Design and Development of IOT based Low Power Consumption in Employee Meeting Rooms

Ammar Yasir Hamood Al Rawahi[a], Shaik Mazhar Hussain[a], Anilloy Frank[a]

In this paper, We design and implement IOT based low power system that can be used in employee meeting rooms. The design is based on number of employees entering and leaving the room and automates room AC, lights and room freshners using relay device. The system designed counts number of employees entering the room using IR device and updates the number using counter and automates electrical appliances of the room and when leaving automatically switches off the devices. The power consumed is updated using ESP 8266 in the cloud called thing speak where the data can be evaluated and analyzed per day and per month. The system has 20*4 LCD which displays the complete details of the employees and electrical appliances. The working of the system starts with the entering of an employee in the room, the buzzer beeps and LED turns on. Arduino Mega is used as a central processor that controls all the appliances. The code is written in C and simulation is done using Proteus ISIS. Finally, the implemented system shows the energy consumption per day and per month and a detailed comparative analysis is done with and without connecting the system which shows a better saving of energy in the employee room. The methodology adapted for our work is V-methodology.

Keywords: ESP8266, 20*4 LCD, LED, Arduino Mega, IR device.

Introduction

This section briefs about proposed work, state of the art, objectives, background, limitations and overview of the work. The idea of the proposed work is to utilize power consumption as effective as possible. The proposed work assumes 12 persons entering and exit the room and 3 electronic appliances are placed for testing purpose. The room is automated for 12 persons only. LCD is for displaying the number of employees entering and exiting the room. Arduino is used for processing and controlling the slave devices. The entry and exit of the employees is detected by IR sensors. The turning ON and OFF of room appliances is automated depending on the number of employees entering and exiting the room. Hence, power can be consumed. Power analysis information is sent to the cloud. Hence proper techniques need to develop to avoid energy wastage. One of the best techniques to save energy is to automate the appliances as compared to manually control the appliances. IOT is one of the methods to save energy and automate the appliances

The objectives of the proposed work includes the following:

- Number of employees entering and exiting the room and the information is displayed on LCD

- Automating appliances using relay.

- Power consumption information is sent to cloud database using ESP8266/12E.

Below section includes the following. Methodology, Literature review, System Design and Analysis, Simulation, Testing and Implementation, Conclusions and Recommendations.

Methodology

Several methodologies have been adopted in the literature such as agile methodology, Scrum Methodology, Waterfall, and V-methodology. This section discusses about the methodology used in the proposed work

V-Methodology

It's a kind of graphical representation methodology. The steps taken in this methodology will be summarized. This methods follows step by step sequence. Results are produced at the end of every level. This methodology is also called as verification and validation model. It's a modified version of waterfall methodology. Each level is verified .In this model, testing implies the examination and surveys of the stage expectations. It causes the group to distinguish the blunders in the life-cycle of the venture improvement and limits the potential deformities in the equipment and programming .There is a comparing test plan for each period of advancement cycle for example each stage is being chipped away at and its testing exercises are arranged that would be utilized later. For each stage, expected expectations of the item are arranged by building up the test designs alongside characterizing the passage and leave criteria of the level .The test exercises of the model are arranged with same subtleties as the structure exercises. On the left half of V, the venture is planned and on the correct side of the V, the task is tried while the correspondence between the two sides is appeared by the lines over the center.

Phases of V-Model

There are several phases of V-model. V-Model is basically divided into two types of phases i.e. verification and validation phases.
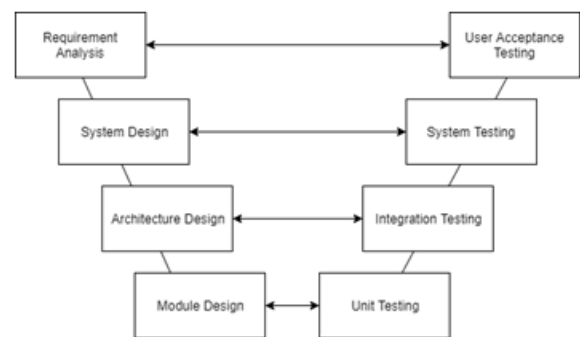

Figure 1. Phases of V-Model (Periyasamy 2019)

The phases of V-model includes Requirement Analysis phase, System Design, Architecture Design, Module Design, User Acceptance, System Testing, Integration Testing, Unit Testing.

