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Sensor-Based Automatic Fan Controlling System and Power Consumption Analysis

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Abstract: Consumption of electric power efficiently is the responsibility of every citizen of our country. Energy saved is energy generated. Resources to generate electric power either are limited or have side effects. There are many devices invented to use the electric power efficiently. But there are hardly any to be used in our everyday life. Hence a system is suggested to analyse the power usage in a Gathering Hall/Auditorium by deploying a visitor counter and automatic fan control system.

Keywords: Raspberry Pi, IoT (Internet of Things), IR Sensors, Counter.

I. INTRODUCTION

In recent days the consumption of electric power is tremendously increasing. In such condition it is the usage of electric power efficiently is the responsibility of every citizen of our country. Energy saved is energy generated. Resources to generate electric power either are limited or have side effects. There are many devices invented to use the electric power efficiently. But there are hardly any to be used in our everyday life.

Hence a system is suggested to analyse the power usage in a Gathering Hall/Auditorium by deploying a visitor counter and automatic fan control system. The main goal of this project is to save the electricity from being wasted when not necessary by automatically switching ON of the appliances that are required based on the number of people present in the hall, instead of blindly switching on all the appliances and also switching them off as and when the people move out of the hall, again based on the count of people leaving the hall.

A. Raspberry Pi

The Raspberry Pi is a credit-card sized, low cost computer which plugs into a TV or the computer monitor. It uses a mouse and a standard keyboard for entering of the commands. It is a tiny device that is handy and capable which is used by people of all the ages, to learn and program in languages like Python.

The Raspberry Pi is a single circuit board that contains various ports for Power supply, USB and HDMI etc as shown in Figure 1. It also has its own SD card where the operating system can be loaded. It uses the Raspbian operating system that is flavour of Linux, an open source and also contributing to make it the low cost system. It actually functions almost similar to a computer. The Raspberry Pi infact shows a very good performance and can also be very well interfaced with the various external devices.

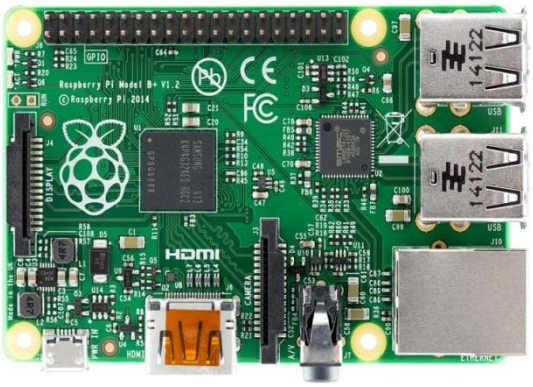

Figure 1: Raspberry Pi

B.IR sensor

An Infrared (IR) sensor is the electronic device that is used to sense the characteristics of its surroundings by emitting and/or detecting infrared radiation. An IR sensor is also capable of measuring the heat being emitted by an object and detecting the motion.

Infrared Radiations have the following characteristics:

- Invisible to human eyes
- Small energy
- Long wavelength
- Emitted from all kinds of objects

The module of an IR sensor consists of an IR LED, IR photodiode, potentiometer and a comparator. The negative input of the comparator is connected to the potentiometer which is used as threshold voltage. Reverse-Biased photodiode resistance is high and voltage at the positive input of the comparator is lower than the voltage at the negative input.

So comparator output is 0 volts (LOW). When IR rays emitted from the IR LED are reflected from an obstacle to the photodiode, then resistance of the photodiode decreases, voltage at positive input of the comparator is higher than voltage at the negative input. So comparator output is 5 volts (HIGH).

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Applications of IR sensor:

- Widely used for distance measurement purposes.
- Surface feature detection.
- Barcode decoding.
- As a tracking system.
- Obstacle detection for mining vehicle, motor vehicle.
- Autonomous cleaning robot.

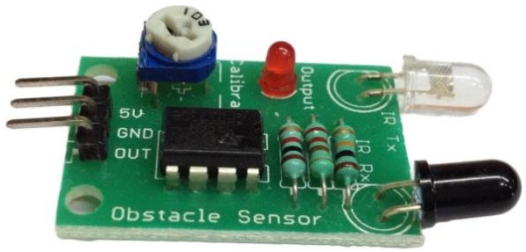

Figure 2: IR sensor

C.DC Motor

A DC motor is an electrical machine that converts direct electrical power current (DC) into mechanical power (Hence the name DC). They produce rotary motion. In this project the DC motor along with the propellers are used as the replica for the fans in the hall/room. When the counter increments, the fans switches ON or OFF one by one based on the number of people entering or leaving the hall/room.

