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Sensor Based Control of Appliances for Energy Saving Using CPU

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ABSTRACT: In this paper, controller is designed to perform a task of controlling the room lights and fans as well as counting the number of persons in the room accurately. The total number of persons in the room is displayed on controlling device (CPU). Given a detailed description of the circuit, principle of operation of sensor based controlled of appliances for energy saving using CPU, IR(Infra Red) sensors and Micro controller. IR sensor is like our eye which detects the presence of an object and Microcontroller (ATMEGA16) to perform the task. The Main concept is, IR LED(Light Emitting Diode) transmits the IR signal on to the object and the signal is reflected back from the surface of the object. The reflected signal is received by an IR receiver. The IR receiver can be a photodiode /phototransistor or a readymade module which decodes the signal. As number of persons increases entering into the room, the count will be increases and required load will be ON. In the absence of person in the room , the lights and fans automatically goes off. The main focus in this paper is to presenting the implementation of IR based obstacle detection for energy saving in detail.

KEYWORDS: IR Sensor, Crystal Oscillator, Program Damper,Working of Designed Kit.

I. INTRODUCTION

The main purpose of this paper is to switch ON and OFF lights and fans without manual operation. By using this system, energy consumption is reduced. IR sensors and Micro controller are the main components of the design. In the present days, automatic system have less manual operation, high flexibility, high accurate, essentially used in the field of electrical automatic system.

The outline of the paper is as follows: Section 2 discusses about various components used in the design, Section 3 discusses about the working condition of the Designed Kit, Section 4 concludes the paper.

II.SYSTEM MODEL AND ITS COMPONENTS

2.1 VOLTAGE REGULATOR (7805 IC):-The 7805IC (also sometimes known as LM78O5IC) shown in the Fig.1, series of devices is a family of self-contained fixed linear voltage regulator integrated circuits. The 7805IC family is a very popular choice for many electronic circuits which require a regulated power supply, due to their ease of use and relative cheapness. When specifying individual ICs within this family, the xx is replaced with a two-digit number, which indicates the output voltage the particular device is designed to provide (for example, the 7805 has a 5-volt output, while the 7812 produces 12 volts). [1]

Fig.1 Voltage Regulator

2.2 PROGRAM DAMPER:- In system programming (ISP), also called In-Circuit Serial Programming (ICSP),shown in Fig.2, is the ability of some programmable logic devices, microcontrollers, and microcontrollers to be programmed while installed in a complete


Fig.2 Program Damper

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system, rather than requiring the chip to be programmed prior to installing it into the system.[1]

2.3 DPDT SWICH:- A switch is an electrical component that can make or break an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow. A relay is a switch that is operated by electricity. Switches are made to handle a wide range of voltages and currents; very large switches may be used to isolate high-voltage circuits in electrical substations.[2]

Fig.3 DPDT Switch

2.4 IR LED:- Here the IR transmitter is nothing but the IR LED. It just looks like a normal LED but transmits the IR signals. Since the IR rays are out of the visible range we cannot observe the rays from the transmitter. These are infrared LEDs; the light output is not visible by our eyes. They can be used as replacement LEDs for remote controls, night vision for camcorders, invisible beam sensors, etc.[6]

Fig.4 IR LED

2.5 LED:- A light-emitting diode (LED) shown in the Fig.5, is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. Appearing as practical electronic components in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.
It is determined by the energy gap of the semiconductor. LED emits no light when junction is reversed biased.[4]

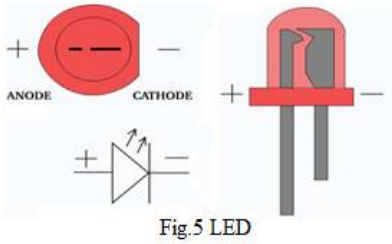

Fig.5 LED

2.6 CRYSTEL OSCILLATOR:- A quartz crystal resonator plays a vital role in electronics oscillator circuitry, shown in the Fig.6. Sometimes pronounced as crystal oscillator, it is rather a very important part of the feedback network of oscillatory circuit. Electronic oscillators are used in frequency control application finding their usage in almost every industry ranging from small chips to aerospace.[4]

A quartz crystal is the heart of such type of resonators. Their characteristics like high quality factor (Q), stability, small size and low cost make them superior over other resonators like LC circuit, turning forks, ceramic resonator etc.

Fig.6 Crystal Oscillator

2.7 DC JACK:- A DC connector (DC plug) is an electrical connector for supplying Direct Current (DC) power, shown in the Fig.7.

