

**A Practical Activity Report submitted for
Engineering Design Project-II (UTA-024)**

by

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Class Group - 2Q12**

Submitted to

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

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INDIA**

Session: Jan-May, 2025

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3	2 (a)	To draw a schematic diagram of IR sensor module circuit (required to move the Buggy module on a predefined path) using CAD tool (Eagle).
4	2(b)	To design a printed circuit board layout of IR sensor module circuit using CAD tool (Eagle).
5	3 (a)	To draw a schematic diagram of pulse width modulation (PWM) based transmitter for generating specified pulse width waveforms for gantries placed at different locations on the path using CAD tool (Eagle).
6	3 (b)	To design a printed circuit board layout of pulse width modulation (PWM) based transmitter circuit using CAD tool (Eagle).

Experiment: 1

Objective:

- To draw a schematic diagram of receiver to receive specified pulse width IR signals from gantries using CAD tool (Eagle).
- To design a printed circuit board layout of receiver circuit using CAD tool (Eagle).

Software Used:Eagle Software

Component Used:

Sr. No	Name of Components	Value	Specifications	Quantity
1.	Resistor	120k Ω	Carbon Resistor with 5% Tolerance	1x
2.	Resistor	100k Ω	Carbon Resistor with 5% Tolerance	1x
3.	Resistor	22k Ω	Carbon Resistor with 5% Tolerance	1x
4.	Resistor	1k	Carbon Resistor with 5% Tolerance	1x
5.	Schottky Diode	BPW41N		1x
6.	Male Header	3-pin	PCB Header	1x
7.	Operational Amplifier	LM311N	Microcontroller	1x

Theory :

1. Resistor

:A resistor is a passive electronic component that limits or regulates the flow of electric current in a circuit by providing resistance, measured in ohms (Ω). It converts electrical energy into heat and is commonly used to control voltage, current, and signal levels. Resistors come in various types, including fixed resistors with constant resistance, variable resistors (like potentiometers) for adjustable resistance, and special resistors designed for specific applications. Key specifications include resistance value, tolerance (precision), and power rating, determining how much power the resistor can safely dissipate.



Fig. 1.1 Various types of resistors [1]

2. Schottky Diode: The Schottky diode is a semiconductor device that allows current to flow in one direction with minimal voltage drop. It is known for its fast-switching speed and low forward voltage drop (typically 0.2-0.4V), making it ideal for high-frequency and power-efficient applications. Unlike standard diodes, it uses a metal-semiconductor junction instead of a p-n junction. Due to their efficiency and rapid response, Schottky diodes are commonly used in rectifiers, voltage clamping, and power supplies.

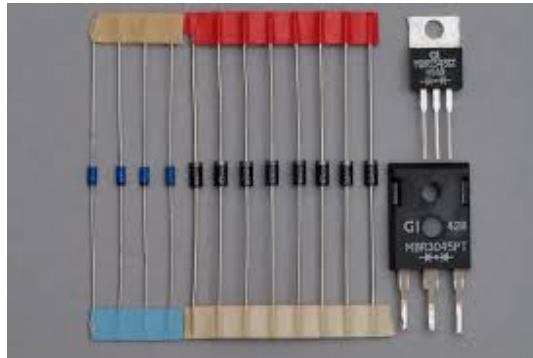


Fig. 1.2 Schottky Diode [2]

3. Led3mm: LED 3mm is a light-emitting diode with a 3mm diameter, commonly used for indication and display purposes in electronic circuits. It emits light when an electric current flows through it, available in various colors like red, green, blue, and white. These LEDs are energy-efficient, have a long lifespan, and are ideal for compact applications due to their small size. They typically operate at low voltages (2-3V) and require a current-limiting resistor to prevent damage.

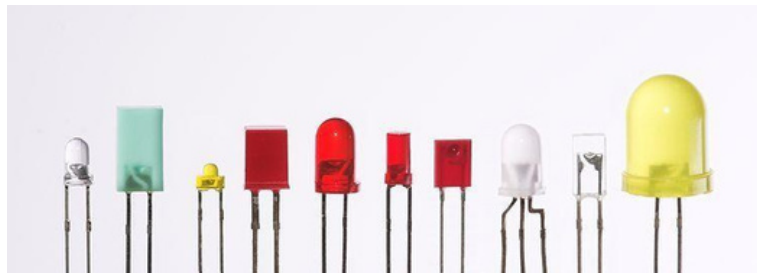


Fig. 1.3 Various types of sub miniature standard LED [3]

4. Male Header: Male PCB Header is a type of connector used in electronics to establish connections between circuit boards or components. It consists of a row (or multiple rows) of metal pins protruding from a plastic base, designed to fit into corresponding female headers or sockets. Male headers come in various pin configurations, sizes, and pitches, making them versatile for prototyping, modular design, and permanent connections in electronic projects.

