

## 1 Intro

## 2 Objectives

The fundamental objective of this project is to gain a more comprehensible knowledge about real-time applications of several electronic components along with a few sensing devices and also to acquire proper idea about interfacing a micro-controller with various electronic components.

Specific objectives of our project are as follows:

1. Automatic Light Switching based on Visitor Count

To switch the lights of a room off by counting the number of people in the room. If the visitors in a room are 0, the system will switch off the lights after a minimum time period has elapsed.

2. Home Security System

This includes detection and hopefully prevention of possible fire accidents. Detect leakage of LPG gas and notify the user in his/her cell via. mobile networking.

3. Automated Trash bin

Design a system such that whenever a motion is detected within the range of the sensor it opens the lid of the trash can automatically and the lid remains open as long as the sensor detects motion.

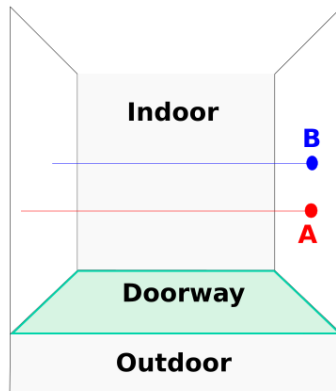
### 3 Method and Materials

Block-diagram of the proposed system:

As seen in the block diagram the micro-controller will be the heart of the system.

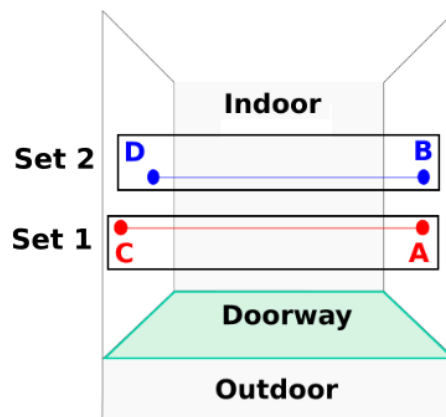
The main component used for automatic light switching is Ultrasonic Sensor. The ultrasonic sensor is used to reckon the number of person entering and exiting a room and determine the number of visitors.

The fundamental principle behind people counter is that two separate US sensors are placed at the front and rear of the doorway such that one sensor is proximal to the indoor and the other is proximal to the outdoor as show in the following diagram:



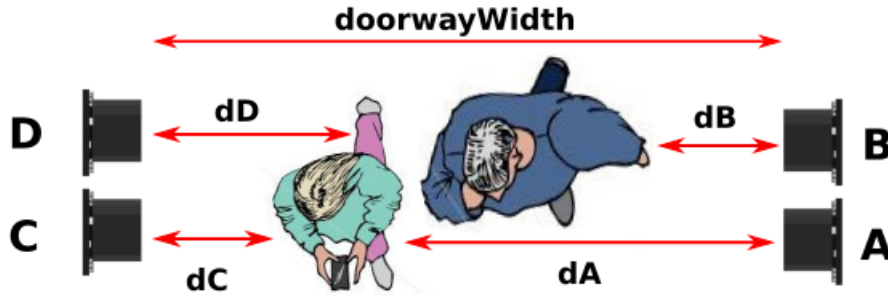
Suppose a sensor A, is placed at the front and another sensor B is placed at the rear of the door the entry door and sensor B, is inside the entry door. So, when a person enters the room, sensor A gets triggered first and then sensor B get triggered sensor. As a result, the time at which the transmitted signal reflects back will be less for sensor and it implies that a person just entered the room. Conversely, when a person leaves the room, sensor B gets triggered first, and sensor A gets triggered second which implies that a person just left the room.

One major flaw of this system is that even if more than one people enter a room simultaneously the sensors are only able to interpret them as a single person. So in order to overcome this limitation, we use four ultrasonic sensors in sets of 2 instead of just 2 sensors. Here is a schematic representation of this arrangement:



As illustrated earlier, set 1 will be placed at front of the doorway and set 2 will be placed at the rear end of the doorway to determine whether a person is exiting or entering. Nonetheless, each set of sensors will have the same horizontal alignment as shown above.

One major advantage of using 4 sensors instead of only two is that it allows the system to estimate the number of people entering the room. The logic behind this is fairly simple. First we calculate an approximate width of the obstacle in the doorway as follows:



The width of the obstacle can now be calculated as

$$\text{obstacleWidth} = \text{doorwayWidth} - (\min(dA, dC) + \min(dB, dD));$$

Finally, this obstacle width can be compared with a standard value to predict the possible number of people walking past the doorway. Using four sensors will not only help to estimate the number of people simultaneously entering or leaving the room, it also helps to improve accuracy in the sense that the width of the doorway won't be much large so sensors from both sets may get triggered at the exact same time. In cases as such, count may get misinterpreted so having an extra sensor will help to reduce or completely eliminate such errors. This may prove to be of great assistance in achieving a significant improvement in accuracy than using only two sensors.

### 3.1 Home Security System

### 3.2 Automatic Trash Can