

# Occupancy and Vacancy Monitoring Technique for Energy-Potent Smart Building Using IoT

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**Abstract:** The paper aims to monitor the Occupancy and Vacancy of people to avoid the wastage of power consumption in large commercial buildings using Atmega 328 Arduino microcontroller and various sensors based on IoT. PIR sensors are sensed to motion, almost always used to detect whether a human has moved in or out of the sensors range. An Infrared (IR) sensor is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation.

**Keywords:** IoT, RFID, IR sensor, PIR sensor, Arduino

## 1. Introduction

The Internet of Things (IoT), is referred as the connection of devices to the Internet. Not only devices Cars, kitchen appliances, and even heart monitors can also be connected through the IoT. The Internet of Things grows heavily in the next few years, so more devices will join that list.

With the rapid increase in the number of Internet of Things (IoT) devices such as smart phones, sensors, cameras, and RFIDs, it is possible to collect exceptionally large amount of data for localization and tracking of people within large commercial buildings.

By enabling such occupancy and vacancy monitoring capabilities, there are extensive opportunities for improving the energy consumption of large buildings and also to avoid the wastage of power in buildings.

## 2. Existing System

Previously remotes are used to control the system, it means that we have to operate the remotes to switch on and off the lights in the room based on occupancy and vacancy.

### Drawbacks

- Long procedure -It means, for switching ON and OFF purpose one has to go and on and off the switch.
- Time consuming procedure-As one has to initiate the process, it is a time consuming procedure.
- Man power required-person has to switch on and off the light

## 3. Proposed System

In this project, for the occupancy collection of data, IR sensors are used for the detection of existence of the persons and it will count the people in the buildings entering. At the exit also the sensor is used to reduce the count as they are out of the building. The sensor is IR pair, Infra-Red made of LED and A Photo Transistor This enhances the occupancy data in the buildings, leading to the smart buildings. This data will be displayed on the Phone as well the computer

using IOT module. The occupancy will be displayed on the LCD. LCD 16\*2 is interfaced to the controller used. The Buzzer is also connected to the Microcontroller, so that the alert will be issued to the security people. The IOT module is interfaced to the controller to send the information of occupancy and vacancy to the concern person or the authorities of the smart buildings. This project output can be checked at the Android mobile phone or in the computer. This project uses the voltage according to the controller used here.

## 4. Block Diagram

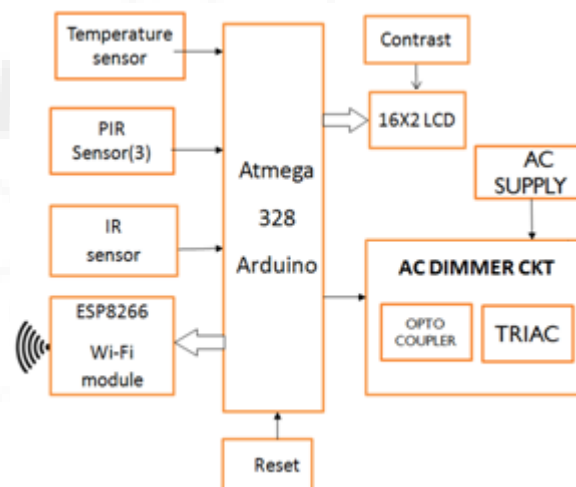


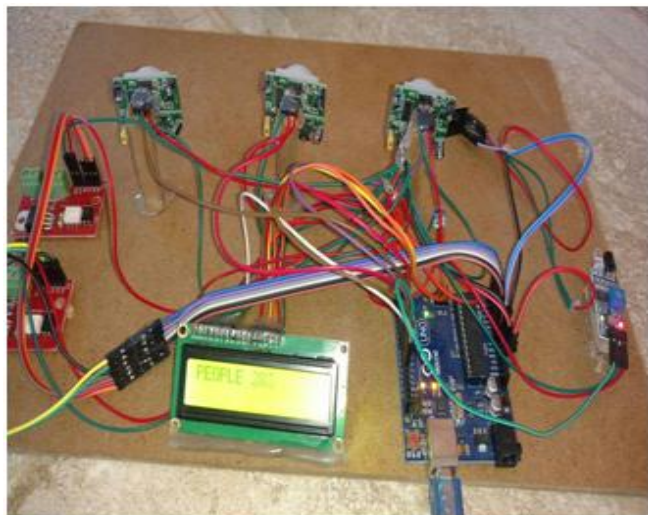
Figure 1: Block Diagram

The PIR acts as a digital output so all you need to do is listening for the pin to flip high or low. The motion can be detected by checking for a high signal on a single I/O pin. Once the sensor warms up the output will remain low until there is motion, at which time the output will swing high for a couple of seconds, then return low. If motion continues the output will cycle in this manner until the sensors line of sight of still again. The PIR sensor needs a warm-up time with a specific end goal to capacity fittingly.

## 5. Experimental Results

### 5.1 Step-Wise Kit Explanation

The purpose of our project is to count the occupancy in the smart buildings. If anyone enters into the room the IR sensor counts the number of persons enters into the room and result will be displayed on the LCD screen.



