Modify The Led Lights By Adding Pir Sensor As A Motion Sensor

Angga Aditya Permana[1*], Allan Pradipta[2], Amir Acalapati Henry[3], Ammar Sufyan[4], Muhamad Maskurudin[5], Zahra Syafiq[6]

[1] Department of Informatic, Faculty of Engineering and Informatic
Universitas Multimedia Nusantara, Kab Tangerang, Banten, Indonesia.
[2,3,4,5,6] Department of Engineering Informatics, Faculty of Science and Technology
UIN Syarif Hidayatullah Jakarta, Kota Tangerang Selatan, Banten, Indonesia.
[*]Corresponding Author:
Email: angga.permana@umn.ac.id

Abstract.

Motion sensor lights have become a popular solution to optimize lighting usage in various spaces and environments. This article explores the concept and advantages of motion sensor lights, which are capable of detecting human motion and automatically controlling illumination. Motion sensor lights use PIR sensors to detect human movement, triggering a relay module as a switch to turn the lights on or off. The primary benefit of motion sensor lights is energy efficiency, reducing unnecessary power consumption. The article also explains how to create motion sensor lights using simple tools and easy-to-follow steps. Consequently, readers can grasp the fundamental concept of motion sensor lights and have a practical guide to make them on their own. Through the research conducted, a modification of regular LED lights into LED lights that can function with a PIR sensor has been achieved through several experiments.

Keywords: *Sensor Lights, LED, PIR Sensor and Modify.*

I. INTRODUCTION

Light Emitting Diodes (LEDs) are electronic components that emit monochromatic light when forward voltage is applied. They belong to the diode family and are constructed from semiconductor materials. The emitted light's color depends on the type of semiconductor material used. LEDs also have the remarkable ability to emit infrared light, invisible to the naked eye, as commonly found in TV remote controls and other electronic devices, serving as an early warning system in detecting gas leaks. LEDs are small, bulb-like devices that can easily be integrated into various electronic gadgets. Unlike incandescent bulbs, LEDs do not require filament combustion, making them more energy-efficient and heat-resistant. Consequently, small-sized LEDs have found extensive use as illumination sources in LCD TVs, replacing traditional tube lights.[1], [2] Given these insights, the author is inspired to design a circuit employing motion sensors capable of detecting human body movements. The objective is to facilitate the everyday use of LED lights. In today's rapidly evolving world, energy efficiency and practicality have become essential considerations. Motion-activated LED lighting is not only convenient but also significantly contributes to energy conservation, promoting a sustainable and comfortable lifestyle.

This manuscript will delve into the design and implementation of a motion sensor-driven LED lighting system, emphasizing its benefits, ease of use, and potential applications in various scenarios, including homes, workplaces, and public spaces. The integration of motion sensors with LED technology is poised to revolutionize our daily interactions with lighting, providing an intelligent and efficient solution that aligns with modern demands and expectations. [3] Additionally, the confluence of motion sensor technology and LED lighting offers an array of advantages, particularly in terms of energy savings and environmental impact. Conventional lighting solutions often waste energy by illuminating spaces when not required, contributing to higher electricity bills and increased carbon footprints. In contrast, motion-activated LED lighting systems respond dynamically to the presence of individuals, ensuring that lights are only active when necessary. This efficiency not only reduces energy consumption but also extends the lifespan of the LEDs, further minimizing the ecological footprint.

[4] The development of such systems is not only beneficial for individual consumers but also holds significant promise in commercial and public settings. Offices, warehouses, and public facilities can benefit from motion-activated LED lighting, promoting a more sustainable and cost-effective lighting solution. In outdoor spaces, such as parking lots and walkways, motion sensors enhance security and visibility while minimizing unnecessary illumination. [5] This manuscript will provide an in-depth exploration of the design, construction, and applications of motion sensor-driven LED lighting systems. It will guide readers through the process of creating their own motion-activated LED lights, encouraging a hands-on approach to harnessing this innovative technology. By the end of this manuscript, readers will gain a comprehensive understanding of the principles behind these systems and be equipped with the knowledge to implement them effectively, whether in their homes or in broader, more extensive settings. Motion sensor LED lighting has the potential to revolutionize our interaction with light and pave the way for a more energy-efficient, eco-friendly, and convenient future. [6]