Literature Review

This chapter summarizes all the work related to the project that has been proposed and implemented earlier. As mentioned by (Jewel, Islam, & Hasan, 2017) the point of this venture is to spare electrical vitality that is being squandered because of us in comprehension. Since the vast majority of the electrical vitality is squandered by leaving the fans, ACs and lights turned on pointlessly, this task proposes a computerized framework that will proficiently utilize capacity to turn on and off electrical machines in homes. The room

machines would possibly be turned on when somebody goes into the room and when there is nobody inside the room, the fans and lights would consequently be killed. A counter is utilized to tally the quantity of individuals going into and leaving the room. In this venture, Arduino board is utilized as an ace controller, while individual counter is created by utilizing two laser diodes and two photograph diodes. This venture improves the security framework and lessen the abuse of power. Since the venture utilizes photodiodes that are less productive than IR sensors so in future, IR sensors can be utilized to improve the proficiency. (Jewel, Islam, & Hasan, 2017) Block graph of the framework is demonstrated as follows.
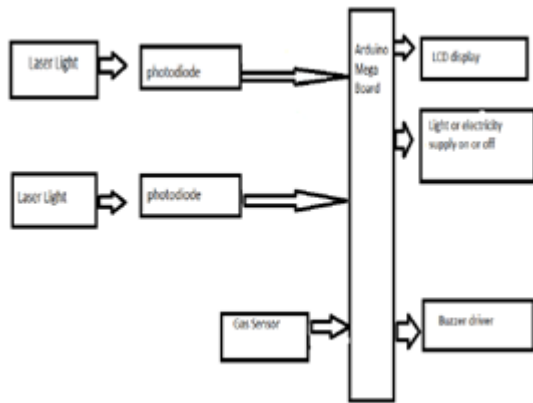
Figure 2. (Jewel, Islam, & Hasan, 2017)

As mentioned in (Chattoraj and Chakraborty 2016), venture includes including the quantity of guests in amphitheater corridor, shopping center, office, sports setting or whatever other room, where it is set. The framework is for the most part intended to meet the developing need of robotized apparatuses with the goal that multifaceted nature of life can be improved. The quantity of clients' entrances and existing is checked by the interference of joined sensors. It likewise shows the guest rely on LCD. Tallying is a tedious procedure and it tends to be troublesome if the group inside the corridor is gigantic in number. The task is very conservative just as efficient as well. It likewise controls the lights of the room naturally when individuals goes into or leaves the room. It amplifies the adequacy, effectiveness and deals capability of the association. Arduino board is utilized as an ace controller and IR sensor module is utilized to recognize the section and exit of an individual. In any case, the task doesn't use IoT to transfer the power utilization information of room lights on the server and room lights can't be checked remotely (Chattoraj and Chakraborty 2016).stem is demonstrated as follows.
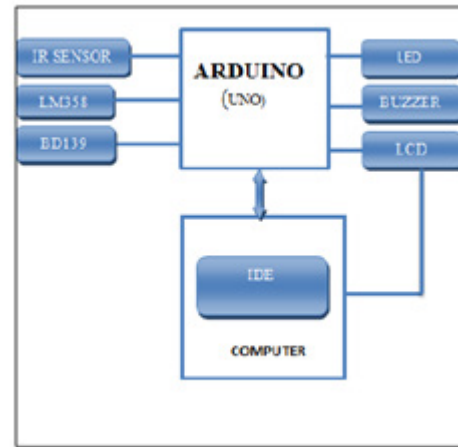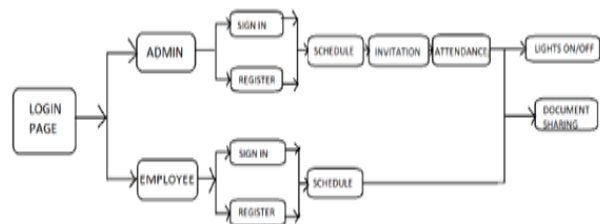
Figure 3. (Subhankar Chattoraj*, 2016)

As mentioned in (Chattoraj and Chakraborty 2016), venture includes including the quantity of guests in amphitheater corridor, shopping center, office, sports setting or whatever other room, where it is set. The framework is for the most part intended to meet the developing need of robotized apparatuses with the goal that multifaceted nature of life can be improved. The quantity of clients' entrances and existing is checked by the interference of joined sensors. It likewise shows the guest rely on LCD. Tallying is a tedious procedure and it tends to be troublesome if the group inside the corridor is gigantic in number. The task is very conservative just as efficient as well. It likewise controls the lights of the room naturally when individuals goes into or leaves the room. It amplifies the adequacy, effectiveness and deals capability of the association. Arduino board is utilized as an ace controller and IR sensor module is utilized to recognize the section and exit of an individual. In any case, the task doesn't use IoT to transfer the power utilization information of room lights on the server and room lights can't be checked remotely (Chattoraj and Chakraborty 2016).stem is demonstrated as follows.

