Automatic Room Light Controller with Bidirectional Visitor Counter

Report for Mini Project/Electronic Design Workshop (EC-681)

B. Tech in Electronics and Communication Engineering

B. P. Poddar Institute of Management & Technology

Under

Maulana Abul Kalam Azad University of Technology

Under the supervision of

Ms. Ankita Indu

Dr. Somali Sikdar

Group No. : **01**

Submitted by

Name	University Roll No	Registration. No	Section
Srija Bhattacharya	11500321020	211150100310078	B
Sagar Kewat	11500321007	211150100310086	B
Shaswati Biswas	11500321003	211150100310091	B

Academic Year: 2023-2024

Department of Electronics& Communication Engineering

B. P. Poddar Institute of Management & Technology

137, V. I. P. Road. Poddar Vihar

Kolkata – 700 052

Department of Electronics & Communication Engineering,
B. P. Poddar Institute of Management& Technology

137, V. I. P. Road, Poddar Vihar. Kolkata – 700052

CERTIFICATE

This is to certify that the project work, entitled "Automatic Room Light Controller with Bidirectional Visitor Counter" submitted by Srija Bhattacharya, Sagar Kewat and Shaswati Biswas have been prepared according to the regulation of the degree B. Tech in Electronics & Communication Engineering of the Maulana Abul Kalam Azad University of Technology, West Bengal. The candidate(s) have partially fulfilled the requirements for the submission of the project work.

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(Name of HOD)	**(Name of the Supervisor)**
Dept. of Electronics & Comm. Engg.	**Dept. of Electronics & Comm. Engg**

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ABSTRACT:

Wastage of electricity is one of the main problems which we are facing nowadays. In our home, school colleges or industry we see that fan/lights are kept on even if there is nobody in the room or area/passage. This happens due to negligence or because we forgot to turn lights off or when we are in a hurry. To avoid all such situations we have designed this project called “Automatic room light controller with visitor counter”. This project has two modules, the first one is known as “Digital Visitor counter” and the second module is known as “Automatic room light controller”. The main concept behind this project is known as “Visitor counter” which measures the number of persons entering any room like seminar hall, conference room, classroom. This function is implemented using a pair of Infrared sensors. LCD display placed outside the room displays this value of person count. This person count will be incremented if somebody enters the room and at that time lights are turned on. And in a reverse way, person count will be decremented if somebody leaves the room. When the number of persons inside the room is zero, lights inside the room are turned off using a relay interface. In this way Relay does the operation of “Automatic room light controller”. Since this project uses 2 infrared sensors, it can be used as a Bidirectional person counter as we.

ACKNOWLEDGEMENTS

It is a great pleasure for me/us to express our earnest and great appreciation to Ms. Ankita Indu and Dr. Somali Sikdar, my project guide. We are very much grateful to them for their kind guidance, encouragement, valuable suggestions, innovative ideas, and supervision throughout this project work, without which the completion of the project work would have been difficult one.

We would like to express our thanks to the Head of the Department, Dr. Ivy Majumdar for her active support.

We also express our sincere thanks to all the teachers of the department for their precious help, encouragement, kind cooperation and suggestions throughout the development of the project work.

We would like to express my/our gratitude to the library staff and laboratory staff for providing us with a congenial working environment.

1. Srija Bhattacharya

2. Sagar Kewat

3. Shaswati Biswas

Date: 29.05.24

(Full Signature of the Student(s)

B. Tech in Electronics & Comm. Engg.

Department of Electronics & Comm. Engg.

B P Poddar Institute of Management and Technology

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TITLE : To design a circuit of automatic light switching system with visitor counter.

OBJECTIVE:

The purpose of this project is to

1. Familiarize students with an in-depth knowledge of Embedded System.
2. Discuss the working function of sensors.
3. Discuss the operating principle of Arduino Uno.
4. Help the learners to learn to work in groups.

DEPARTMENTAL MISSION & VISION :

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply to reason informed by the contextual knowledge to health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

1. Students will acquire knowledge in Advance Communication Engineering, Signal and Image Processing, Embedded and VLSI System Design.

2. Students will qualify in various competitive examinations for successful employment, higher studies and research.

PO& PSO MAPPING:

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
3	3	2	3	3	2	2	3	3	3	2	3	3	3

JUSTIFICATIONS OF MAPPING:

PO/PSO MAPPED	LEVEL OF MAPPING	JUSTIFICATION
PO1	3	Applying knowledge of engineering fundamentals, mathematics, science and an engineering specialization.
PO2	3	Analyzing some complex engineering problems like how sensors work bydetecting obstacles, how lcd works, how bulb work simultaneously with sensors.
PO3	2	The design solution for complex engineering problems that meet thespecific needs with some societal and environmental activities.
PO4	3	Use research-based knowledge and research methods to analyze, interpretand synthesis of the information to provide valid conclusion.