II. METHODS

Fig 1. Research Flow

1. Analysis

The method of analysis in this case involves several stages. First, we describe in detail the basic concept of LED, such as how it works and the types of semiconductor materials used. Second, we explain how LEDs are used in various electronic devices and compare them to incandescent bulbs. Furthermore, we outline how motion sensors make it easier to use LED lights in daily life, such as saving energy, providing convenience, and practical applications. Finally, we provide a comprehensive understanding of the topic by explaining how to create a motion sensor-controlled LED lighting system.

2. Design

The design method in this case involves several steps. First, we identify the needs and goals of the motion sensor-controlled LED lighting system. Second, we plan and design the electronic circuit required to integrate LED with the motion sensor. Next, we select appropriate components, such as the motion sensor and the right LED, and assemble them according to the designed layout. Finally, we test and ensure that the system functions properly, making any necessary adjustments for optimal performance. With this design method, we can create an efficient and effective lighting system using motion sensor and LED technology.

3. Development

The development method involves a series of steps to turn the design into a tangible product. First, we gather all the necessary materials and components as per the design plan. Second, we carefully begin assembling these components, following the provided instructions. Next, we conduct tests to ensure that the system functions properly and make any necessary adjustments. Finally, the finished product is ready for use or distribution to users. The development method ensures that the initial design is transformed into a functional product.

4. Implementation

The implementation method involves the steps to put into action or execute a planned system or process. First, we prepare all the necessary tools and resources to kickstart the implementation. Second, we begin carrying out the plan or system according to the predefined stages. Next, we monitor and evaluate the progress of the implementation, ensuring that everything aligns with the plan. Finally, we make adjustments if needed to ensure the successful execution. With this implementation method, the plan or system can be executed effectively and in line with the established objectives.

5. Evaluation

The evaluation method involves assessing the outcomes of a process or project. The first step is to gather the necessary data and information for evaluation. Second, the data is analyzed and compared to the predetermined objectives. Next, we assess the success or failure of the process or project. Finally, the evaluation serves as a basis for making further decisions, such as improvements or future developments. With this evaluation method, we can understand the extent to which objectives have been achieved and how we can enhance outcomes in the future.

III. RESULT AND DISCUSSION

1. Analysis

The concept is to transform a regular light into a light that turns on automatically with any movement up to a distance of 6 meters. The light is modified using a Passive Infra-Red (PIR) sensor. PIR sensor, short for "Passive Infra-Red" sensor, is employed for this purpose. The type of light used can vary, but we have chosen to use LED lights due to their significantly better lifespan and electrical efficiency compared to other types of lights.

2. Design

The creation of this motion sensor light involves several manufacturing stages. It begins with preparing the materials and tools used, such as setting up the light socket and the power source socket. The subsequent process involves the assembly of the electronic schematic of the motion sensor light system. This comprehensive approach ensures the proper preparation and assembly of the components for the motion sensor light system.

The tools and materials used are: PIR Sensor, LED Lights, Lamtis Module (relay module, 1N4148 diode, 330-ohm resistor, 2 LED indicator lights, 5 Volt DC Pin Head, 5 Volt DC Jack Connector).