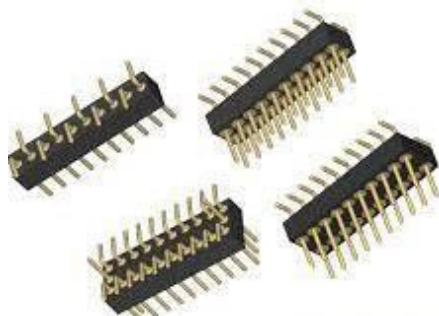


Fig. 1.4 Male PCB Header [4]

5. Operational Amplifier (LM311N)

: Operational amplifier LM311N is a high-speed operational amplifier (op-amp) commonly used as a voltage comparator. It compares two input voltages and provides a digital output, indicating which input is higher. It features low power consumption, wide supply voltage range, and fast response time. The LM311N can operate with a single or dual power supply and is commonly used in applications like zero-crossing detectors, oscillators, and signal conditioning. Its flexibility and reliable performance make it a popular choice in analog and mixed-signal circuits.

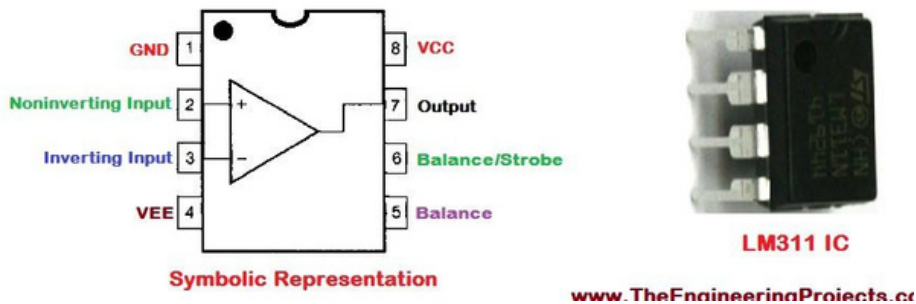


Fig. 1.5 LM311N [5]

Schematic diagram:

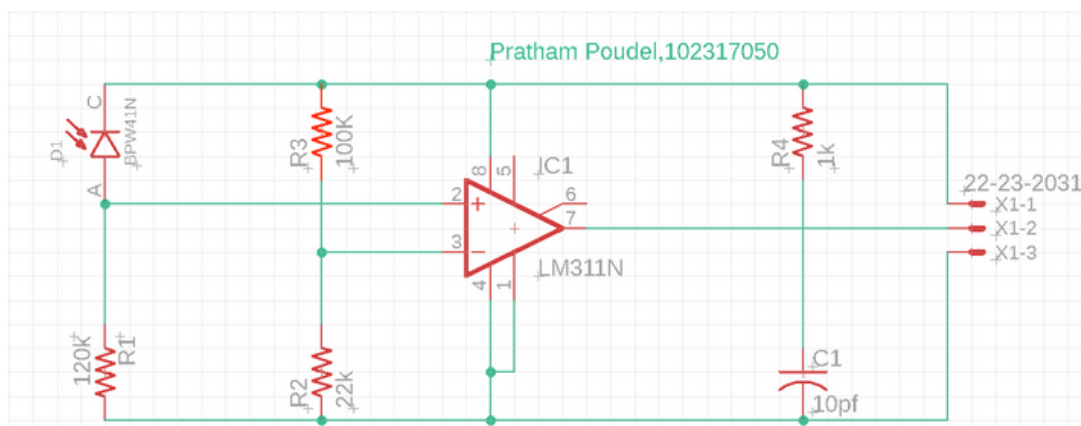
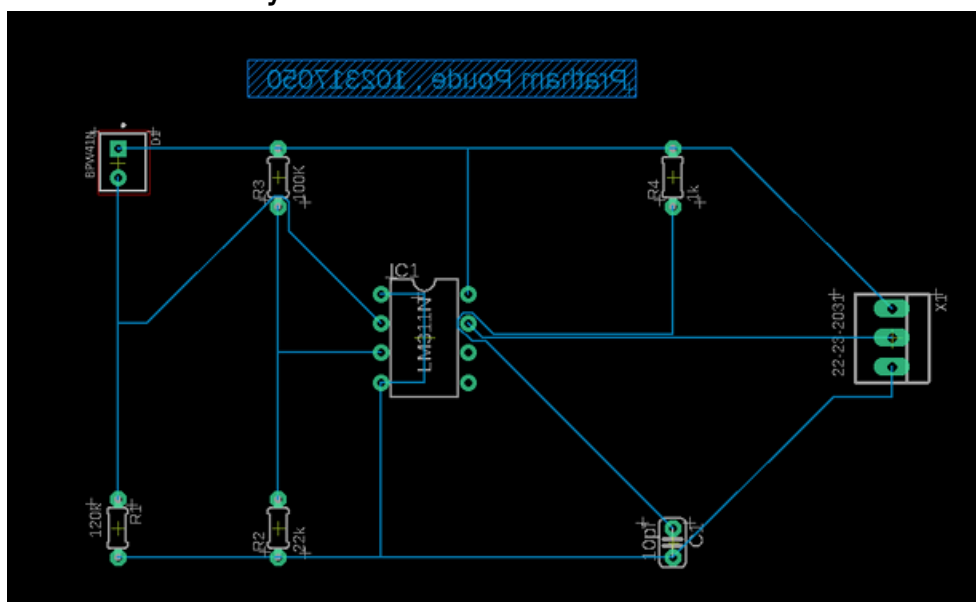


