Home Automation System

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***Abstract*—In recent years, the crisis of electricity has become one of the major problems in almost all the developing countries. Wastage of electricity is mainly responsible behind this crisis. The work aims at designing a system that will automatically switch on the lights and fans when it's necessary. Whenever there is shortage of light in a room it will automatically switch on the lights and switch off the lights if there is plenty amount of light available in the room. In the same way the system will automatically switch on the fans whenever the room temperature is high enough to feel uncomfortable and switch off the fans when the room temperature is in a comfortable zone. This work will minimize the waste of electricity by automatically controlling the lights and fans. This project can be implemented in every home and office environment and that will surely decrease the waste of electricity.**

***Index Terms*—Home Automation,LDR, Temperature Sensor, PIC18 microcontroller**

I. Introduction

Electronic and Electrical environment with respect to this context is any environment which consists of appliances such as fans, television sets, air conditioners, motors, heater, lighting systems, etc. We use these electronic device on a daily basis. What happens when we can't make the proper use of these devices. That makes the waste of electricity.

In recent times, there have been shortage of electricity in Bangladesh caused by mainly not doing proper use of electronic devices.We almost all the time keep our lights on during the day time and we most of the time don't switch off our fans and lights when we are leaving our apartments. These actions could have been easily prevented, if there was a system which can detect the shortage of light in a room and detect the temperature in a room and turn it on if necessary and turn off if not necessary.

A number of research papers have been published on Home Automation System. In some of them they used LDR for detecting amount of lights in a room and temperature sensor to detect the temperature of the room. then they programmed the microcontroller so that if there is insufficient light in the room it will turn on the lights and if the temperature is high in a room it will switch on the fans. Some of them also used remote control system in their projects, where the system can turn on the lights fans and all other electronic devices like aircondition, oven by just sending an SMS.In some applications the used Android based app which use Bluetooth technology to send signals to the microcontroller and the microcontroller controls all the electronic device of the house.

The design of Home Automation System is proposed for home and office environment. Because these two are the most common places where electronic devices are used widely and a system like this can be implemented to reduce the wastage of electricity.

The system mainly detects lights using LDR(Light Dependent Resistor) and temperature using temperature sensor.Then the microcontroller is programmed in such a way that it calculated the data that it receives from the sensors and take actions accordingly. Like whenever the temperature is above 23 degree celcius the system turn on the fan. Then the system continues to receive data from the sensor and whenever the temperature goes under 18 degree celcius and turn off the fan.

II. Design Methodology

In this work a sensor capable of detecting the amount of light in a room is required. And two white LED lights is used in this system. So whenever the sensor sense less light in the room the system turn on those two white LED lights to remove darkness from the room. We also need a sensor capable of detecting the temperature of the room. For that we used LM35.We also used a DC Fan in this system. So whenever the temperature sense the room temperature higher than 23 degree celcius, the system turn on the Fan. and then when it's below 18 degree celcius the system turn of the Fan.

III. System Overview

The system comprises of a PIC18 microcontroller, a LDR(Light Dependent Resistor), a LM35(temperature sensor), two white LED lights, an exhaust fan.