Compared to domestic AC power plugs and sockets, DC connectors have many more standard types that are not interchangeable. The dimensions and arrangement of DC connectors can be chosen to prevent accidental interconnection of incompatible sources and loads. Types vary from small coaxial connectors used to power portable electronic devices from AC adapters, to connectors used for automotive accessories and for battery packs in portable equipment.

Fig.7 DC Jack

2.8 RELAY:-An electric current through a conductor will produce a magnetic field at right angles to the direction of electron flow. If that conductor is wrapped into a coil shape, the magnetic field produced will be oriented along the length of the coil. The greater the current, the greater the strength of the magnetic field, all other factors being equal. [5]

Fig.8 Relay

Fig.9 Shows the block diagram of paper which contains one CPU, one RS232, Couple of Sensors, one Microcontroller, along with Relays and Transistors and loads(fans and lights).This components explained in detailed in above sub sections.

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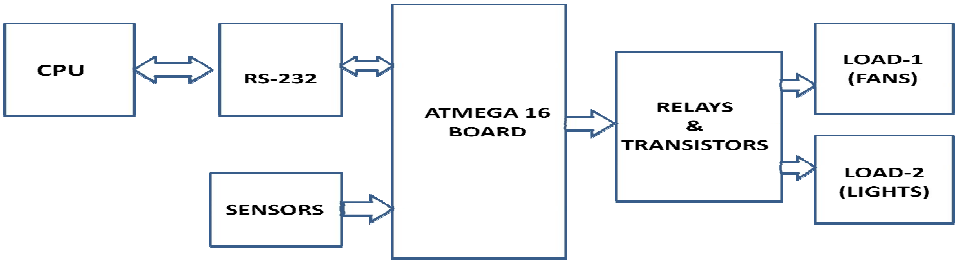

Fig.9. Block Diagram

III.INFRA RED SENSOR

The circuit shows that the output of IC1 555 IC, which is designed for a duty cycle of 0.8mSec, with a frequency of 120Hz and 300 mA peak current, is used to drive the infra red LED,D1.From the connection it is clear that the diodes D1 and D2 are on the same line, just a few centimeters apart, on the breadboard. Thus diode D2 receives the infra-red output from the diode D1.The diode signal, which is given to the inverting terminal of the op-amp IC LM 358 gets amplified and its peak is detected by diode D4 and capacitor C4.The forward voltage produced by diode D4 is compensated by diode D3 with R5 and R6.According to the distance between the infra-red transmitter and receiver, a proportional DC voltage is fed to the inverting input of IC2.According to the output of the comparator the LED is turned ON and OFF and this is detected by the transistor Q1.Thus the relay is driven according to the output of Q1.The comparator output is set according to the value of the pot.

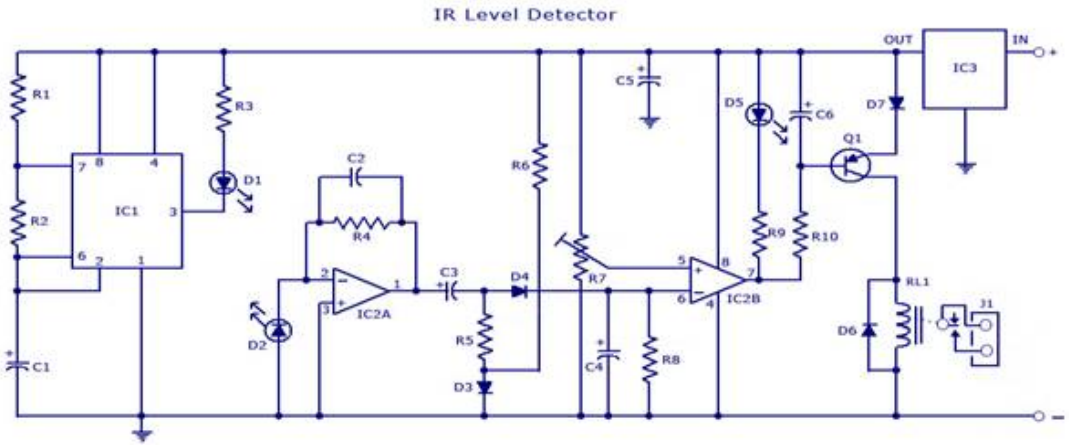

Fig.10. IR Level Detector

This circuit is mainly used for liquid level detection or proximity detection. It operates detecting the distance from the target by reflection of an infra-red beam. The biggest advantage of this circuit is that there is no physical contact with the liquid whose level is to be measured. The range is set by adjusting the pot. Range can vary depending on infra-red transmitting and receiving LEDs used and is mostly affected by the color of the reflecting surface. Black surfaces lower greatly the device's sensitivity.