PO5	3	Create, select and apply appropriate techniques, resources and modernengineering and IT tools to predict and model complex engineering activities with an understanding of the limitations.
PO6	2	Apply to reason informed by the contextual knowledge to assess societal, safety and the consequent responsibilities relevant to the professional engineering practice.
PO7	2	Understand the impact of professional engineering solutions anddemonstrate the knowledge of, and need for sustainable development.
PO8	3	Apply ethical principles and commit to professional ethics andresponsibilities.
PO9	3	Function effectively as an individual, and as a member or leader.
PO10	3	Comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	2	Apply knowledge to one's own work, as a member or leader in a team, tomanage projects.
PO12	3	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning.
PSO1	3	Acquire knowledge in Embedded System.
PSO2	3	Qualify in higher studies and research.

ACTIVITY CHART:

JOB	15th -30th January	1st -30th February	1st -30th March	1st-15th April	16th-30stApril	1st-15th May	16th-25th May
Literature Review	⟷						
0th Review		⟷					
Problem definition and requirement analysis			⟷				
Midterm report and presentation				⟷			
Design and Implementation					⟷		
Optimization and Results						⟷	
Report writing and project presentation							⟷

Chapter 1

INTRODUCTION:

In today's world, energy efficiency and automation are crucial in managing resources effectively and sustainably. Lighting systems, being a significant part of energy consumption in residential and commercial buildings, present a prime area for implementing smart solutions. This project, "Automatic Light Switching with Bidirectional Visitor Counter," aims to enhance energy conservation and convenience through an intelligent lighting system.

The core idea of this project is to automatically control lighting based on the presence and movement of individuals within a specified area. By integrating a bidirectional visitor counter with an automatic light switching mechanism, the system ensures that lights are only turned on when needed and turned off when the area is unoccupied. This not only reduces unnecessary energy consumption but also extends the lifespan of lighting fixtures.

The bidirectional visitor counter uses sensors to detect and count the number of people entering and exiting the area. This real-time data is processed to manage the lighting system dynamically. When the first person enters the room, the lights are switched on, and when the last person leaves, the lights are turned off. This seamless automation eliminates the need for manual switching, providing both convenience and energy savings.

By implementing this project, we aim to demonstrate how simple yet effective automation can lead to significant energy savings and enhance the user experience in everyday environments. The project showcases the potential of integrating sensor technology with intelligent control systems, paving the way for smarter and more sustainable living spaces.

Chapter 2

THEORY

This project is based on the interfacing of some components such as sensors, motors etc. with Arduino microcontroller. This counter can count people in both directions. This circuit can be used to count the number of persons entering a hall/mall/home/office in the entrance gate and it can count the number of persons leaving the hall by decrementing the count at same gate or exit gate and it depends upon sensor placement in mall/hall. It can also be used at gates of parking areas and other public places.

This project is divided in four parts: sensors, controller, counter display and gate. The sensor would observe an interruption and provide an input to the controller which would run the counter increment or decrement depending on entering or exiting of the person. And counting is displayed on a 16x2 LCD through the controller. When any one enters in the room, IR sensor will get interrupted by the object then other sensor will not work because we have added a delay for a while.