Figure 4. (Joshi, Ashwini, Saloni, & Gayatri, 2018)

(Sfikas, Akasiadis, & Spyrou, 2016), A framework proposes in which an ordinary gathering room is changed into a keen gathering room. The SYNAISTHIST stage is utilized to interconnect gadgets and benefits and give the vital framework. Different preparing, inciting and detecting modules are being created and conveyed in the venture. The gathering room is being checked remotely and choices are being taken consequently and physically to control all the room apparatuses like room lights, radiators, ACs and projector. There are a few issues with the task, for example, to commotion because of which, some off-base choices were taken. There is a need of more s-type administrations and room reservation application. (Sfikas, Akasiadis, & Spyrou, 2016).
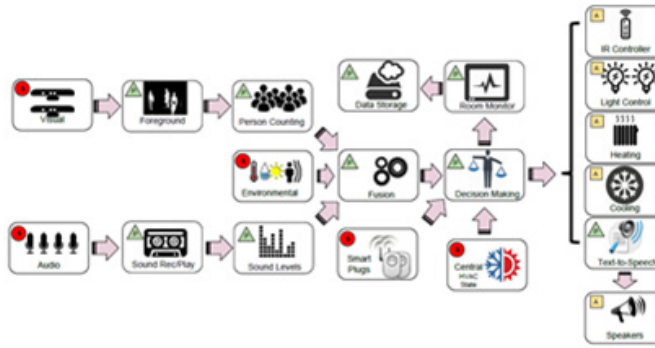
Figure 5. (Sfikas, Akasiadis, & Spyrou, 2016)

As referenced in (Ekansh and Gupta 2018), a brilliant participation observing and tallying framework dependent on IoT. A counter is utilized to include the items in workplaces, homeroom, ventures, assembly hall, shopping centers and so on. It has gotten important to use control adequately either in a shopping center or an industrial facility. It is very easy to understand and it has diminished all the administrative work required for participation. In any case, the framework utilizes IR sensors that are less successful when contrasted with ultrasonic sensors.
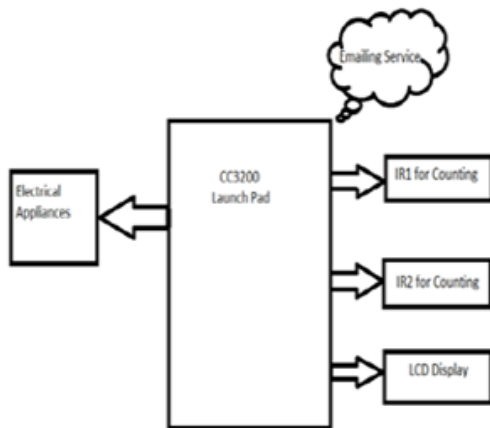
Figure 6. (Ekansh Gupta, 2018)

Design and Analysis
This section briefs about the block diagram, flowchart and schematic diagram. In addition, the schematic diagram is analysed and equated.

System Block Diagram

The system block diagram is shown below. It includes Electrical appliances, Launch pad-CC3200, Infrared sensors for counting and LCD to display the information. Three electrical appliances are considered. AC's, Bulbs and room freshners. Total of 12 persons are considered for entering and exit. IR1 and IR2 for counting number of employees entering and exit. LCD display to display the information. The power consumption is analysed and sent to think speak.
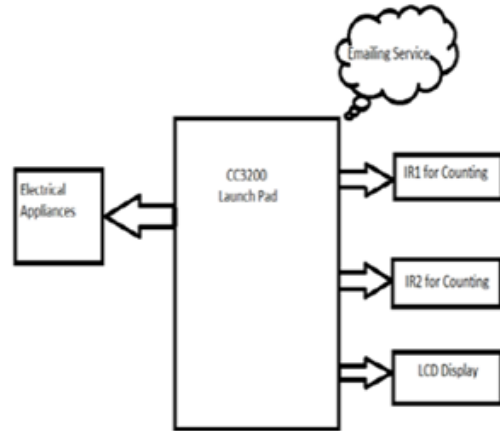

