

Design and Installation of Home Automation and Security System Using Microcontroller and ZigBee Modulation

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Abstract-Technology has developed in the field of electronics, and brought tremendous changes in the day to day life. Advancement of technology, things are becoming simpler and easier day-by-day. Automatic systems are opted over manual system. This paper deals with the INTELLIGENCE OF HOME AUTOMATION SYSTEM (IHAM) which is developed using microcontroller with the ZigBee module wireless and GSM network, technology that control home appliance. The automation centres with recognition of voice commands and uses low power to control all lights and electrical appliances in home or office using HM2007 chip. This paper gives the overall framework of hardware and software designs. Also it explains security system for fire hazards that may occur through smoke sensor or GSM module and it is control by the same controller that send SMS to the user if the smoke is detected.

Index terms:- 8051 microcontroller , ADC ,Automation , GSM module , HM2007 chip , LCD display, LDR, relay ,sensors, stepper motor, ZIGBEE module.

I. INTRODUCTION

Technology has been developed in the field of electronics, has brought tremendous changes in the day to day life. Advancement of technology things are becoming simpler and easier for every human living. Home automation become more popular and introduces many technologies for mobile communication for controlling the home appliances. ZIGBEE is developed in recent years, a short range wireless communication module with low data, low power, short distance, low cost, and safe and reliable. This paper presents a home automation system based on ZIGBEE technology. The Central Processing Unit for the system is developed using the PIC microcontroller which is a low cost and efficient controller used in many applications. Here combine embedded system technology with the wireless technology.

Through this paper we have tried to show automatic control of a house, so that we can reduce power usage to some extent.

II. HOME AUTOMATION

In recent days home automation is one of the greatest development that current technology has achieved. Home automation is simply control of almost all electrical devices. Recent days we have many products that controls automatically, or by using remote controller, or by voice command also.

Home automation also referred as Demotic is a residential extension of "building automation". It can control lighting, ventilation system, air conditioning, and many more for the comfort and security of the consumer.

Integration of devices is possible through Home automation along with control of domestic activities like home entertainment system, yard watering, and domestic robots etc. these devices can be controlled through a personal computer or with remote with the help of internet access.

In recent days a typical new home will be outfitted with the home automation during construction for various reasons like accessibility of walls and to equip in the decorative manner which will reduce cost of wiring and changes in them.

III. NEED FOR HOME AUTOMATION

In previous paragraphs we have discussed about the advantages of the home automation and its installation. Here we discuss why we actually need HOME AUTOMATION.

- a) An automated device can reduce the human effort and can reduce the error of due to humans.

- Replacing human effort can be both physical and psychological
 - The replacing can be done where there is a dangerous environment like volcanoes, space and many more
 - Performing the tasks which are beyond the human capacity.
- b) This is why the current paper looks into construction and its implementation

IV. SUPPLY UNIT

Supply unit is the source for the any electronic device. We are using 1-VOLT DC SUPPLY to the system which gives the required power to the whole system. The main components required for the system are:

- TRANSFORMER
- RECTIFIER
- INPUT FILTER
- REGULATOR
- OUTPUT FILTER
- OUTPUT INDICATION
- CONTROL UNIT

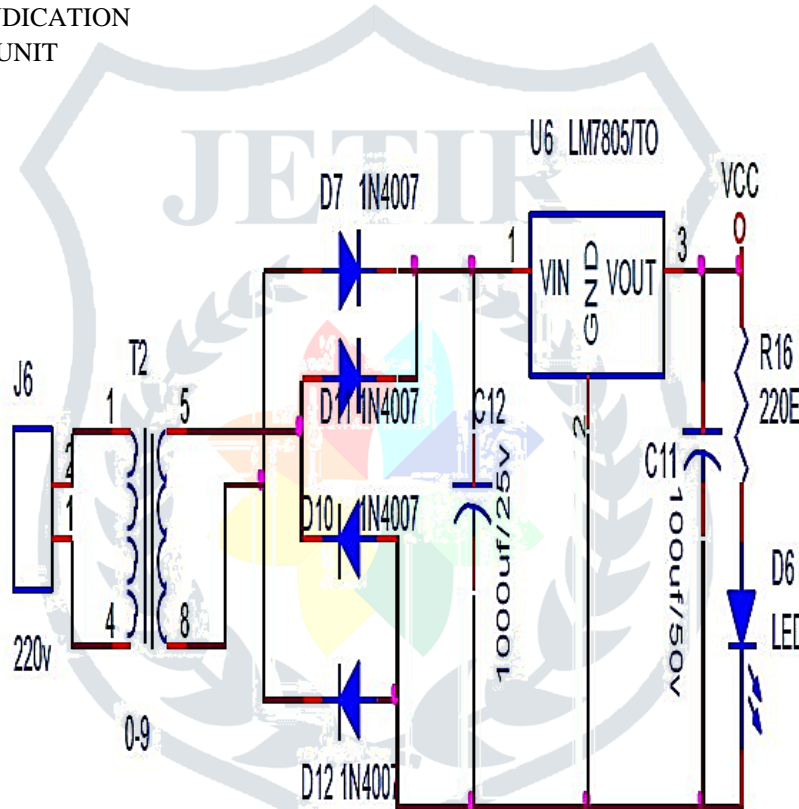


Fig.1 Source input for the Automation system

A. TRANSFORMER:

The main source for the system is a transformer. The output power supply is completely depend on the maximum output power of transformer. As we know power is depend on the current and voltage ratings. eg: If the transformer current and voltage ratings are 10V,500mA then maximum power delivered by transformer is 5watt. It means the system can drive a load up to 5watt.

In our project maximum power required is 1watt. So to get 1watt power we use 12V, 250mA transformer. So the maximum output power of this transformer is 4watt. That means it can drive a load up to 4watt.

B. RECTIFIER:

Rectifier is used to convert ac signal into dc signal. For every electronic device it requires DC supply, so we are using four diodes to get DC supply to the system.

C. INPUT FILTER:

After rectification we will get DC supply but it is not pure DC supply. It may contain some AC ripple. AC ripple may be low frequency ripple or high frequency ripple.

To reduce these ripples we have to use electrolytic capacitor. The capacitor voltage rating should be double from the incoming DC supply. So that it will blocks DC and supply ripple to the ground.

D. REGULATOR:

Regulators are the devices which gives constant output with varying input. There are two types of regulators

- i) FIXED-VOLTAGE REGULATOR
- ii) ADJUSTABLE REGULATOR

We have used fixed voltage regulator that is LM78XX whereas last two digits refer to output voltage. The voltage for our system is 5V .so we have used 7805 regulator which gives 5V from the 12V dc supply.

E. OUTPUT FILTER:

After the input filter still ripples are present means it rectify the ripples.

F. OUTPUT INDICATION:

By the name itself we can say it indicates the output of the system. We used LED for the indication. If LED glows means the system is working under proper condition of our supply.

This supply is for the display, relay and microcontroller unit. The microcontroller requires 5V supply to desired task.

G. CONTROL UNIT:

Here we used two control unit one for the internal control unit and for the external control unit where as these control unit are based on ATMEL'sAT89S52 microcontroller (below fig). The give diagram will show the functional pins and basic requirement of microcontroller to make it functional.

AT89S52 is an ATMEL microcontroller with the core of INTEL MCS-51. The pin configuration is show above figure. It is a low power, high performance CMOS 8-bit microcontroller with erasable read only memory and 8k bytes downloadable flash programmable and 2k bytes of EEPROM. It is compatible of 8051 instruction set and pin output.

