



Microcontroller Based Room Automation

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ABSTRACT: Electricity is one of the most important resources in this century. We should conserve the electricity; otherwise next generations may have to live without Electricity. But many times we come outside the room/hall and forget to turn off the lights/fan, thus the electricity is wasted. Also in most cases switches of lights and fan are located inside the room and so we may have to search them in darkness and in case of guests, it becomes more difficult. To overcome these problems we have planned to implement a project called “microcontroller based room automation”. This project has 2 parts. First is “Person counter” and the other one is “Automatic room light and temperature controller with a temperature and light intensity display”. The first part is to count and display the number of persons entering in any room which can be used in large rooms like seminar halls, conference rooms, theatres etc to decide the no of seats remaining. When number of persons inside the room is zero, power supply inside the room can be cut using a TRIAC and when somebody enters the room, the system automatically measures the temperature and light intensity inside the room and accordingly controls the light and fan. During daytime lights will not be operated and during cold season fan may not be operated. This helps to save electricity and reduces our effort. LCD display placed outside the room displays number of person inside the room, temperature and light intensity.

KEYWORDS: Automation, Person Counter, TRIAC.

I. INTRODUCTION

Energy crisis is the main problem that we are facing nowadays. So the conservation of energy is relevant in this occasion. The objective of this project is to overcome this problem. This project has 2 parts. First is “Person counter” and the other one is “Automatic room light and temperature controller with a temperature and light intensity display”. In today’s world, there is a continuous need for automatic appliances. With the increase in standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life.

The temperature and light intensity in the room is sensed and with respect to that, light and fan in the room is switched ON/OFF when a person enters/leaves the room. The circuit consists of IR transmitter and receiver LEDs which are used to sense the entering or leaving of a person to or from the room. The temperature sensor measures the temperature inside the room and the analog signal from the sensor is processed by the microcontroller. Likewise the Light dependant resistor (LDR) generates the analog signal proportional to the available light inside the room. This signal is also processed by the microcontroller. The speed of the fan and brightness of the light is controlled accordingly. Whenever the person leaves the room, light and fan will be switched OFF.

The circuit which we have designed is simple and compact. With the help of some software tools, we were able to develop the required coding and burn it to the Integrated circuit.

This Project —Microcontroller based room automation is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. When somebody enters into the room then the counter is incremented by one and the light in the room will be switched ON and when any one leaves the room then the counter is decremented by one. The same is done with the fan also. The light will be only switched OFF until all the persons in the room go out. The total number of persons inside the room is also displayed on the seven segment displays.

The microcontroller does the above job. It receives the signals from the sensors, and this signal is operated under the control of software which is stored in ROM. Microcontroller ATMEGA328 continuously monitor the Infrared Receivers, When any object pass through the IR Receiver's then the IR Rays falling on the receiver are obstructed , this



obstruction is sensed by the Microcontroller.

Thus this project will provide more convenience and comfort for the user. More than that it saves a appreciable amount of energy. The only disadvantage is that the initial cost of establishment is high. This project can be implimntd in malls, offices, schools, etc.

II. OVERVIEW ON AUTOMATION

Home/office automation is the control of any or all electrical devices in our home or office, whether we are there or away. Home/office automation is one of the most exciting developments in technology for the home that has come along in decades. There are hundreds of products available today that allow us control over the devices automatically, either by remote control; or even by voice command.

A home automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties), and the use of domestic robots. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the internet.

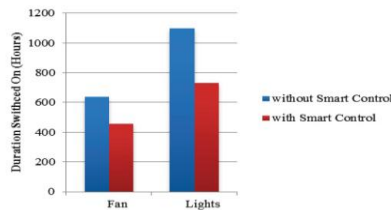


Fig. 1 Power consumption comparison

III. BLOCK DIAGRAM

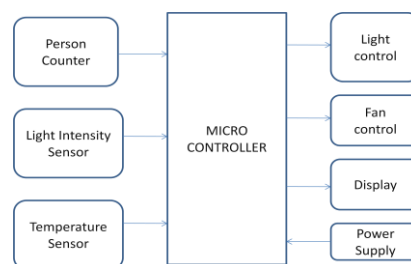


Fig. 2 Block Diagram

Block diagram of this project is shown above. It consists of seven blocks .