Fig. 1.6 Schematic diagram of Receiver circuit [6]

Printed Circuit Board layout:



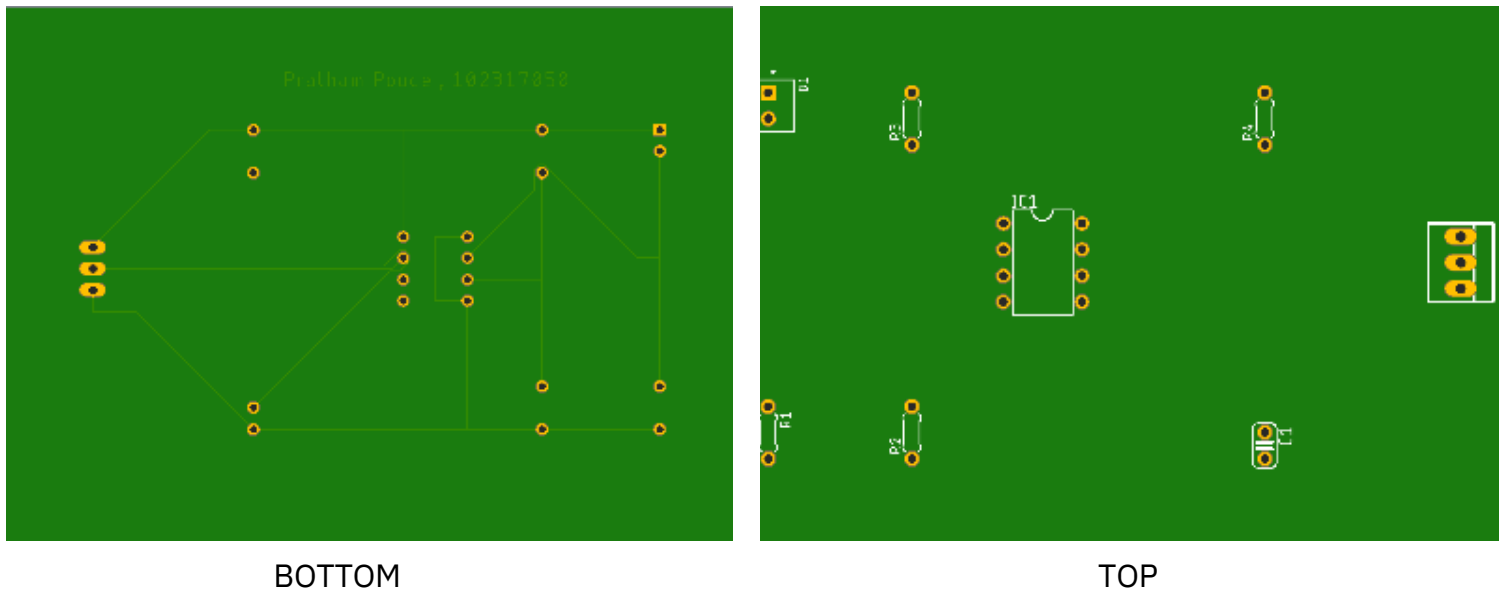


Fig. 1.8 PCB layout of Receiver circuit [7]

Discussion:

In this experiment, we have learnt how to draw a schematic diagram of receiver to receive specified pulse width IR signals from gantries and to design a printed circuit board layout of receiver circuit using CAD tool (Eagle).