Note: Use a good quality regulated power supply .The sensor diodes must not be subjected directly to other light sources.

IV.ELTIMA-SOFTWARE

We are using MIKRO C AVR for compiling the programme. MikroC PRO for AVR is a full-featured ANSI C compiler for AVR devices from Atmel. It is the best solution for developing code for AVR devices. It features intuitive

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IDE, powerful compiler with advanced SSA optimizations, lots of hardware and software libraries, and additional tools that will help you in your work. Compiler comes with comprehensive Help file and lots of ready-to-use examples designed to get you started in no time. Compiler license includes free upgrades and a product lifetime tech support, so you can rely on our help while developing.

4.1 PROGRAM STIMULATION

We are using PROTEUS ISIS for programme stimulation.

Fig.11 Software PROTEUS

The Proteus Design Suite is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB Layout modules. It is developed in Yorkshire, England by Lab centre Electronics Ltd with offices in North America and several overseas sales channels. The software runs on the Windows operating system and is available in English, French, Spanish and Chinese languages.

Proteus is a Virtual System Modeling and circuit simulation application. The suite combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs. Proteus also has the ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it. It simulates Input / Output ports, interrupts, timers, USARTs and all other peripherals present on each supported processor.

V. HARDWARE ANALYSIS

5.1 ATMEGA BOARD

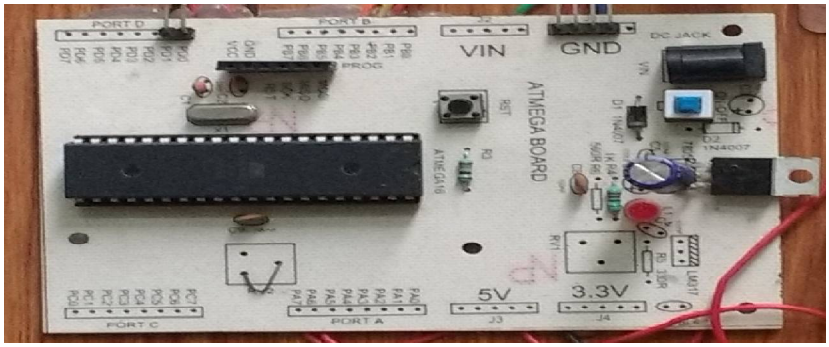

Fig. 12 ATMEGA Board

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ATMEGA board shows the basic components of kit that includes microcontroller, DC jack, capacitors, crystal oscillator, voltage regulator, resisters, led, switch, program damper and reset batten.Through the programmer damper we are damping, the required program into the microprocessor and the reset button is to reset the program. Dc jack is used to gi`ve the supply and the voltage regulator will allow maximum of 5V. LED indicates the supply ON or OFF condition and the button is used to ON and OFF the supply. Capacitors are placed for limiting frequency noise and resisters for limiting high currents.

5.2 LOAD CONTROLLER

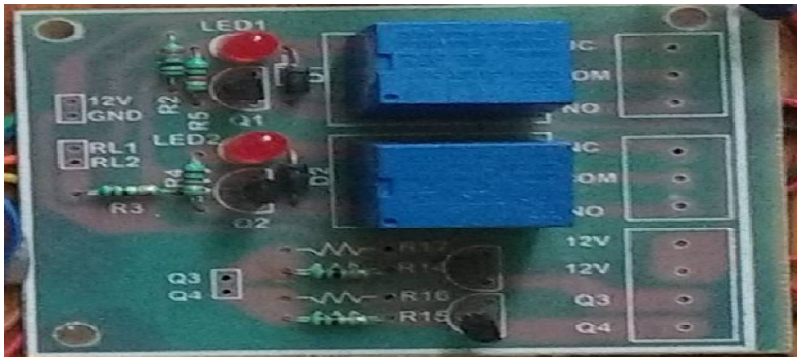

Fig. 13 Load Controller

Fig.15 shows the controlling unit of load that includes transistors, relays, LED's and resisters. For the motor loads relays are used to control the supply and transistors are used to control the light loads. A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

Transistors can be regarded as a type of switch, as can many electronic components. They are used in a variety of circuits and you will find that it is rare that a circuit built in a school Technology Department does not contain at least one transistor. They are central to electronics and there are two main types; NPN and PNP. Most circuits tend to use NPN. There are hundreds of transistors which work at different voltages but all of them fall into these two categories.