Chapter 3

PROPOSED SYSTEM

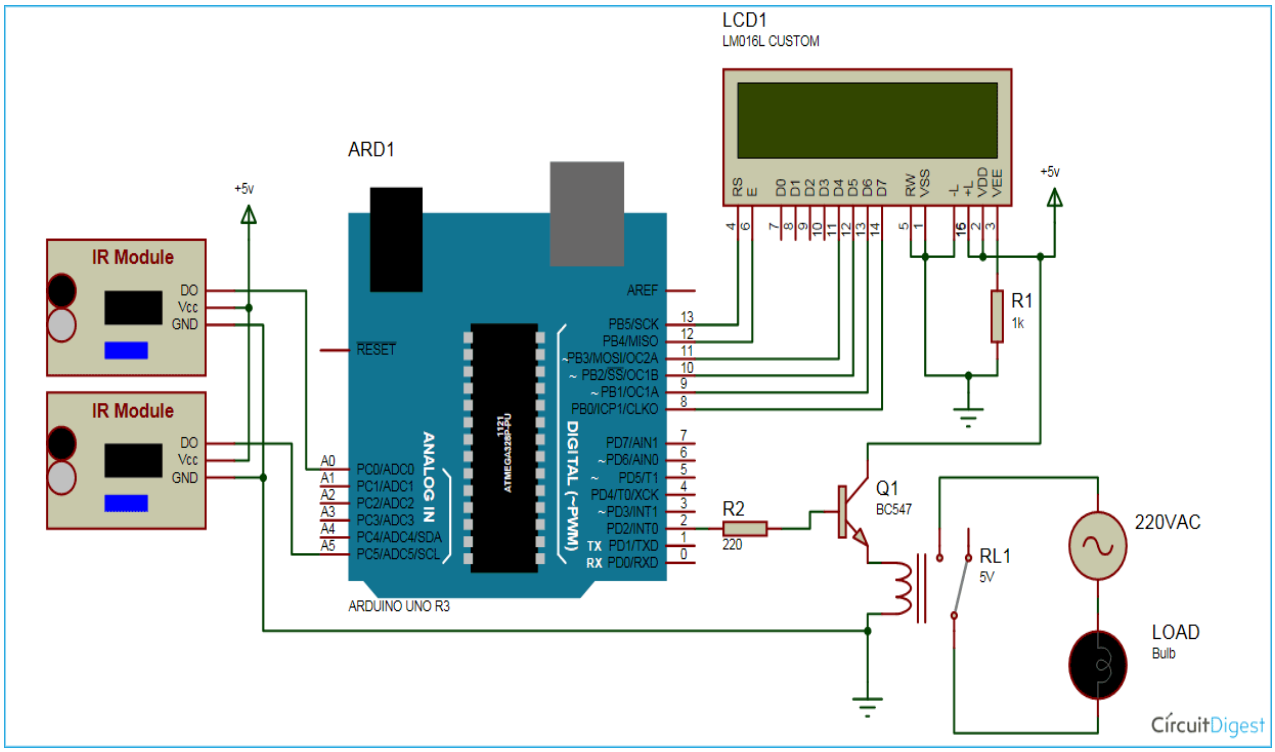

Fig.1. Circuit Diagram

Chapter 4

MATHEMATICAL FORMULATION

IR Sensor Module always remains to HIGH.

HIGH = 1

When it senses any object then it becomes LOW.

LOW = 0

Chapter 5

RESULTS & DISCUSSIONS

The project results indicate that the automatic light switching system with a bidirectional visitor counter is highly effective in enhancing energy efficiency and user convenience. Several key points emerge from the implementation and testing phases:

1. *System Reliability*:

- The reliability of the system was a significant success factor. The use of robust sensors ensured consistent performance. However, in environments with high traffic or rapid movements, occasional discrepancies in counting were observed, suggesting the need for further calibration or more advanced sensor technology.

2. *Scalability*:

- While the project was implemented in a single room, the principles can be scaled to larger environments such as office buildings, schools, and public facilities. Future work could involve integrating this system into a centralized building management system for broader application.

3. *Energy Savings*:

- The quantifiable energy savings underscore the potential of such systems to contribute to broader energy conservation goals. Future studies could expand on this by evaluating long-term savings and return on investment in various settings.

4. *User Interaction and Adoption*:

- User interaction with the system was intuitive, requiring no special training or adjustments. This ease of use is crucial for widespread adoption. Additionally, providing users with feedback on their energy savings could further encourage positive behavior towards energy conservation.

. *Technological Enhancements*:

- Potential improvements include integrating advanced features such as dimming controls, occupancy prediction algorithms, and integration with other smart home or building systems. Enhancements in sensor technology, such as thermal imaging or machine learning-based recognition, could further improve accuracy and reliability.

In conclusion, the project successfully demonstrated the viability and benefits of an automated light switching system using a bidirectional visitor counter. By addressing minor challenges and exploring additional features, this technology holds significant promise for contributing to smarter, more sustainable living and working environments.