Reference:

- [1] <https://www.electricaltechnology.org/2015/01/resistor-types-resistors-fixedvariablelinear-non-linear.html>
- [2] <https://www.shutterstock.com/image-photo/Schottky Diode>
- [3] <https://byjus.com/physics/types-of-led/>
- [4] <https://www.shutterstock.com/image-photo/spare-parts-on-isolatedwhitebackground- 728318440>
- [5] <https://www.shutterstock.com/image-photo/operational-amplifier>
- [6] CAD tool (Eagle software)
- [7] CAD tool (Eagle software)

Signature of Faculty member

Experiment: 2

Objective:

- To draw a schematic diagram of IR sensor module circuit (required to move Buggy module on a predefined the path) using the CAD tool (Eagle).
- To design a printed circuit board layout of IR sensor module circuit using CAD tool (Eagle).

Software Used:Eagle Software

Component Used:

Sr. No	Name of Components	Value	Specifications	Quantity
1.	Resistor	220 Ω	Carbon Resistor with 5% Tolerance	4x
2.	Resistor	10k Ω	Carbon Resistor with 5% Tolerance	2x
3.	Potentiometer	10k Ω		2x
4.	led3mm	5V	Dome Lamp	2x
5.	IR Transmitter	SFH482		2x
6.	IR Receiver	BPX65	PCB Header	2x
7.	Operational Amplifier	LM358P	Microcontroller	1x

Theory :

1.Resistor: A resistor is a passive electronic component that limits or regulates the flow of electric current in a circuit by providing resistance, measured in ohms (Ω). It converts electrical energy into heat and is commonly used to control voltage, current, and signal levels. Resistors come in various types, including fixed resistors with constant resistance, variable resistors (like potentiometers) for adjustable resistance, and special resistors designed for specific applications.



Fig. 2.1 various types of resistors [1]

2. IR Trasmmitter (BPX65): The IR Transmitter BPX65 is an infrared (IR) transmitter commonly used for emitting infrared light in electronic circuits. It operates by converting electrical signals into IR light, which is invisible to the human eye but detectable by IR receivers. The BPX65 is efficient, compact, and typically used in applications such as remote controls, optical sensors, and wireless communication systems. It is valued for its high reliability, fast response time, and ability to function effectively in various environments.



Fig. 2.2 IR transmitter [2]

3. IR Receiver (SFH482): The IR Receiver SFH482 is an infrared (IR) receiver designed to detect and respond to infrared light emitted by an IR transmitter. It converts the received IR signals into electrical signals for processing in electronic circuits. Known for its high sensitivity and compact design, the SFH482 is widely used in applications like remote control systems, IR communication, and proximity sensors. Its fast response time and reliable performance make it suitable for a variety of industrial and consumer applications.



Fig. 2.3 IR Receiver [3]

4. Led3mm: LED3mm is a light-emitting diode with a 3mm diameter, commonly used for indication and display purposes in electronic circuits. It emits light when an electric current flows through it, available in various colors like red, green, blue, and white. These LEDs are energy-efficient, have a long lifespan, and are ideal for compact applications due to their small size. They typically operate at low voltages (2-3V) and require a current-limiting resistor to prevent damage.

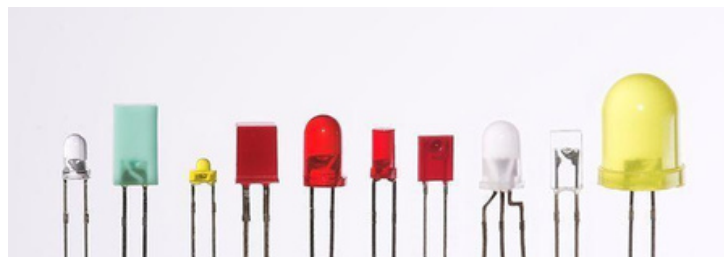


Fig. 2.4 Various types of sub miniature standard LED [4]

5. Potentiometer: A potentiometer is a three-terminal variable resistor used to adjust voltage or current in a circuit. It consists of a resistive element and a movable wiper that slides along the element, allowing for smooth and precise control of resistance. Potentiometers are commonly used in applications like volume controls, dimmer switches, and calibration settings. They come in various forms, such as rotary or linear, and are valued for their simplicity and versatility in adjusting electrical parameters.



Fig. 2.5 Potentiometer [5]

6. Operational Amplifier (LM358P): Operational amplifier LM311N is a high-speed operational amplifier (op-amp) commonly used as a voltage comparator. It compares two input voltages and provides a digital output, indicating which input is higher. It features low power consumption, wide supply voltage range, and fast response time. The LM311N can operate with a single or dual power supply and is commonly used in applications like zerocrossing detectors, oscillators, and signal conditioning.

