Smart Light Using PIR and LDR
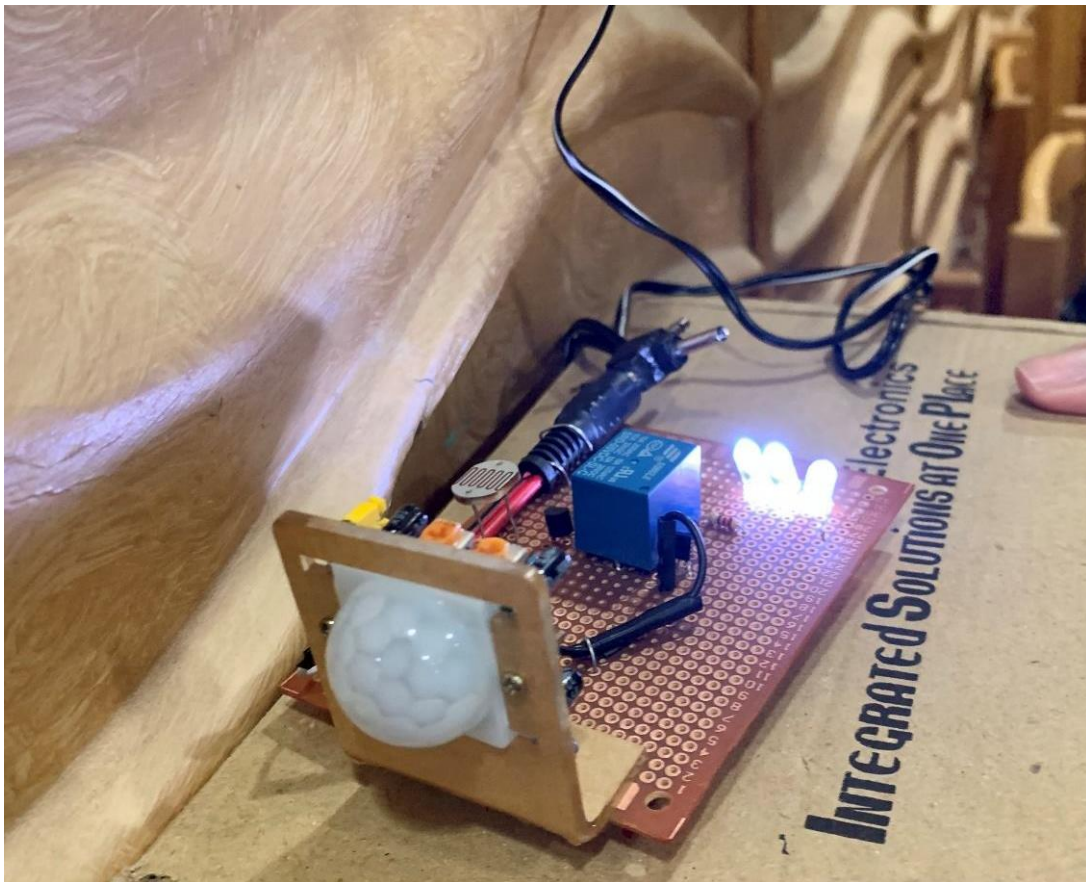

MEASUREMENTS AND TESTING PROJECT

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ABSTRACT

The purpose of this project was to create a smart light that initiates its operation whenever the circuit experiences any movement in its range at nighttime.

Firstly, we used the combination of both PIR circuit and LDR circuit to make this project work, unfortunately, our first circuit failed even though it was running on Proteus, it was not working in real life.

We then decided to come up with our own circuit from simpler components and from our own knowledge about hardware components and their utilizations.

This night activated PIR motion sensor light project was a challenge to execute even after research we failed at first but thankfully, we were able to improvise and create our own circuit for this project on time.

TABLE OF CONTENTS

- Introduction
- Project description
- Project applications
- Circuit (1)
    - Hardware components
    - Circuit diagrams
- Circuit (2)
    - Hardware components
    - Circuit diagrams
- Conclusion

INTRODUCTION

In this report we will be discussing our chosen project which is the night activated PIR motion sensor which we have successfully built from scratch after a lot of research and multiple failures.

We first constructed this circuit using two different circuits one consists of the LDR circuit and the other is the PIR circuit and we connected them using the Proteus program and verified that it'd work, but after multiple of times trying to connect the circuit we failed although we took all necessary steps to check our circuit and components we also reran the circuit on the program to check that it works which it did but we couldn't make it works so we were forced to improvise which resulted in the making of the second circuit.