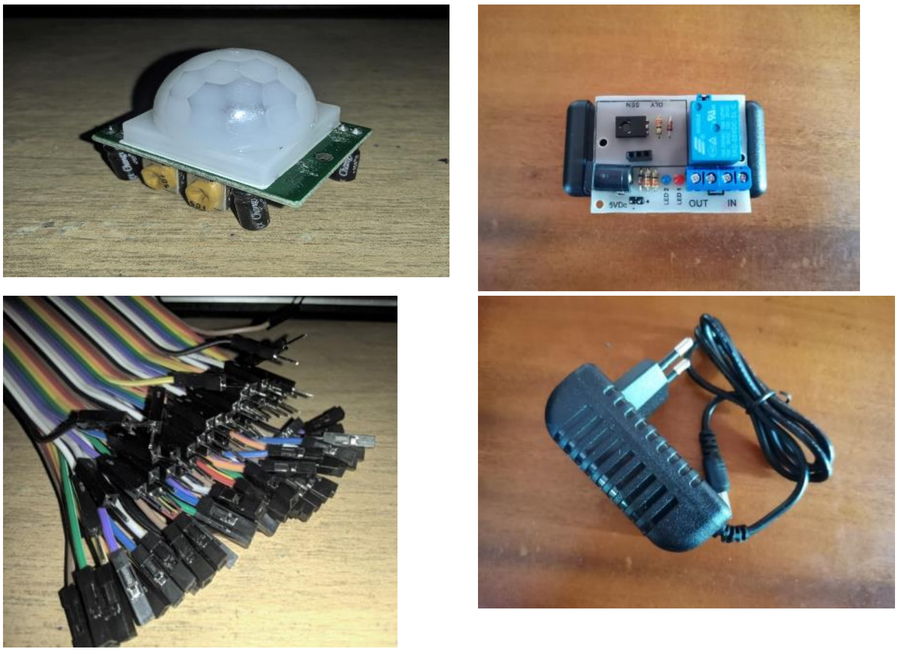

Fig 2. Tools and Material

3. Development

In the manufacturing phase, we need to prepare the components to be used, such as the PIR sensor, Lamtis module, AC cable, 5V adapter, and jumper cables. Then, follow these steps:

Connect the lamp to the relay module using additional cables.

Connect the PIR sensor to the circuit using jumper cables.

Connect the AC cable to the relay module.

Connect the 5V adapter to the circuit.

The design of the motion sensor light modification program is carried out by first creating a flowchart design, which will serve as a reference for building the circuit.

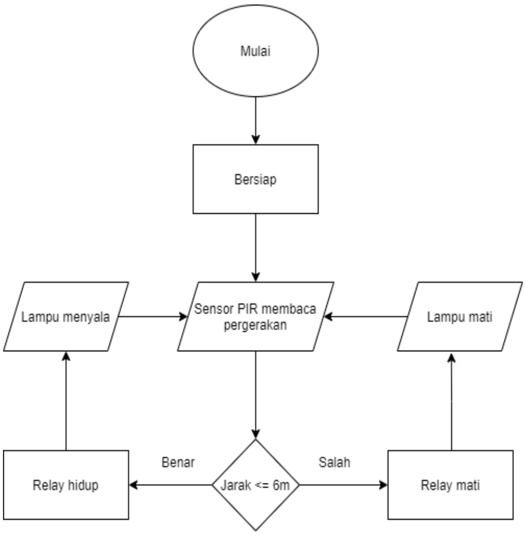

Fig 3. Flowchart System

4. Implementation

Once the system is constructed based on the previously made designs, the next step is to connect the circuit to the electrical supply. In this phase, it can be achieved by plugging the 5V adapter into the power outlet and connecting the AC cable to the power socket.

Fig 4. The circuit of the motion sensor light system and the circuit on the relay module.

5. Evaluation

After all components are properly connected, a test is conducted. System testing is performed by using a living being or an object that emits infrared within the range of the PIR sensor. This device operates by connecting the circuit to a 5 Volt adapter and connecting the AC cable to the circuit to supply power to turn on the lights. When the PIR sensor detects motion, the relay module will connect the electrical power supply, allowing the lights to illuminate as they receive an electrical current.The system is tested at a distance of approximately 0.5 meters. When the sensor doesn't detect any movement, the lights remain off. However, when the sensor detects motion, the lights operate effectively.

Fig 5. (Left) does not detect motion, (Right) detects motion at a distance of 0.5 meters.

The system is also tested for motion detection at a distance of 3.5 meters. When a person passes in front of the PIR sensor at a distance of 3.5 meters, the lights function effectively. This demonstrates that the PIR sensor remains effective in detecting motion at distances greater than 3 meters.

Fig 6. (Left) does not detect motion, (Right) detects motion at a distance of 3 meters.

Next, the system is tested for motion detection at a distance of 4 meters. When a person passes in front of the PIR sensor at a distance of 4 meters, the lights function effectively. This demonstrates that the PIR sensor remains effective in detecting motion at distances of up to 4 meters.