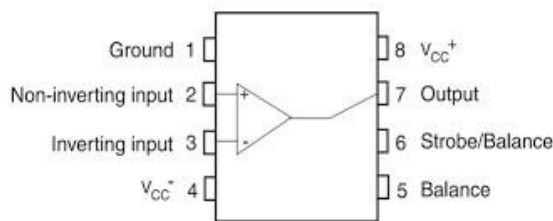


Fig. 2.6 LM358P [6]

Schematic diagram:

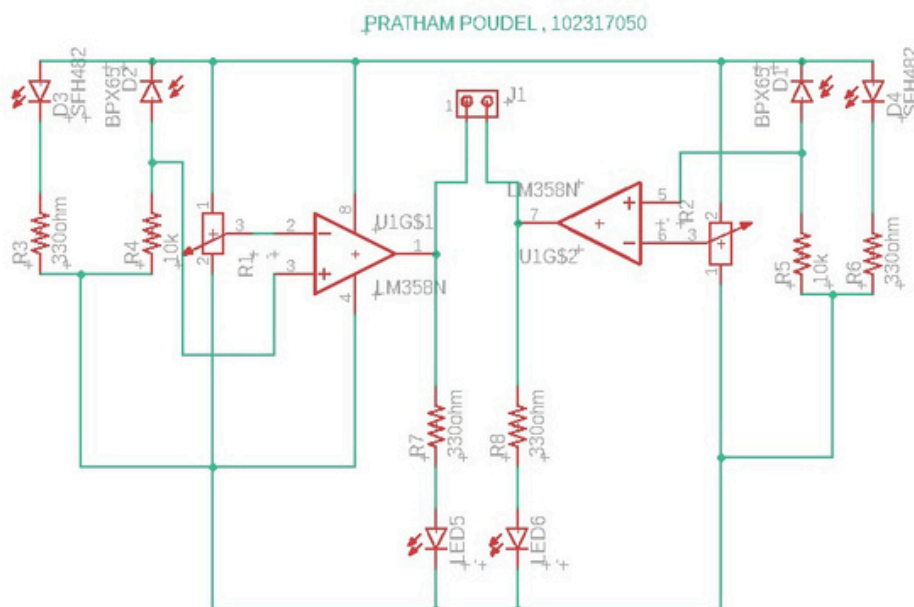
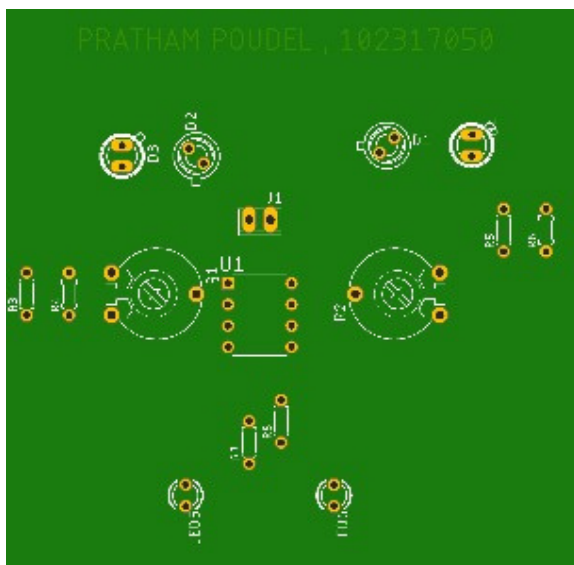
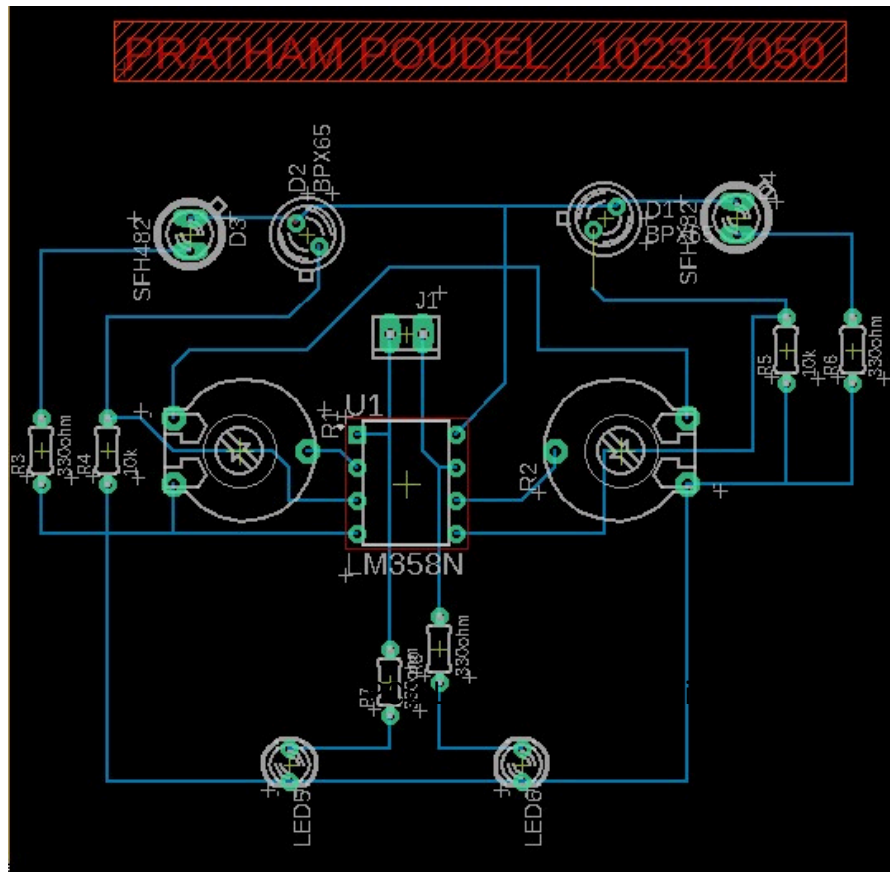
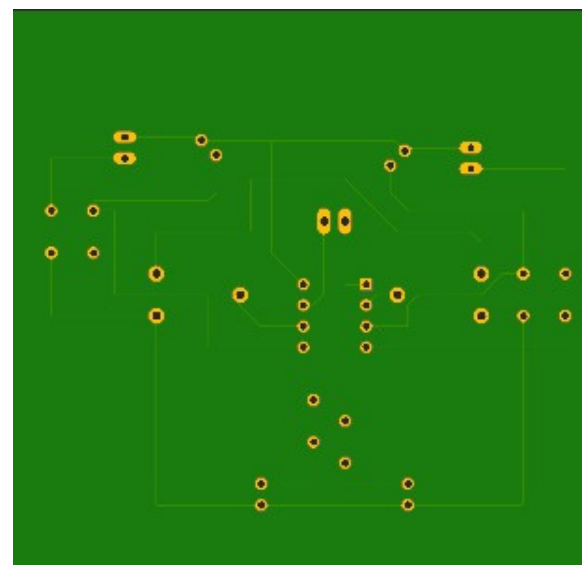


