This system indicate the over-voltage or over - current by buzzer.

This module cut off the power supply of relay of that particular device automatically or manually by remote.

Relay	Command	Status of Appliances
Relay 1 (Refer Figure.no. -2)	1 = Relay 1 ON	Bulb 1 ON
	0 = Relay 1 OFF	Bulb OFF
Relay 2 (Refer Figure.no. - 2)	1 = Relay 2 ON	TV ON
	0 = Relay 2 OFF	TV OFF
Relay 3 (Refer Figure.no. - 2)	1 = Relay 3 ON	Fan 3 ON
	0 = Relay 3 OFF	Fan 3 OFF
Relay 4 (Refer Figure.no. - 2)	1 = Relay 4 ON	PC ON
	0 = Relay 4 OFF	PC OFF

Table 1.

REFERENCE

- [1] “Home Energy Management System Based On ZigBee” – International Journal of Inventive Engineering and Sciences (IJIES) ISSN: 2319–9598, Volume-2, Issue-4, March 2014.
- [2] “Remote Monitoring and Controlling System Based on ZigBee Networks” - International Journal of Software Engineering and Its Applications Vol. 6, No. 3, July, 2012.
- [3] “Wireless Energy Management System for Residential Area”-International Journal of Environmental Science and Development, Vol. 4, No. 5, October 2013.
- [4] “Zigbee Technology and Its Application in Wireless Home Automation Systems: A Survey”-International Journal Of Computer Networks & Communications (IJCNC) Vol.6, No.4, July 2014.
- [5] "Home Appliance Energy Monitoring and Controlling Based on Power Line Communication" Proceedings of the 27th International Conference on Consumer Electronics (ICCE), 2009.
- [6] “Remote Controllable and Energy Saving Room Architecture Based on ZigBee Communication, ”IEEE Trans. on Consumer Electronics, Vol. 55, No. 1, pp. 265268, Feb. 2009.