PROJECT DESCRIPTION

Night Activated PIR Motion Sensor initiates its operation whenever the circuit experiences any movement in its range. This circuit will also consequently be enacted around evening time and go off at day due to the light detection feature that will be added.

Night Activated PIR Motion Sensor circuit design is centered around a passive infrared (PIR) motion detector module, type HC-SR501. The PIR sensor used detects the radiated heat of a person and these data converts to an electrical signal, this signal is sent to the switching for processing, then the signal creates a specific voltage for the relay to activate the power switching. When nobody is detected, the power is automatically turned off.

The PIR motion detector module is used here with an added ambient light detection (day/night) feature using LDR. The task of LDR is to detect the approaching of human person based on the principle of light/dark sensing.

The main objective of this project is to implement a system for power saving. When the room's light is switched off or goes off due to power cut, the LED in circuit glows automatically. For the power control system, a detection method is used for a power ON/OFF automatically in respective place.

PROJECT APPLICATIONS

Generally, PIR sensor lamps are mostly used to save energy by detecting the motion of humans, animals, etc. It is likewise used in security systems, PIR sensors light, streetlight projects, etc.

Additionally, areas of applications of the PIR sensor are all outdoor light, lift lobby, common staircases, basement or parking areas, shopping malls, garden lights etc.
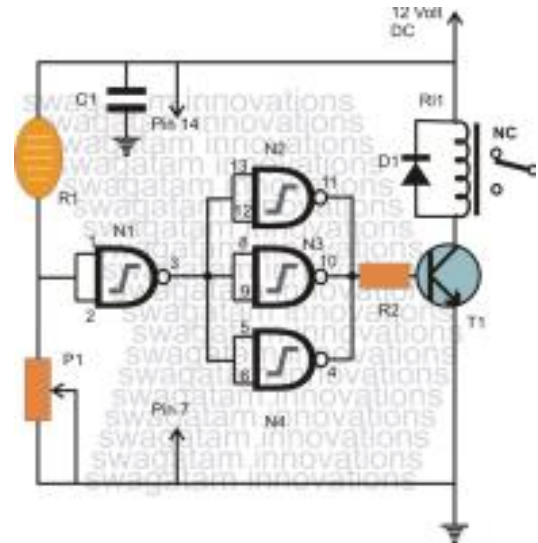
CIRCUIT (1)

In the operation of the system, this system is divided into two parts. There is a particular operation for each part.

- The first part is the light/night detector circuit. Depending on the light incident on the LDR, it triggers the relay for activation. As an operation, it is required a small delay in the sensing process. Because the sudden changes in the intensity of light affect the trigger of the circuit.

- The second part is the PIR sensor circuit. It is fed to the base of the transistor. Based on the output of the PIR sensor, the transistor works in its operation. When PIR detects the presence of a human being in its vicinity, it produces a high output. If the transistor gets the high data from PIR, it activates the relay, and the connected lamp gets power and is lit up. If the human moves away, then there is no power and the light switch off automatically.

Component number	Components	Value	Quantity
1	PIR Motion Sensor	-	1
2	LDR	-	1
3	IC	4093	1
4	Op Amp	741	1
5	Transistor	2N2222	2
6	C1	10uF	1
7	C2	10uF	1
8	R1	330K	1
9	R2	330K	1
10	R3	1K	1
11	R4	10K	1
12	R5	330K	1
13	R6	2.2K	1
14	R7	220R	1
15	RV1	1K	1
16	LED	-	1
17	Relay	5V/240R	2
18	Relay	12V/240R	1

CIRCUIT DIAGRAM

CIRCUIT DIAGRAM USING PROTEUS

CIRCUIT (2)

We constructed this circuit to operate the same as the first and it turned out to be much simpler.

First, we connected a circuit that mainly consists of the LDR (Figure 1). Then, we connected another circuit that consists of the PIR (Figure 2), and we verified that each circuit works separately, finally we connected the two circuits using a relay as the relay would allow the two circuits simultaneously. (Figure 3).