Fig. 2.7 Schematic diagram of IR circuit [7]

Printed Circuit Board layout:



TOP



BOTTOM

Fig. 2.8 PCB layout of IR circuit [8]

Discussion:

In this experiment, we have learnt how to draw a schematic diagram of IR sensor module circuit (required to move Buggy module on a predefined the path) using CAD tool (Eagle) and also to design a printed circuit board layout of IR sensor module circuit using CAD tool (Eagle).

Reference:

- [1] <https://www.electricaltechnology.org/2015/01/resistor-types-resistors-fixedvariablelinear-non-linear.html>
- [2] <https://byjus.com/physics/potentiometer-working/>
- [3] <https://robu.in/ir-sensor-working/>
- [4] <https://byjus.com/physics/types-of-led/>
- [5] <https://www.hackatronic.com/what-are-potentiometers-or-variable-resistors/>
- [6] <https://www.shutterstock.com/image-photo/operational-amplifier>
- [7] CAD tool (Eagle Software)
- [8] CAD tool (Eagle Software)

Signature of Faculty member

Experiment: 3

Objective:

- To draw a schematic diagram of pulse width modulation (PWM) based transmitter for generating specified pulse width waveforms for gantries placed at different locations on the path using CAD tool (Eagle).
- To design a printed circuit board layout of pulse width modulation (PWM) based transmitter using CAD tool (Eagle).

Software Used:Eagle Software

Component Used:

Sr. No	Name of Components	Value	Specifications	Quantity
1.	Resistor	220 Ω	Carbon Resistor with 5% Tolerance	1x
2.	Capacitor	1000nF	Electrolytic Capacitor	1x
3.	Capacitor	10nF	Ceramic Capacitor	1x
4.	DCJ0202	NA	DC Power Jack	1x
5.	led3mm	5V	Dome Lamp	1x
6.	IC 78L05Z	5V	Positive Voltage Regulator	1x
7.	22-23-2031	NA	PCB Header	1x
8.	ATTINY85	NA	Microcontroller	1x

Theory :

1. Resistor: A resistor is a passive electronic component that limits or regulates the flow of electric current in a circuit by providing resistance, measured in ohms (Ω). It converts electrical energy into heat and is commonly used to control voltage, current, and signal levels. Resistors come in various types, including fixed resistors with constant resistance, variable resistors (like potentiometers) for adjustable resistance, and special resistors designed for specific applications.