Fig 7. Sensor detects motion at a distance of 4 meters.

Then, the system is tested for motion detection at a distance of 5 meters. When a person passes in front of the PIR sensor at a distance of 5 meters, the lights function effectively. This demonstrates that the PIR sensor remains effective in detecting motion at distances of up to 5 meters.

Fig 8. Sensor detects motion at a distance of 5 meters.

Afterward, the system is tested for motion detection at a distance of 6 meters. When a person passes in front of the PIR sensor at a distance of 6 meters, the lights function effectively. This demonstrates that the PIR sensor remains effective in detecting motion at distances of up to 6 meters.

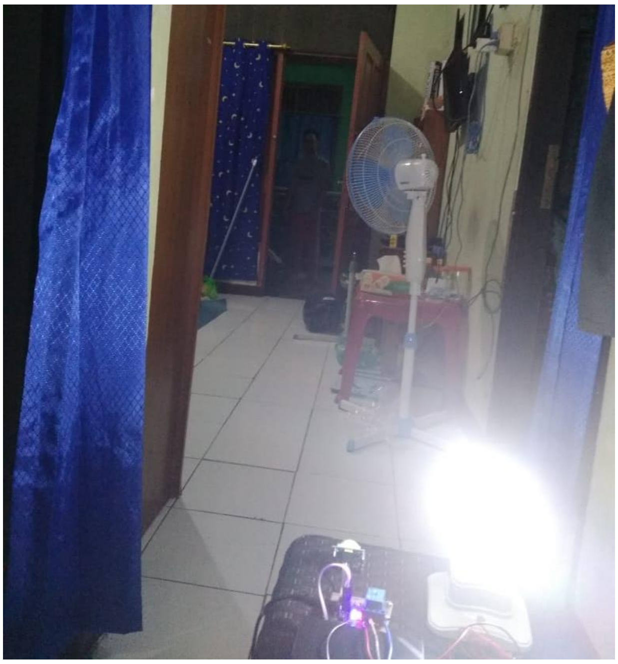

Fig 9. Sensor detects motion at a distance of 6 meters.

Finally, the system is tested for motion detection at a distance of 7 meters. When a person passes in front of the PIR sensor at a distance of 7 meters, the lights function effectively. This demonstrates that the PIR sensor remains effective in detecting motion at distances of up to 7 meters.

Fig 10. Sensor detects motion at a distance of 7 meters.

Thus, the experiment results are as shown in the following table.

Table 1. Experiment Result

Distance	Detected	Sensitivity
<3 m	YES	Strong
4 m	YES	Strong
5 m	YES	Strong
6 m	YES	Strong
7 m	YES	Strong

The table explains that the PIR sensor can detect motion from a distance of less than 3 meters up to 7 meters. Its sensitivity is still considered strong in detecting motion.

The system is tested to detect motion from the side of the PIR sensor.

Fig 11. (Left) using a living object, (Right) using an inanimate object, from the side.

When a hand is placed beside the PIR sensor, the lights can turn on. This demonstrates that the PIR sensor not only detects motion directly in front of it but can also detect motion from the sides within a certain angle of reach.However, when an inanimate object is placed beside the PIR sensor, the lights do not turn on. This confirms that the PIR sensor does not detect motion originating from non-living objects because they do not emit infrared radiation.

IV. CONCLUSION

Based on the entire system that has been designed and created, here are some important conclusions. The motion sensor LED light using a PIR sensor functions as intended, turning on when detecting movement. The PIR sensor effectively detects human motion by capturing infrared radiation emitted from the human body. This sensor commands the module to turn on the light for a predetermined duration. The PIR sensor can detect motion within a range of distances, from less than 3 meters up to 7 meters. It also has a half-circle-shaped coverage area, enabling it to keep the light on when there is movement from the side of the PIR sensor. The PIR sensor only responds to motion that emits infrared radiation, so the light won't turn on if an object that doesn't emit infrared radiation moves toward the PIR sensor. This demonstrates the PIR sensor's ability to avoid irrelevant disturbances when activating the light.

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