1. HARDWARE COMPONENTS

a. Components Table

Components	Values
PIR	-
LDR	12mm
Relay	5 Volts
LED	White
R1, R2	47K, 220 ohms
Q1, Q2	BC547
Voltage Source	Variable adapter 6v

b. Hardware Components Details

1. PIR (Passive infrared sensor)

PIR sensor detects a human being moving around within approximately 10m from the sensor. This is an average value, as the actual detection range is between 5m and 12m. PIR is fundamentally made of a pyro electric sensor, which can detect levels of infrared radiation. Most PIR sensors have a 3-pin connection at the side or bottom. One pin will be ground, another will be signal, and the last pin will be power. Power is usually up to 5V. The PIR sensor needs a warm-up time with a specific end goal to capacity fittingly. This is because of the settling time included in studying nature's domain. This could be anyplace from 10-60 seconds.

2. LDR (Light-dependent resistor)

LDR is a light-dependent resistor (LDR), such as an ORP12, is a special type of component whose resistance changes in an inversely proportional manner to the light intensity falling upon it. In the dark, its resistance increases; however, in light, its resistance decreases. if the resistance decreases, then the voltage across the resistor must decrease too.

3. Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms.

The COM (Common) connection of a relay is the part of the relay that moves. When a relay is off, the COMMON is connected to the NC (Normally Closed). The NO (Normally Open) connection of the relay is not connected until the relay turns on. When the relay turns on, the COMMON moves from NC to NO. Mechanical relays create a Clicking sound that indicates movement of the COMMON terminal. Not all relays have a Normally Closed Connection.

4. Transistors BC547

A semiconductor device like a transistor is one kind of switch which controls electrically. It consists of three terminals like an i/p, o/p & a control line. These are named as the emitter (E), collector(C) and base (B). A transistor works like a switch as well as an amplifier to convert the waves from audio to electronic. Transistors are smaller in size, long life and can operate with low voltage supplies. The BC547 transistor is an NPN transistor. A transistor is nothing but the transfer of resistance which is used for amplifying the current. A small current of the base terminal of this transistor will control the large current of the emitter and base terminals. The main function of this transistor is to amplify as well as switching purposes. The maximum gain current of this transistor is 800A.
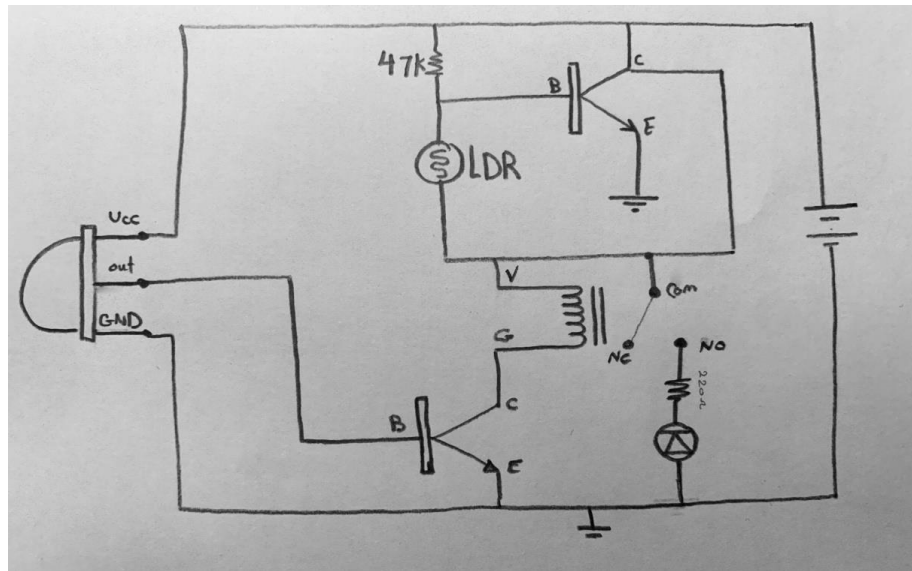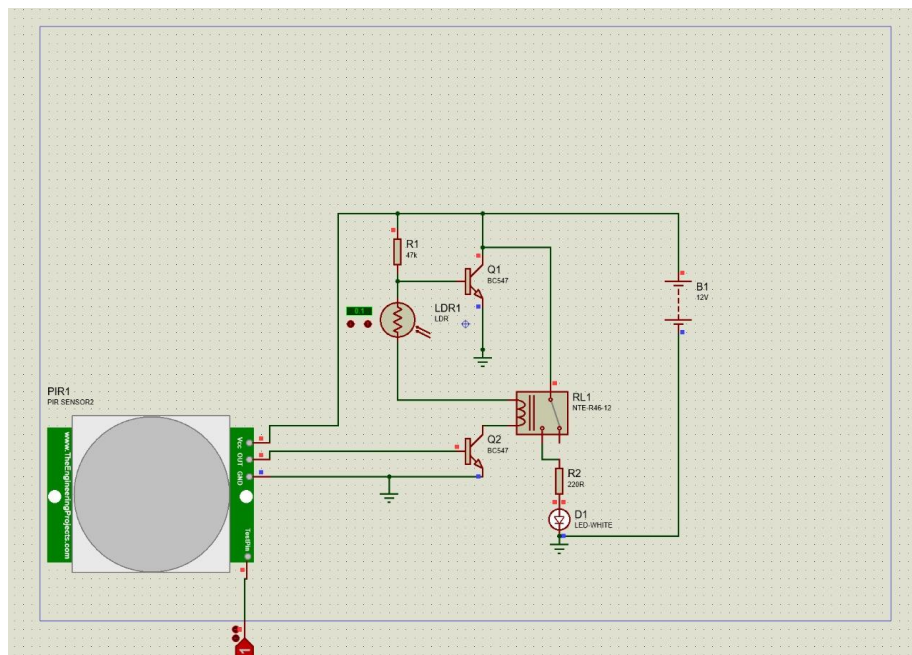
2. CIRCUIT DIAGRAMS
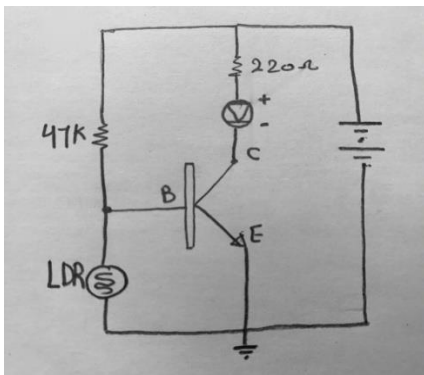
(Figure 1)
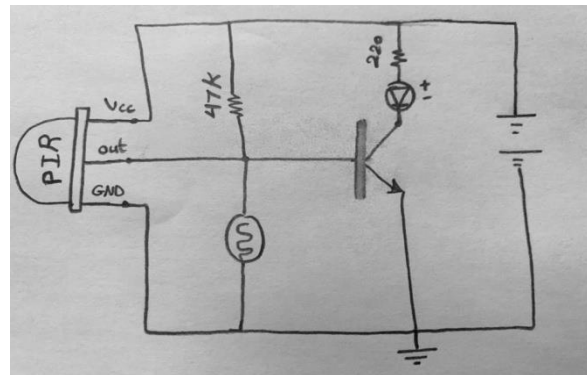
(Figure 2)