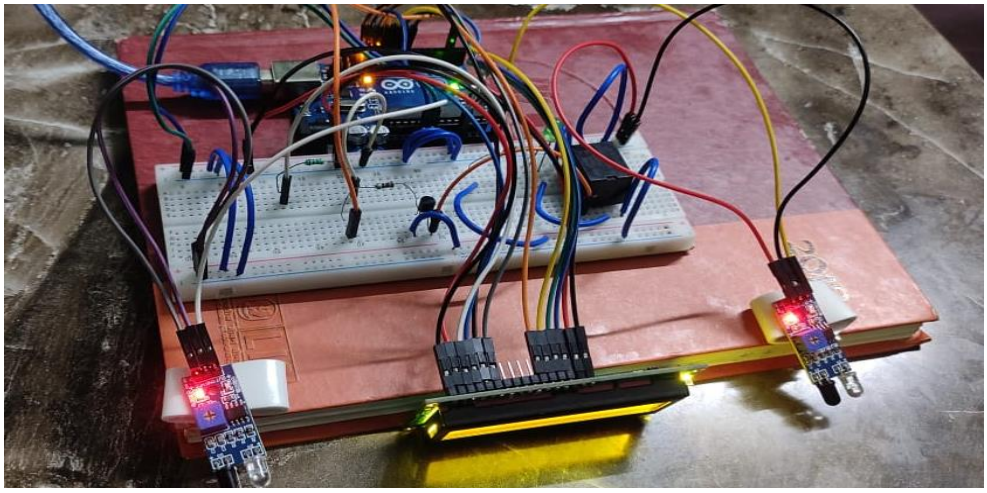

Fig.2.

Fig.3.

Fig.4.

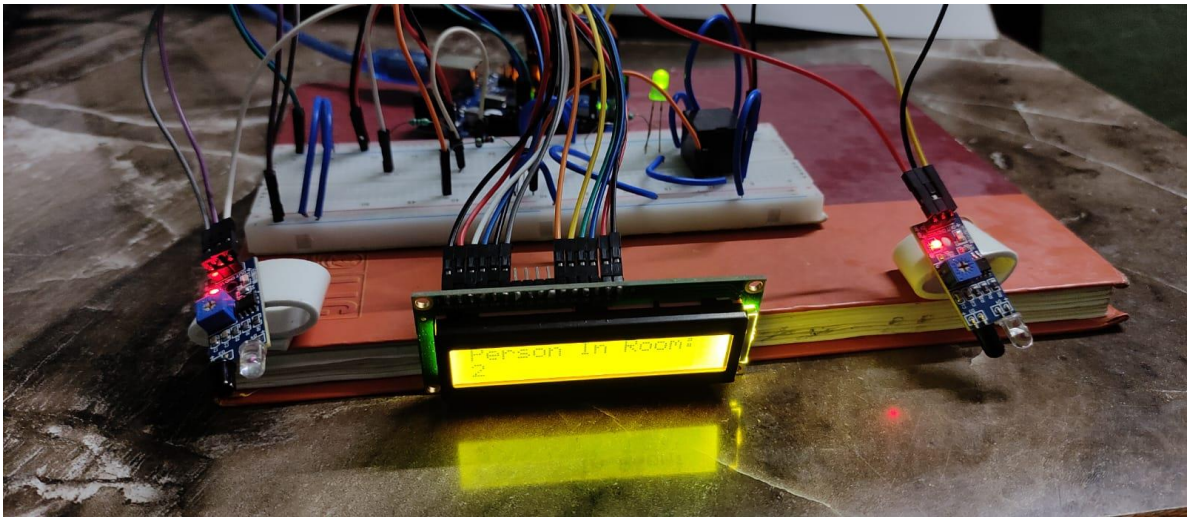

Fig.5.

FUTURE PLAN:

1. **Data Storage and Analysis**:

- Implement data storage for visitor counts.

- Integrate functionality for data analysis and visualization, if desired.

2. **Networking and Connectivity**:

- Add networking capabilities for remote monitoring and control.

- Options include Wi-Fi, Bluetooth, or Ethernet connectivity.

3. **Power Management**:

- Design power-efficient algorithms to prolong battery life (if applicable).

- Implement power-saving modes when the room is unoccupied for extended periods.

4. **Testing and Validation**:

- Conduct thorough testing to ensure the system functions as intended.

- Validate the accuracy of visitor counting and reliability of light control.

5. **Documentation and User Manual**:

- Document the project including schematics, code, and assembly instructions.

- Create a user manual for installation, operation, and troubleshooting.

6. **Deployment and Feedback**:

- Deploy the system in a real-world environment.

- Gather feedback from users and stakeholders for further improvements.

7. **Iterative Improvement**:

- Based on feedback and testing, iterate on the design to enhance performance, reliability, and user experience.

8. **Future Enhancements**:

- Explore additional features such as integration with home automation systems, smartphone apps, or voice control.

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