Figure 7. Block diagram

System Flow chart

Below figure shows the complete flow of the proposed work

Figure 8. Proposed flowchart

Schematic Diagram

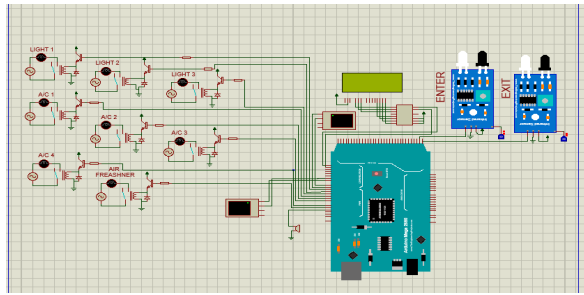Figure 9 shows the implemented idea with bulbs, room freshners, IR sensors, arduino, motors etc.

Figure 9. Schematic Circuit

IR sensors are placed to detect number of persons entering and exiting the room based on which the electrical appliances will become ON and OFF.

Simulation, Testing and Implementation

This section explains about the project simulation in ISIS proteus. Simulation results and explained. Accuracy and precision are explained. Testing procedures are also explained. Proteus ISIS is used to perform hardware project simulation. Below figures shows the simulation under ideal condition
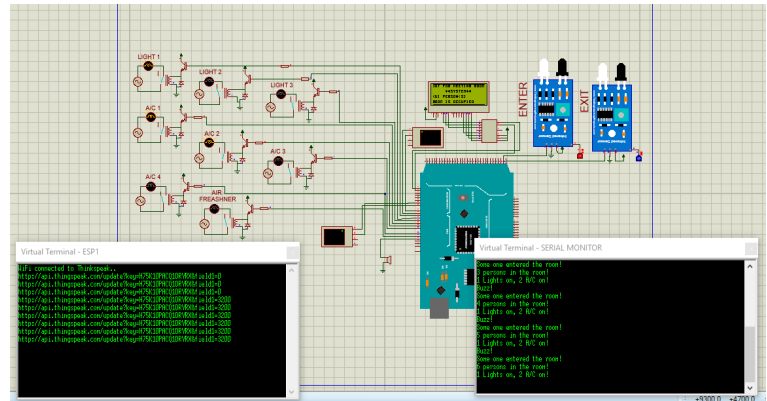

Figure 10. Simulation of the project when it is turned off

Figure 11. Simulation of project when there is no one in the room

Figure below shows the simulation screen shot with 1 light and 2 AC's working. For 6 persons, 1 light and 2 AC's are on. The data is transmitted to the think speak cloud using ESP 8266.

Figure 12. Screenshot of the simulation when there are maximum 6 persons in the room