**Figure 2:** Plant set-up

First, the IR sensor counts the number of persons entered into the room and displays on the LCD display.

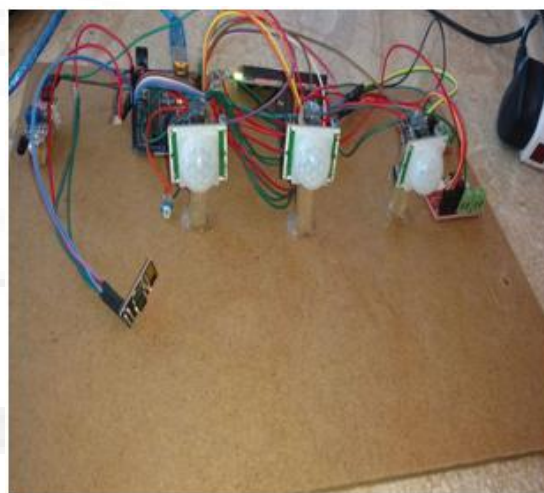


**Figure 3:** IR Sensor



**Figure 4:** Count Displayed Through IR Sensor

And then the PIR sensor will senses the body of the motion and the information from both PIR and IR will sends to the microcontroller.



**Figure 5:** PIR sensors

In this project, we are placing three PIR sensors because its sensing range is upto 16 meters long and 180 degrees.



**Figure 6:** Arduino Board

This MCU sends the information to the AC dimmer circuit, it consisting of opto coupler and traic.





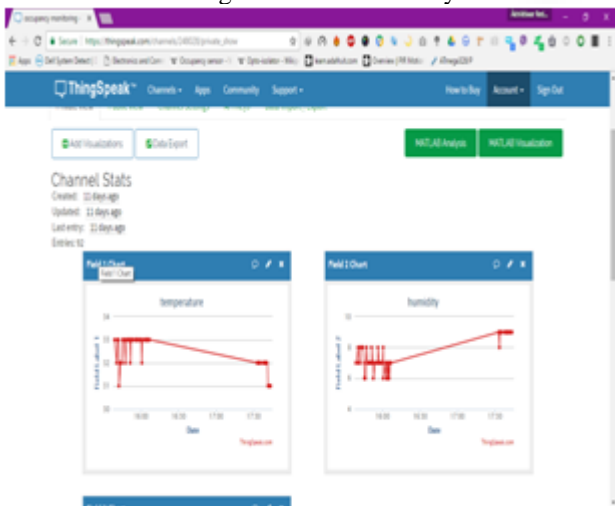
**Figure 7: AC Dimmer Circuit**

The opto coupler couples the light signals and is used to dim and dark the brightness of the light.



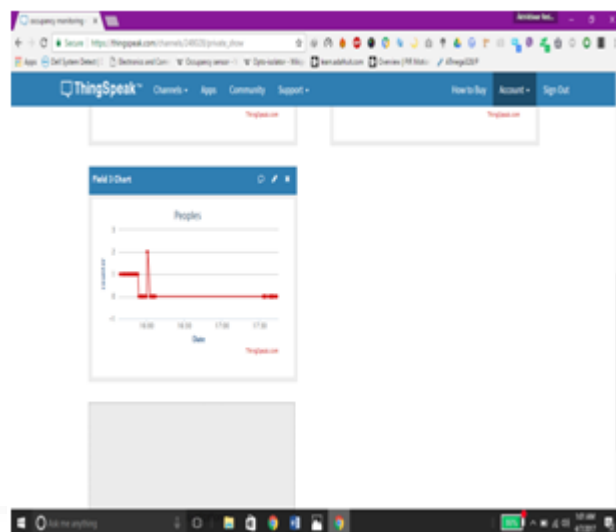
**Figure 8: Wi-Fi Module**

As this project is an IoT, we link the whole process with certain internet through Wi-Fi module only.



**Figure 9: Temperature and Humidity Shown In Internet**

The temperature and humidity in particular room is shown in the internet and it is seen in all over the world.



**Figure 10: Occupancy Shown in the Internet**

## 6. Advantages

- Counting
- Occupancy detection
- Highly reliable
- Fit and forget system
- Reduces the man power
- Power usage is up to our requirement

## 7. Applications

- Shopping complexes
- Malls
- Colleges
- IT industries
- Office appliances

## 8. Conclusion

In this paper, we surveyed and analyzed the existing efforts for occupancy monitoring in smart buildings for energy-efficiency purposes. Specifically, we first identified the problem types that are related to people occupancy. Finally, we investigated the current efforts where IoT comes into picture with the involvement of smart phones, motion sensors and Wi-Fi APs. We concluded the paper by identifying major future trends in this emerging area.

## 9. Future Scope

Right now we have implemented the idea for Building parameter and occupancy & vacancy monitoring through IOT. Therefore the system is limited to the parameter and occupancy monitoring. But in future we intend to extend for security, automation.

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