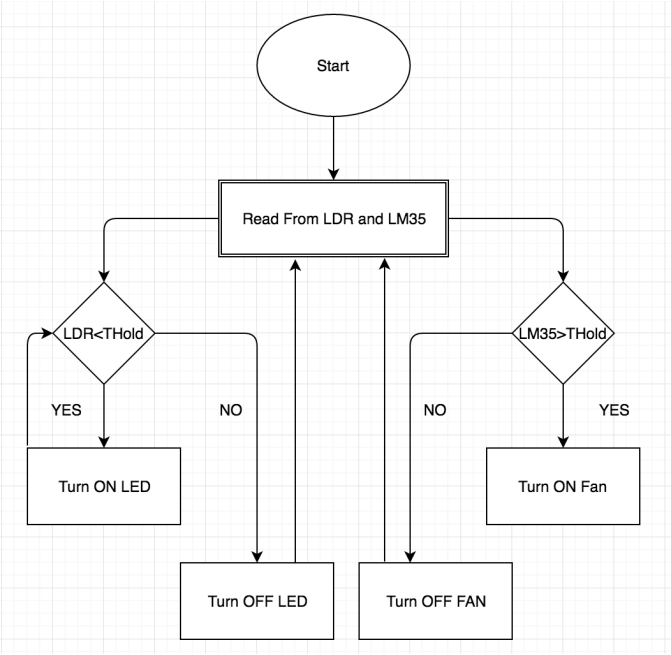

Fig. 1. System Block Diagram

A. PIC18 Microcontroller

An efficient and smooth working controller is needed to continuously sense both leakage and level of the gas. And also fast response is require when leakage found. Along with this, the monitoring system must provide additional leakage information which can be used in further processing. Here, PIC18F4550 is used as the main microcontroller. It has a 40-pin configuration. It has 32 KB Program memory and 2 KB RAM.

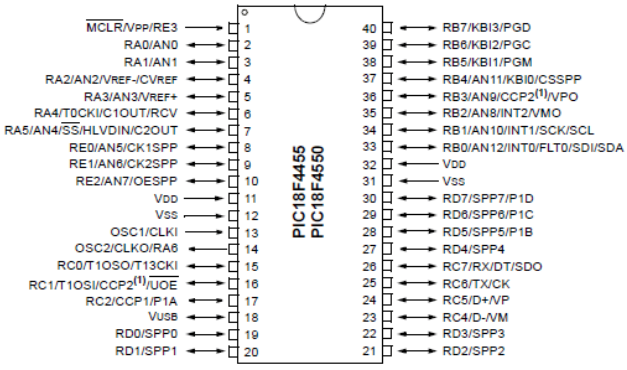

Fig. 2. PIC18F4550 Pin Diagram

It has a 10-bit ADC with 13 input channels, so it can detect 2^{10} levels. It needs 5V for operation. The ADC module five registers, of which three are control registers and two result registers. The output registers contain high and low bits. When the microcontroller gets value from gas sensor, the results are stored in those registers.

B. LDR-Light Dependent Resistor

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

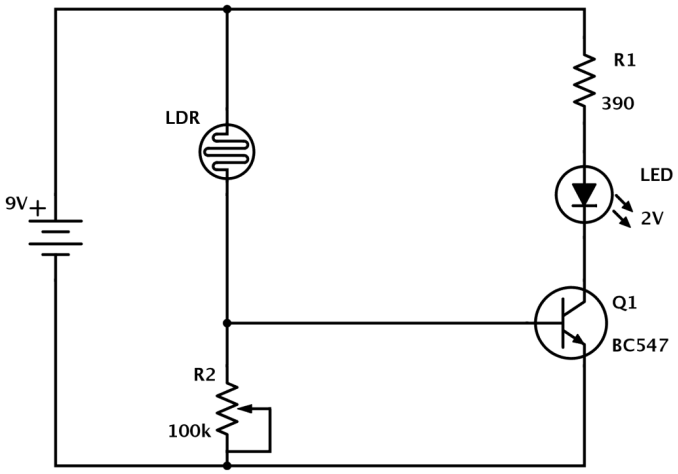

Fig. 3. LDR Diagram

A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing throgh the device when the circuit is closed and hence it is said that the resistance of the device has been decreased.

C. LM35(temperature sensor)

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of C at room temperature and C over a full 55C to 150C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy.