Figure below shows hardware screenshot with 3 Lights turned ON, 4 AC's and room freshner is also working with 12 persons inside the room. Through Wi-Fi, the information is transmitted to think speak cloud server.
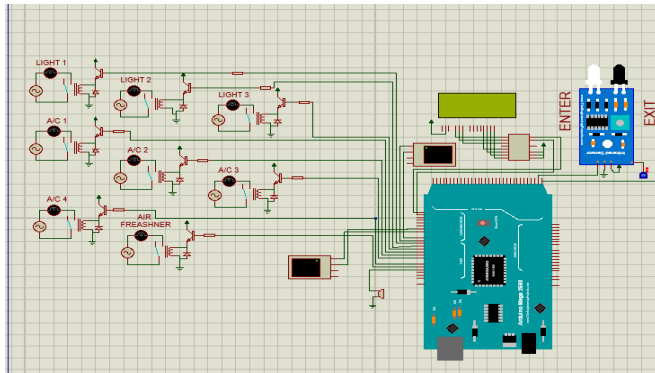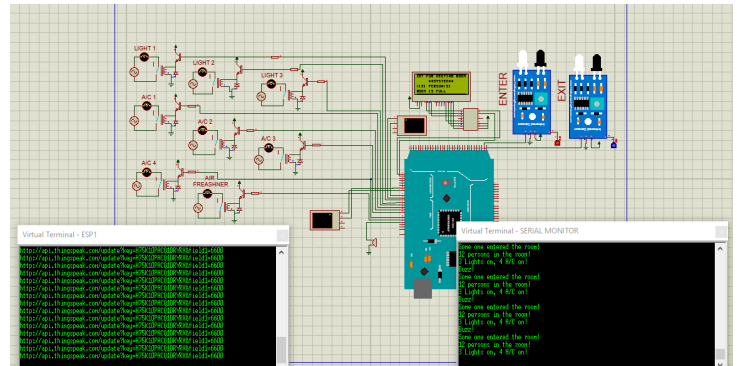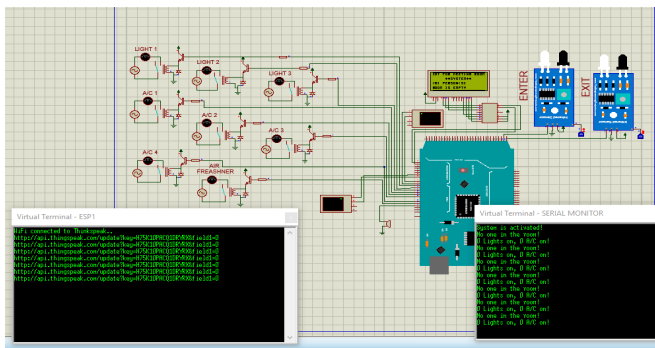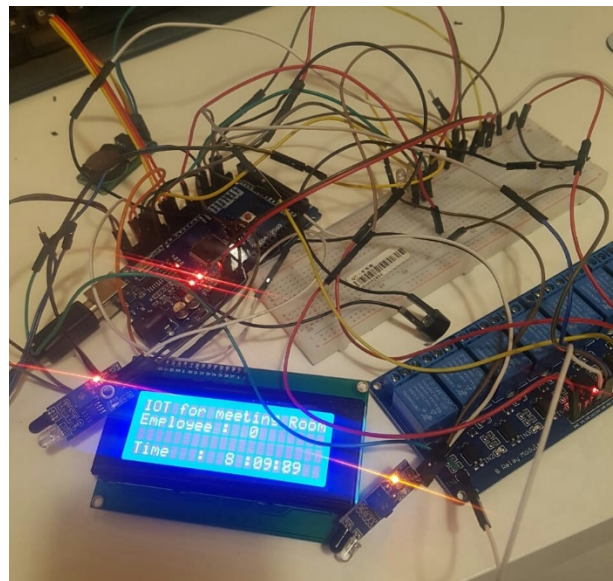

Figure 13. 12 Employees in the room
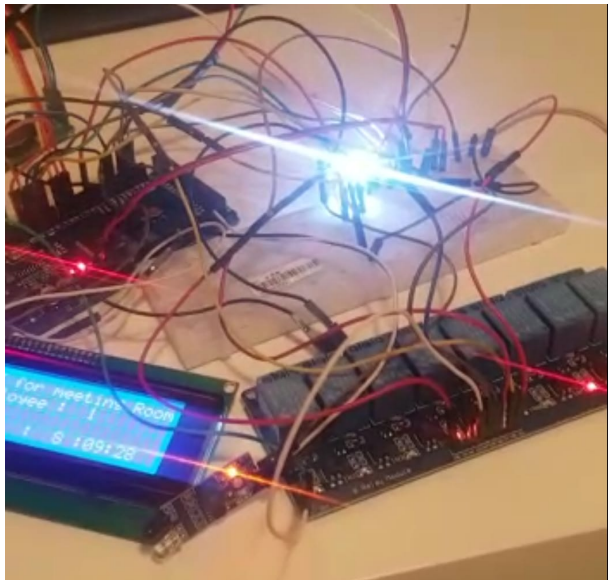

Figure 14. No employee scenario

Figure 15. 1 employee scenario

System Implementation/Prototyping

The system design implemented is shown below. Figure below shows the complete prototype design
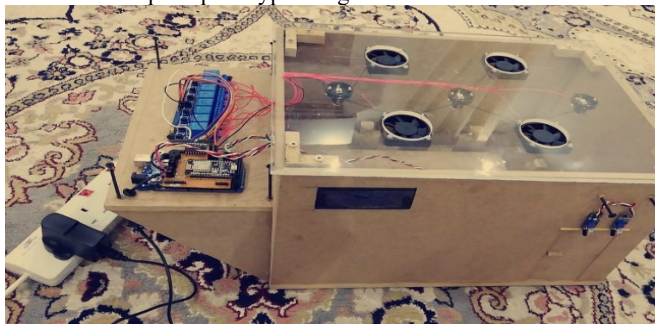