(Figure 3)

Circuit Diagram using Proteus:

CONCLUSION

In summary, our smart light is a night activated PIR motion sensor light that initiates its operation whenever the circuit experiences any movement in its range. This circuit would also accordingly be enacted around evening time and go off at day due to the light detection feature that will be added.

We tried to connect an LDR circuit with another PIR circuit from the Internet to come up with a circuit that works like what we want, unfortunately, the circuit was running on Proteus but not in real life.

After the failure of the first circuit, we deduce that the circuit was larger than necessary and as the circuit grows it gets more and more complicated. We then decided to simplify the circuit by using simpler components, like LDR, PIR, BC547, RELAY 5V, R47K, R220ohms and LEDs.

This circuit is divided into two parts:

1. The first part consists of LDR, BC547 and R47K. LDR was used to determine the night and thus turn off the circuit at daytime because it acts as a switch intended to determine if it is night. The relay is used as electromagnetic switch, this basic relay is also called a SPDT type of relay meaning single pole double throw, since here we have a single central pole but two alternate side contacts in the form of N/O, N/C, hence the term SPDT.
2. The second part of the circuit is made up of PIR, BC547, R220 ohms and LED. the main element is the PIR sensor, and it is used to detect the movement around it, the transistor works to transfer the signals, and the resistance is used for amplifying the current.

The first and second circuits are both connected by relay and the performance is enhanced by using it.

We as a team gained multiple skills and lots of knowledge while working on this project together, such as learning how to research, working on the PCB and the Breadboard, collecting knowledge about hardware components and what they are used for, problem solving, etc.

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