5.3 RS 232

Fig. 14 RS 232

It is a standard for serial communication transmission of data. It formally defines the signals connecting between a *DTE* (data terminal equipment*)*, such as a computer terminal, and a *DCE* (data communication equipment), such as a modem.

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5.4 INFRARED SENSOR

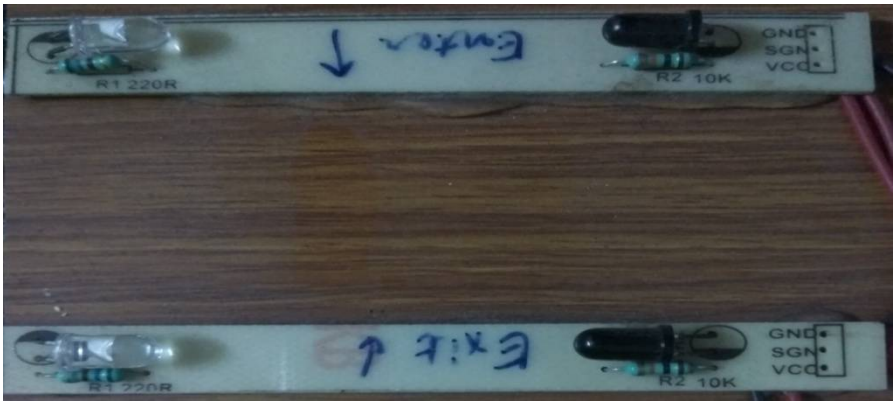
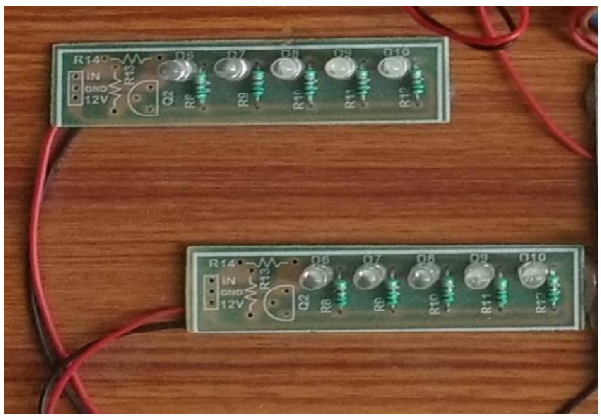


Fig.15 IR (Infra Red) Sensor

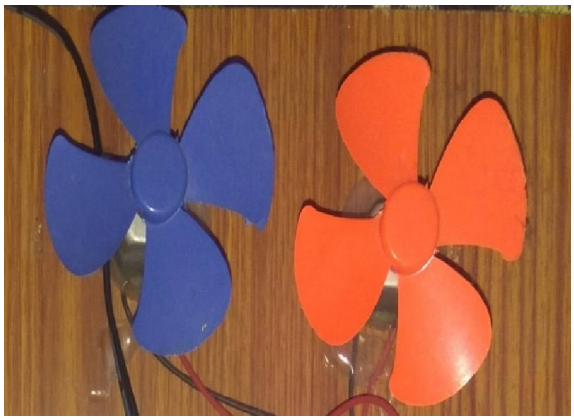
IR Transmitter: We have implemented the Person counter module using 2 transmitters and 2 receivers. We have used Infra-Red transmitters. Reason behind choosing IR LED is, infrared beams are not visible to human eyes and they are not easily triggered by other sources in the environment. Transmitters used are IR LEDs.

IR Receiver: We have used IR sensor as an Infrared receiver. It is an active low device, which means it gives low output when it receives the Infrared rays. So when the IR rays are interrupted by any person then Microcontroller will receive a high pulse from the IR receiver.

When a person enters into the room , the count shown on the CPU will be 1.As number of persons increases the count will be increases and required load will be ON as we comment on the CPU. In the absence of person in the room , the lights and fans automatically goes off.