Figure 16. Prototype of the project when the system is off

Figure below shows the system prototype when no one is inside the room and hence there is no signal from IR sensors. LCD will display the room status as empty. All the appliances will be kept off.
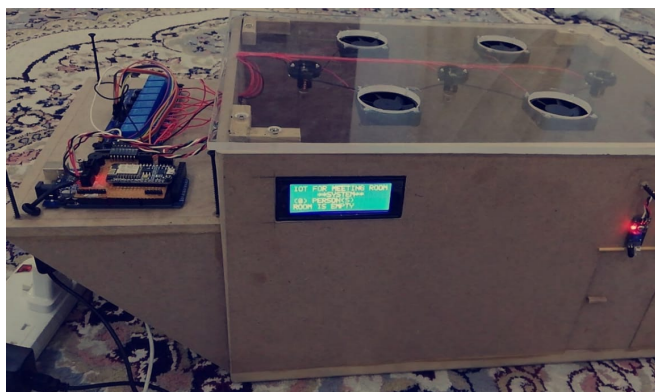

Figure 17. Prototype of the system when the room is empty

Below figure shows the system prototype with 1 person in the room. In such case, only 1 bulb and 2 AC's will be turned on. The information will be displayed on LCD

Figure 18. Prototype of the system when 1 person is inside the room

Below figure shows the system prototype with 7 persons inside the room. Such case says that 3 bulbs, 4 AC's are in operation. The same count will be displayed on LCD.
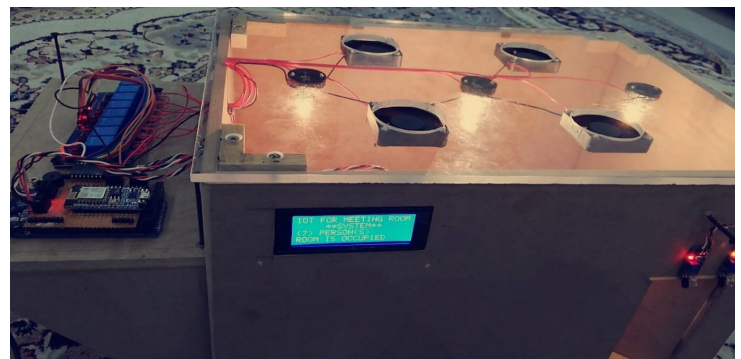

Figure 19. Prototype of the system when 7 persons are inside the room

Figure 21 below shows the system prototype. The below figure illustrates that when there are 12 persons then the room is full and the appliances will be turned on. LCD displays the count. The complete power consumption details are uploaded on think speak through ESP 8266/12E.

Figure 20. System shows 12 persons inside the room

Conclusion and Recommendations

The proposed work is based on IOT to automate employee meeting rooms where low power can be consumed. The system is based on designing employees entering/leaving the office. The designed system controls AC, Bulbs and Room freshners to automate and control the room. The power consumption data will be uploaded to think speak database using ESP8266. LCD connected to the system counts number. Number of persons entering or leaving the room will be detected by IR module and the counter will be updated accordingly. When person enters the room, LED will blink and buzzer will be turned ON. Room lights, Fans and Room Freshners are the appliances used for controlling purpose. Through IOT, the power consumption is monitored. The proposed work will be a contribution to the society in terms of saving energy. The idea is implemented using ISIS proteus. The prototype is developed and all the objectives are achieved.

Acknowledgment

References

Ekansh Gupta, N. S. (2018). Smart Attendance Monitoring and Counting System. *International Research Journal of Engineering and Technology (IRJET)* , 2000-2004.

Jewel, M. H., Islam, M., & Hasan, M. J. (2017). *Automatic Room Light Control Using Bidirectional Visitor Counter and Gas Detection.* Dhaka.

Joshi, D., A. K., S. W., & G. Y. (2018). Effective Meeting Management Using Android Application with IOT. *International Journal of Innovative Research in Computer and and Communication Engineering*, 1238-1242.

Sfikas, G., Akasiadis, C., & Spyrou, E. (2016). Creating a Smart Room using an IoT approach. *Conference: AI-IoT workshop, in conjunction with SETN.*

Subhankar Chattoraj*, A. C. (2016). Bidirectional Visitor Counter with Automatic Room Light Controller and Arduino as the master controller. *International Journal of Scientific and Research Publications*, 357-359.