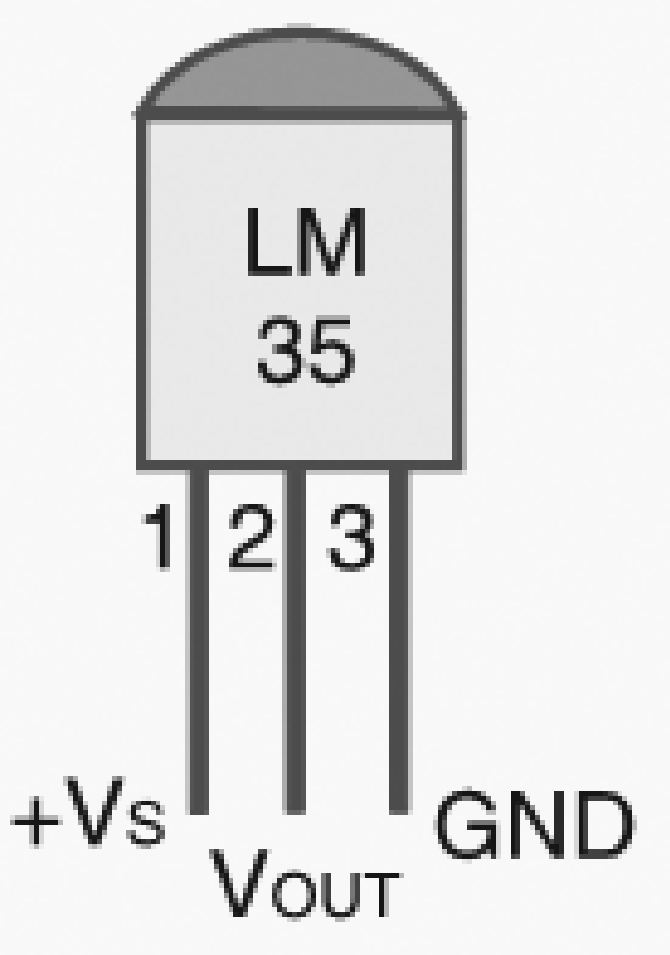

Fig. 4. LM35 Diagram

D. DC Fan

DC cooling fans use direct current (DC) electrical flows. This type of electrical flow can only move in one direction.

IV. Experimental Setup

PIC18F4550 is the base of the system. The input given to the microcontroller are the output of LDR(Light Dependent Resistor) and LM35(temperature sensor).The output of the controller are given to the two white LED lights and a DC fan. First RA0 and RA1 pin of PIC18F4550 is initialized an analog input. Then LDR and LM35 sensor is connected with RA0 and RA1 pin. The microcontroller converts those analog data received from the sensor to digital data.

The sensor data is compared with threshold value. If the threshold value is exceeded, then signal is sent to LED light, DC fan. This signal is for turning these things on. Then again if the sensor data is less then the threshold value it again send signal to LED light and DC Fan. This time the signal is for turning these off.

V. Result

Testing was carried out by creating a dark surroundings and high temperature around designed system. After power on, the sensor keeps checking in the atmosphere for possible light availability. The white LED lights and DC Fan are switched on once the sensors point exceeds or equals the set point.

While there is dark and high temperature around, the white LEDs and the fan keeps operating. After a while, when temmperature around decrease due to the use of the fan, then the fan turns off. And if the light around the system increases means there is enough light around the system then the white LEDs are turned off.

VI. Conclusion

This work solved the problem of electricity wastage. This system can be implemented in every home and office environment to reduce wastage of electricity.

It was observed that when there was totally no light in the room the white LED was fully on without blinking. But when there was little light on the system the white LED began to blink and when there was enough light around the system then the white LED turned off.On the other hand when temperature sensor is touched with hand it's temperature increased and the DC fan triggered but as PIC can not give enough voltage as output the fan sometimes does not run automatically. It had to be rotated once then it started to work. then after sometime as temperature decrease the fan turned off.

VII. Future Work

This project can be enhanced by using a motion sensor. then whenever anyone will enter into the room the light will automatically turn on if there is less light in the room. And if you just leave the room and will turn of the lights and fans for you.

Another enhancement can be made by adding IOT(internet of things) or wireless remote system. By which people would able to control their home electronics like lights, fans, by their smartphones through some Apps, even they are not at home. They can control the system being outside of the system.

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