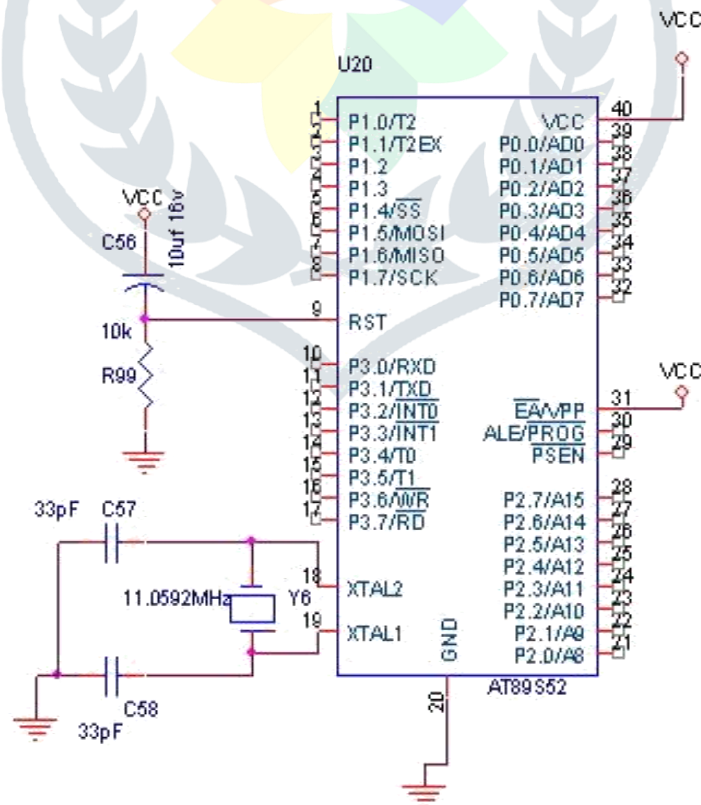


Fig.2 Pin diagram of the Microcontroller

The downloadable flash of On-chip allows the program memory to be reprogrammable in the system through the SPI serial interface or by the conventional non-volatile memory programmer. By combining the 8-bit CPU with downloadable flash on a monolithic chip, the Atmel AT89S52 is a very powerful microcomputer and which provides a highly flexible cost effective and highly flexible solution to many embedded control applications.

The Atmel AT89S52 gives the following standard features: 8K bytes of 2K bytes of EEPROM, 256 bytes of RAM, Downloadable Flash32 I/O lines, two Data Pointers, Programmable watchdog timer, three 16-bit timer/counters, a six-vector two-level Interrupt, on-chip oscillator, serial port, a full duplex and clock circuitry.

The AT89S52, it is designed in such way that the static logic for operation get down to zero frequency and it supports to two software selectable power saving mode. While in the idle mode it stops the CPU while it allows the timer/counter, RAM, serial port, and interrupt the system to continue functioning. The power down mode it saves the RAM contents, but it freezes the oscillator, disabling the all other chip functions until hardware reset or next interrupt.

The downloadable flash can be changed into a single byte at a time and it is accessible through the SPI serial interface. The holding reset active, forces the SPI bus into a serial interface and it allows the program memory to read or to write from unless Lock Bit 2 has been activated.

FEATURES:

- 8K bytes of reprogrammable downloadable flash memory
- Endurance (1000 write/erase cycles)
- compatible with MCS-51 product
- Fully static operation
- 4V to 5.5V operating range
- 256x8 bit internal memory
- Three 16 bit Timer/Counter
- Interrupt recovery from power down mode
- low power Idle and power down mode
- SPI serial interface for program downloading

ADVANTAGES

- Low cost
- Less power consumption
- High speed
- Less space required

V. DISPLAY UNIT

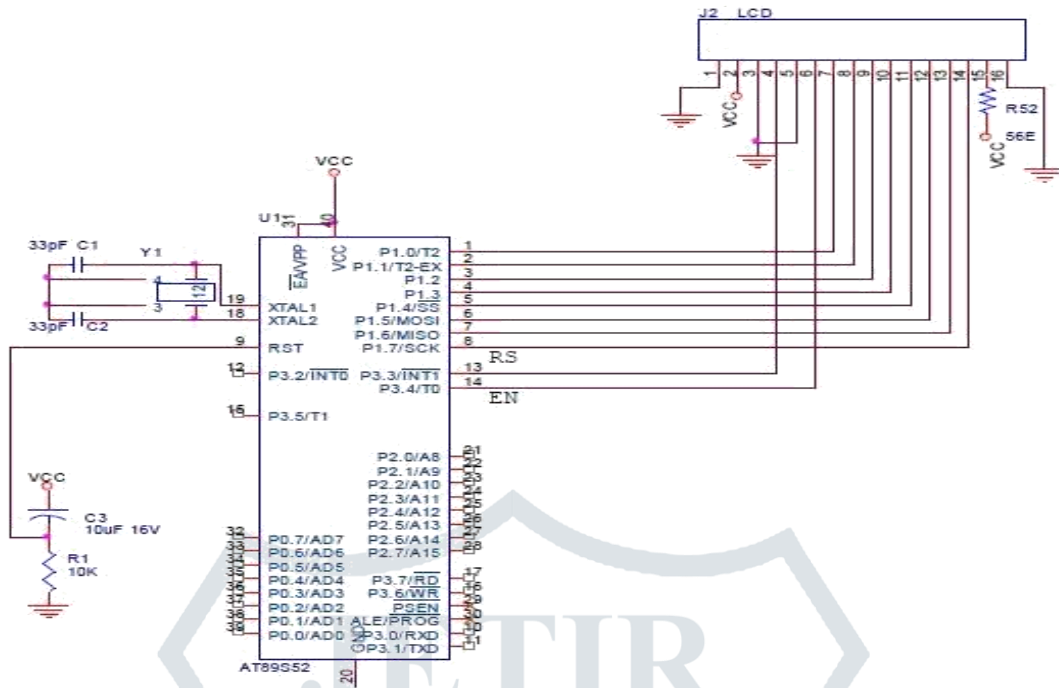


Fig.3 Display unit of Automation

VI. WHAT CAN BE AUTOMATED

Anything in the office/home that is powered with electricity can be controlled or automated. We can control all our electrical devices and we can turn on lights automatically when someone approaches