(a) Light Load



(b) Fan Load

Fig.16 Loads

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VI. RESULT AND DISCUSSION

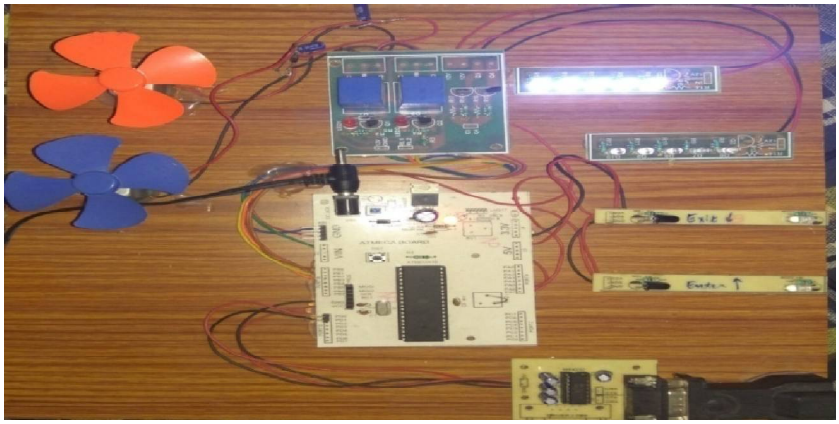

Fig.17 Light load

Fig.17 shows the light load in ON condition.When the person enters in to the room the sensor will sense it and show the count on CPU. Then user have to comment on the CPU for the light load to ON. When all the persons entered the room lease away the count on the CPU get zero and the lights load get switched OFF automatically.

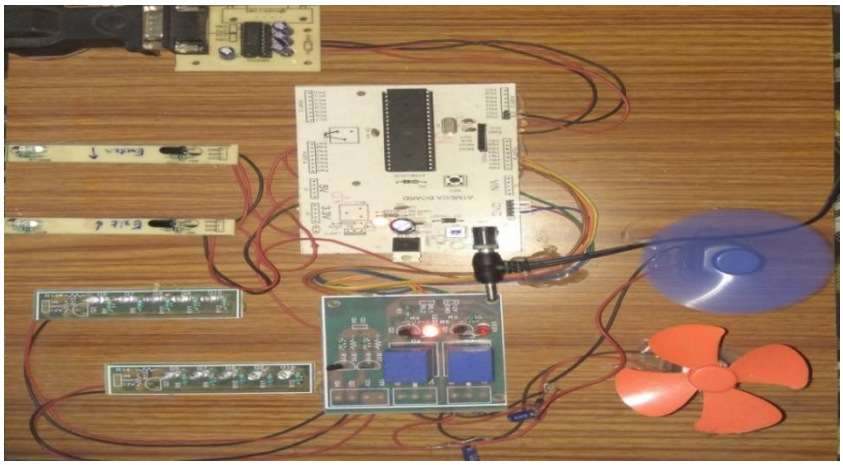

Fig.18 Fan load

Fig.18 shows the fan load in ON condition. When the person enters in to the room the sensor will sense it and show the count on CPU. Then user have to comment on the CPU for the light load to ON. When all the persons entered the room lease away the count on the CPU get zero and the fan load get switched OFF automatically.

Fig.19 shows the lights and fans load in ON condition. When the person enters in to the room the sensor will sense it and show the count on CPU. Then user have to comment on the CPU for the light load to ON. When all the persons entered the room lease away the count on the CPU get zero and the lights and fans loads get switched OFF automatically.

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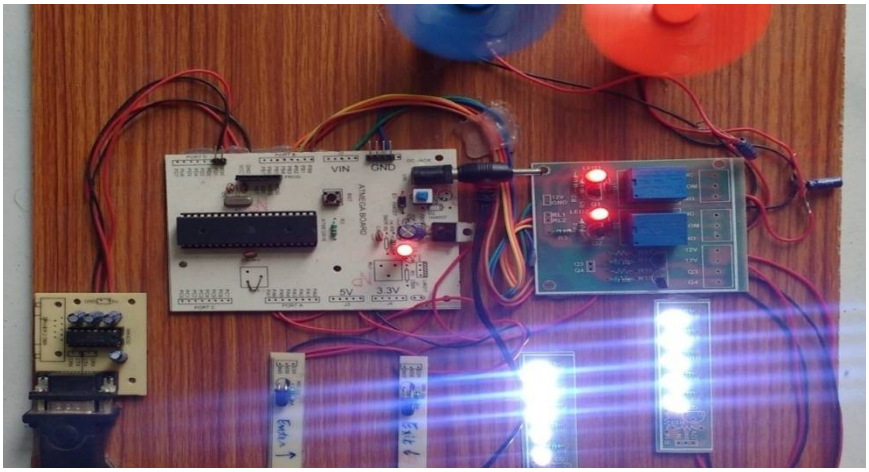

Fig 19 Both Light & Fan Loads

VII.CONCLUSION

By doing this study, we can save the energy and minimize the man power. In our study, we made use of techniques such as infrared sensor to sense any motion of the object and 8051 microcontroller . We have used a software named Eltima which can be easily understood by the user. By effectively using these techniques at different stages of our study, we are able to represent the automation in switching off of the loads which saves power.

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