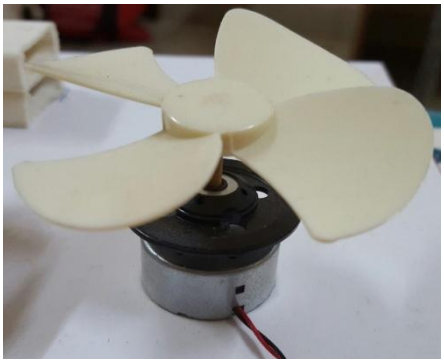

Figure 3: DC Motor

II. LITERATURE SUREY

This chapter includes all the discussions on research done prior to take up the project and understand the various methods that were used previously. A detailed analysis of the existing systems was performed. This study helped in identifying the benefits and also the drawbacks of existing systems.

In the paper [1], the author explained the concept of interfacing the IR sensors in order to obtain a bidirectional visitor counter. They have used microcontroller but in our we are not using the microcontroller, instead we use raspberryPi.

In the next paper [2], the authors used the same thing for implementation of a visitor counter in addition to it they designed an automatic system for a hall/room where the lights turn on as soon as the counter is incremented and it is turned off when there is no one in the hall/room. They also used a microcontroller.

In the paper [3], the authors used the zigbee technology. Zigbee is a low-power, low-cost, wireless mesh networking. They used the concept of both IR sensors and PIR sensors. Based on the number of people present in the room plus the temperature and light intensity of the room shown by the PIR sensors the lights and fans are automatically switched ON and OFF. In our project we try to implement the same thing using a new and more convenient technology i.e. RaspberryPi.

In the paper [4], the author have made use of the new and more convenient technology i.e. RaspberryPi. They designed a home automation system that provides the user with remote control of the various appliances and lights within their home. This system was designed for a smaller scale usage like home. It was not counter based as such.

From the above survey, it reveals the various technologies being used by each of them. The technology we are using in our project is new and more convenient, the RaspberryPi. We use a counter based automated system to automatically switch ON the fans based on the number of people entering the hall/room, and also automatically switching OFF the fans as and when the people leave the room/hall.

III. PROBLEM DEFINITION AND OBJECTIVE

A. Problem Definition:

Sensor-Based automatic fan controlling system and Power consumption analysis.

Automatic turning ON and OFF of fans based on the number of people present in the Hall. A graph that shows the live usage of the fans in the hall. A report that shows how much power is consumed each day in terms of wattage used.

B. Objective:

The Project Objective is to analyse and save the unnecessary wastage of electrical power by developing a system which will control the turning ON and OFF of AC's/Fans automatically based on number of people present in the Hall/room.

C. System Design:

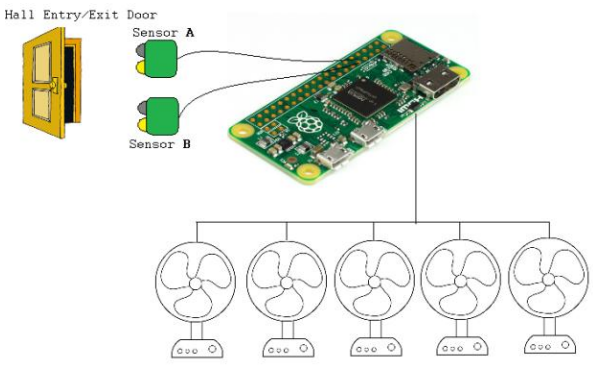

Figure 4: Architecture diagram.