Fig. 3.1 Various types of resistors [1]

2. Capacitor: A capacitor is a passive electronic component used to store and release electrical energy in a circuit. It consists of two conductive plates separated by an insulating material called a dielectric. Capacitors are widely used for filtering, energy storage, signal

coupling, and timing applications. They come in various types, such as ceramic, electrolytic, and film capacitors, each suited for specific purposes. The key parameters of a capacitor include capacitance (measured in farads), voltage rating, and tolerance.

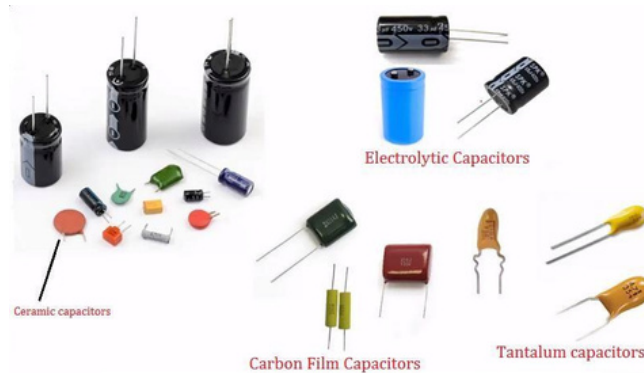


Fig. 3.2 Various types of capacitors [2]

3. Led3mm: LED3mm is a light-emitting diode with a 3mm diameter, commonly used for indication and display purposes in electronic circuits. It emits light when an electric current flows through it, available in various colors like red, green, blue, and white. These LEDs are energy-efficient, have a long lifespan, and are ideal for compact applications due to their small size. They typically operate at low voltages (2-3V) and require a current-limiting resistor to prevent damage.

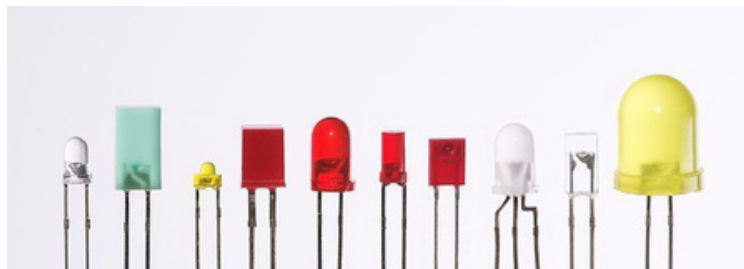


Fig. 3.3 Various types of sub miniature standard LED [3]

4. IC 78L05Z: The IC 78L05Z is a compact, fixed positive voltage regulator that provides a stable output voltage of 5V. It is part of the 78Lxx series, designed to deliver up to 100mA of output current. This IC is commonly used in low-power applications requiring a steady 5V supply, such as microcontroller circuits, sensors, and small electronic devices. It features builtin protection against overheating and overcurrent, ensuring reliable operation in various conditions.

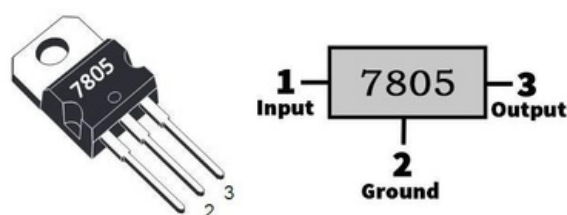


Fig. 3.4 Voltage regulator 78L05Z [4]

5. ATTTINY85: The ATTiny85 is a compact 8-bit microcontroller from Atmel's AVR series, designed for small-scale and low-power applications. It features 8 KB of flash memory, 512 bytes of RAM, and 512 bytes of EEPROM. With 6 I/O pins, it supports functions like ADC,

PWM, and serial communication, making it versatile for tasks like sensor interfacing, automation, and small embedded systems.

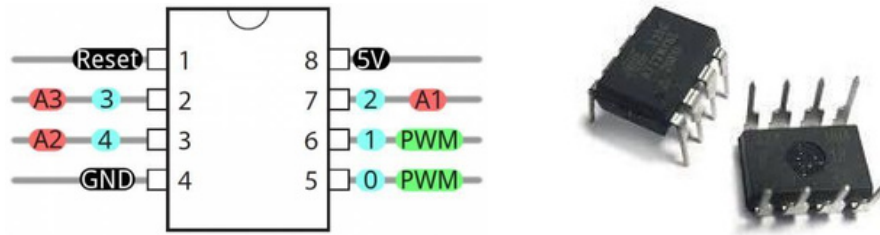


Fig. 3.5 IC ATTINY85 [5]

6.DCJ0202: This DCJ0202 is a novel anticancer agent designed to target and inhibit specific pathways associated with tumor growth and survival. It works by modulating key signaling mechanisms, such as apoptosis and cell cycle regulation, to promote cancer cell death while minimizing effects on normal cells. Currently under investigation, DCJ0202 shows promise in preclinical studies for treating various malignancies and may offer a new therapeutic option, especially for resistant cancer types.