1. Power Supply
2. Microcontroller
3. Person counter
4. Temperature sensor

5. Light intensity sensor
6. Light and fan control
7. Display

IV. CIRCUIT DIAGRAM AND EXPLANATION

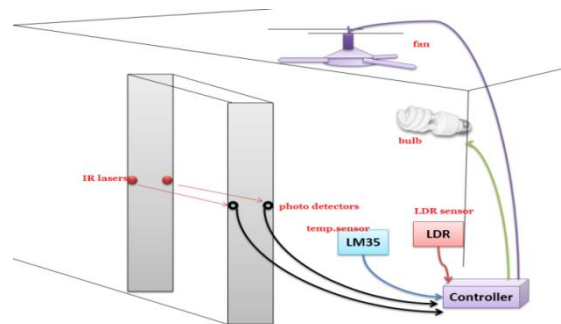


Fig. 3 Schematic diagram

4.1 CIRCUIT DESCRIPTION

The main parts of our project are

- TM 1. Transmission Circuit (Infrared LEDs)
- TM 2. Receiver Circuit (Sensors)
- TM 3. Light and temperature sensor
- TM 4. Microcontroller
- TM 5. power control unit

IR signal IR Transmission circuit is used to generate the IR waves. The circuit consists of two resistors of 220Ω and one resistor of 1kΩ. The D2 LED which is an IR LED will be continuously producing an IR wave which is received by the D3 LED. In this condition the transistor Q2 is off. Whenever the IR rays are cut, the transistor will be ON. This indicates the presence of a person in the room.

4.1.2 Light and temperature sensor

The light sensor used is LDR it provides analogue output proportional to the light intensity which is converted to digital by analogue to digital converter (ADC) available

in the microcontroller. Similarly temperature sensor LM 35 also gives analogue output that is converted to digital by ADC. The measured analogue value is compared to some

Preset value in software. After analyzing the sensor readings signal is sent to the receiver for changing the power delivered to the loads.

4.1.3 Microcontroller

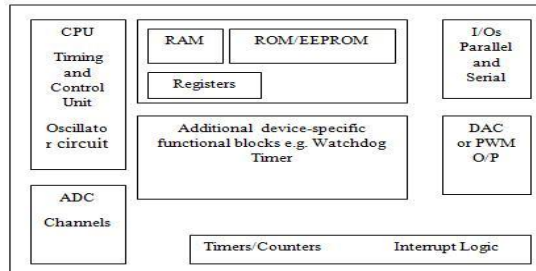


Fig.4 Microcontroller system

Microcontroller essentially consists of Central Processing Unit (CPU), timers and counters, interrupts, memory, input/output ports, analog to digital converters (ADC) on a single chip . With this single chip integrated circuit design of the microcontroller the size of control board is reduced and power consumption is low. A temperature sensor has been used to measure the temperature of the room and the speed of the fan is varied according to the room temperature using PWM technique. The duty cycle is varied from 0 to 100 to control the fan speed depending upon the room temperature, which is displayed.