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The description of the architecture design as shown in the Figure 5.1 as follows:

- The pair of IR sensors interfaced, senses the obstacle passing through them (in or out of the room) and gives the signals to the Raspberry pi.The sensors data are sent serially to the Raspberry Pi.
- Raspberry Pi keeps a count of people present inside the hall by incrementing and decrementing the counter according to the signals sent by the IR sensors (people entering and leaving the hall/room).The Raspberry pi continuously monitors the IR sensors.
- When the people enter the hall and count is incremented, the Raspberry pi switches ON the required number of fans by passing 5 volts to each of them. Likewise when people leave the hall and count is decremented, the fans not required are switched OFF.
- The Raspberry Pi monitors and collects the data and sends it to the master node.
- Master node keeps on monitoring the IR receivers. If the patient's observed data is above or below the specified threshold values of the blood pressure and heartbeat then collect the current location of the patient through the GPS technology used in the Android phone and then send the SMS to the preconfigured relatives numbers and as well as to the doctor.
- It continuously transmits the parameters information to a Master node through wireless network.
- Master node plots the graph that shows the current live usage of the fans in the hall, showing how many fans are ON at that time. Also the total power consumption of each day is stored in the database and is shown in the report generated in the form of wattage used.

After fetching the values counter is updated likewise. Based on the counter value the required number of fans are switched on by passing 5 volts to each DC motor connected.

IV. RESULTS

The code is written in the editor and then saved. It is then executed using the python command followed by its filename with '.py' extension. Sudo command is used to execute the code using the super user mode.

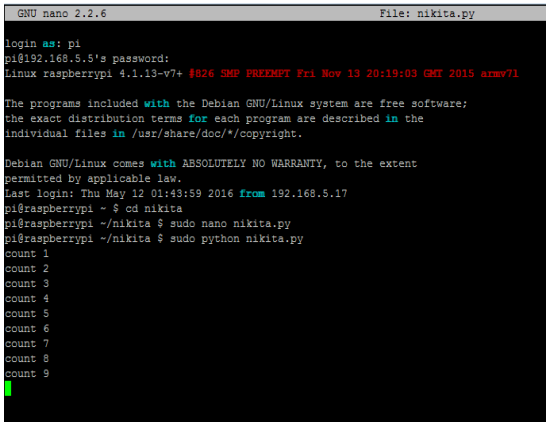

Figure 5: Execution of main file.

In the above snapshot, the Raspberry Pi is logged in by using the user name and password. After successfully login to Raspberry Pi execute the main file 'sudo python project.py'. This will execute the code 'project.py'.

Figure 6: Graph plotted (Live usage).

This Snapshot shows the page that appears when the 'Display Live Usage' button is clicked on the main page of master node (Power consumption Analysis). This is the graph that shows the live usage of the fans in the hall. It shows how many fans are actually ON in the classroom/hall.

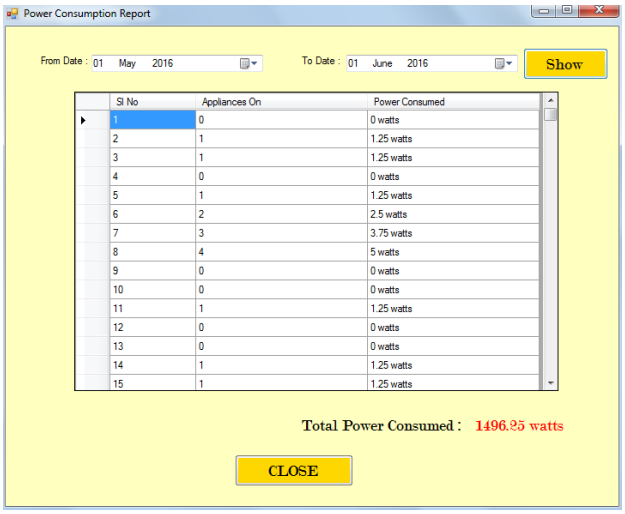

Figure 7: Power Consumption Report.

This Snapshot shows the page that appears when the 'Power Consumption Report' button is clicked on the main page of master node (Power consumption Analysis). It gives the electric power consumption report for each day in terms of wattage used. We can also give the particular dates and check the power consumption during that particular period.

CONCLUSION

Humans make mistakes and forget to switch the fans OFF while leaving the halls, class rooms or any other place for that matter. This system will control the electric power usage by automatic switching ON and OFF of the fans based on the number of people present in the hall/room, eliminating the unnecessary wastage of power. It will also analyse the power consumption pattern with automated

system and generate the live usage reports on power consumption showing how many fans are ON right then. It will also show the electric power consumption report for each day and saving in terms of wattage used.

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BIOGRAPHIES

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