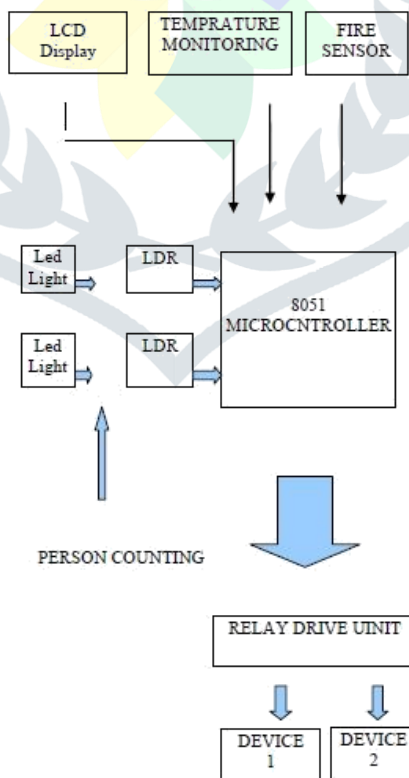


Fig.4 Automatic System

VII. ZIGBEE PROTOCOL:

To monitor the system we need a Wi-Fi connection to get control over the electronic gadgets, so that we are using ZIGBEE protocol. The system implements the wireless network communication with radio frequency modulation. It is the one of the communication protocols that is proposed in the system. It provides 250kbps as maximum baud rate, but we can still use it up to 1151200 bps was used for receiving and sending with high speed. We can use wireless communication for control this appliances. It is communicate with 250kbs, but 40kbps is more than sufficient for controlling the home automation devices. The below depicts the general block diagram of the ZigBee based home automation of the system.



Fig.5 Block diagram of automation system

VIII. SOFTWARE DESIGN OF THE SYSTEM

As the microcontroller is used as the central processing unit of the system. We can write the program for the integrated chip in embedded C programming language. The software is developed in module and it is integrated for all implementation of the system.

A. DATA FROM HM2007

- i) The data from speech recognition module and it is stored in a separate memory location.
- ii) Compare the command speech with the switch case statement in the program, so that the command for the particular appliance is triggered through the wireless communication.

B. ZIGBEE COMMUNICATION

- i) Initialize the serial communication register
- ii) Transmit all the data serially through ZigBee module by placing it in TXREG register
- iii) At the receiver side, it receives the data through RCREG register and it is stored in a separate memory location
- iv) Turn ON or turn OFF the relay depending on the received data

C. GSM MODULE AND SMOKE DETECTION

- i) For the smoke detector sensor the ADC register are initialized and voltage which is obtained in the analogy input pin of the controller

- ii) The ADC value is compared and processed with the predefined value for triggering the GSM module by sending the data signal to the RS 232 in the controller and we make use of the another serial peripheral register for this purpose.

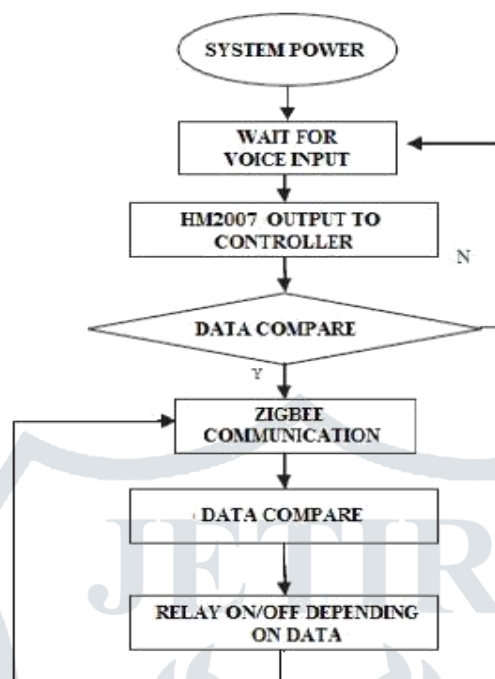


Fig.6 Flow Chart for the software development

IX. CONCLUSION:

Home automation is based on the voice recognition which uses PIC microcontroller as the central processing unit which was explained in this paper. The system is completed focused on at differently abled people and elderly people. The prototype which is developed can control electrical appliance in an office or home. This system implement the voice recognition unit using HM2007 and also the system implement wireless network using ZigBee radio frequency module for their efficiency and low power consumption. The security system is mainly useful in the case of the fire accident at the home.

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