4.2 CIRCUIT DIAGRAM AND WORKING

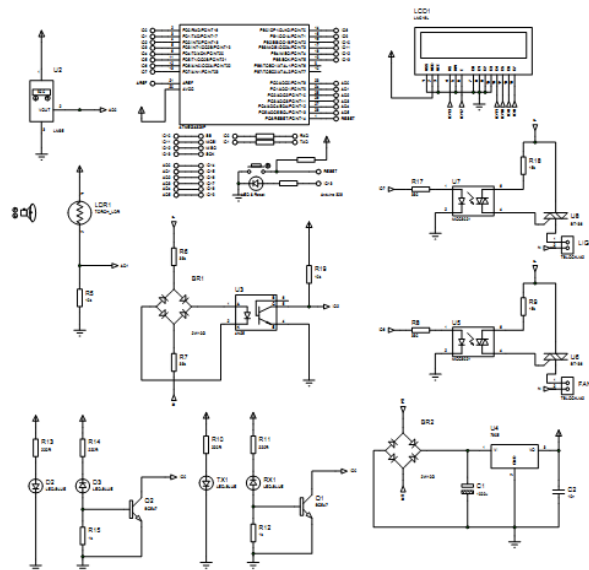


Fig. 5 Circuit Diagram

The person counter checks and counts the number of persons entering the room. This part of the circuit is implemented using two sets of IR transmitter and receiver. One set is placed at the outer side of the door and the other one is kept at the inner side of the door. When a person enters the room, he crosses the first IR firstly and second IR secondly. Reverse process occurs when anybody leaves the room. The microcontroller counts the number of persons inside the room, if it is not zero, the analog voltage output from temp sensor and LDR circuit are measured to find the temp & light. If these values are not in the required range, light intensity and fan speed are controlled accordingly using the TRIAC control circuit.

V. HARDWARE REQUIREMENTS

1. ATMEGA328
2. Temperature sensor LM35
3. LDR
4. Resistors
5. Capacitors
6. Transistors
7. IR LEDs
8. LCD
9. Rectifier IC

5.1 Description of components

5.1.1 Microcontroller ATMEGA328

The ATMEGA328 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel ATMEGA328 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.



Fig. 6 ATMEGA328

5.1.2 Temperature sensor LM35

The temperature sensor is that use substances of various physical properties with temperature variation of the sensor and let the temperature converted to electricity. These regularly change the physical properties of the main body temperature sensor is a core part of the temperature measuring instruments, and a wide variety. In accordance with the measurement method is divided into contact and non-contact two major categories, In accordance with the characteristics of sensor materials and electronic components into the thermal resistance and thermocouple. Used in this experiment is the LM35 temperature sensor. LM35 IC is used as the temperature sensor. It consists of three pins. For every 1 degree variation in the room temperature, there will be a variation of 10 mV in the output voltage of this IC. This analog signal output will be given to the microcontroller for further processing and controlling. The room temperature will be displayed in the LCD.



Fig.7 LM35 IC

5.1.3 LDR

A **photo resistor** or **light-dependent resistor (LDR)** or **photocell** is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.



Fig. 8 LDR

5.1.4 LCD

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.



Fig. 9 LCD

VI. HARDWARE AND DESIGN

Printed circuit boards, PCBs, form an essential part of any electronics equipment these days. The PCB design and layout forms an integral part of the design of the whole product, and it can be the key to the success of the product meeting its performance requirements in many instances.

ARDUINO BOARD

Arduino is a platform for developing software. The arduino board help as to check whether a program will work in that hardware or not.

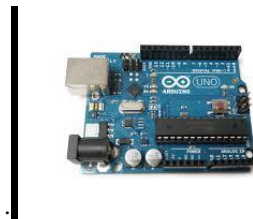


Fig. 10 ARDUINO BOARD

VII. SOFTWARE TOOLS

We used proteus software for designing the PCB and for the simulation. the required C coding was developed on ARDUINO which is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.

PROTEUS

Proteus (PROcessor for TExt Easy to USE) is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages. it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

VIII. RESULT

Following are the results that we have got here. Whenever a person enters or leaves the room, IR sensor placed near the door senses and the count is incremented or decremented accordingly. Then the light and fan will be ON. By comparing the intensity of light and the room temperature with the set value, the brightness of light and the speed of the fan is controlled. 15 W incandescent lamp is used here as the light source and 1.5 A, 6500 rpm sewing machine motor is used instead of fan.

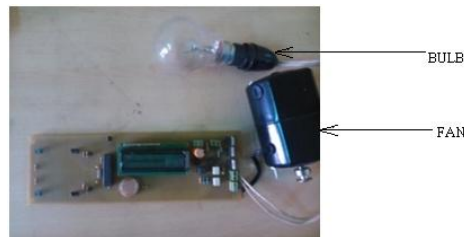


Fig. 11 HARDWARE PICTURE

IX. CONCLUSION

Studies on energy consumption have shown that it is at a stage of retardation by the involvement of government and due to advance technological growth. Such a mechanism to improve not only energy consumption but also a comfortable living can be achieved by room automation technique. Since the technologies are growing day by day there will be more advanced automation techniques which can improve current life style and can save more energy will capture our market. by doing this project we came to the conclusion that even though we have developed a small part of automation in a single room, it can be extended using more components such that it could be installed in bigger rooms. By using the internet services more development can be done.

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