Fig. 3.6 IC DCJ0202 [6]

7. 22-23-2031(MTA02-100): 22-23-2031 (MTA02-100) is a 2.54 mm pitch wire-to-board connector designed for reliable and efficient electrical connections in various applications. It features a compact design suitable for space-constrained environments and provides secure mating to ensure robust performance. Commonly used in industrial, automotive, and consumer electronics, this connector is valued for its durability and ease of assembly, making it a versatile solution for diverse wiring needs.

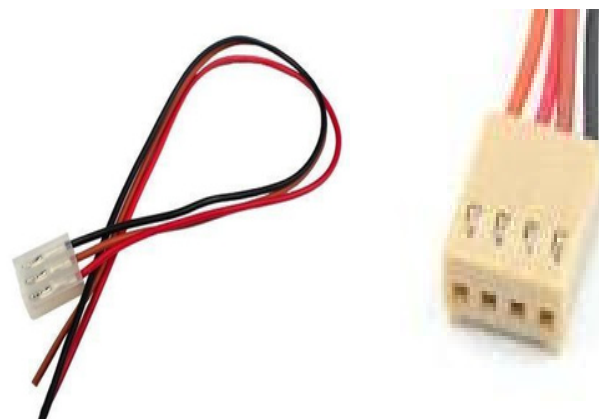


Fig. 3.7 Series female wire connector [7]

Schematic diagram:

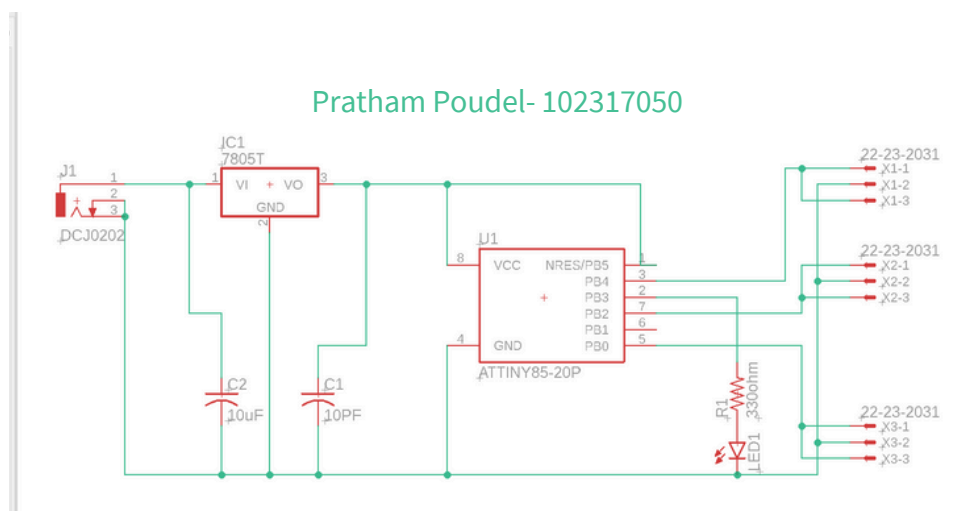


Fig. 3.8 Schematic diagram of Transmitter circuit [8]

Printed Circuit Board layout:

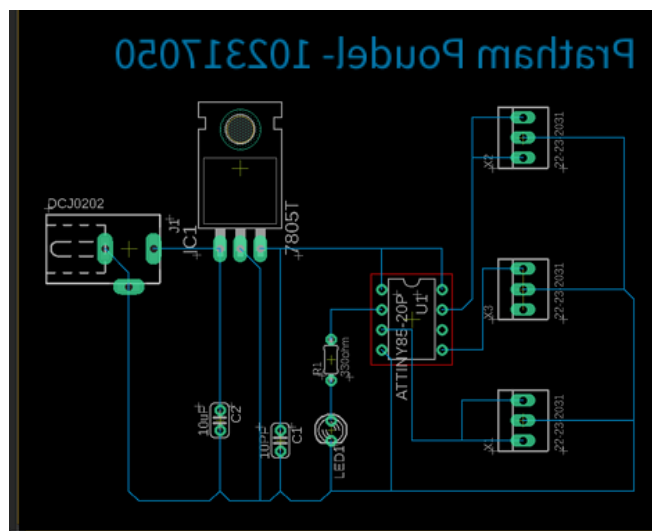
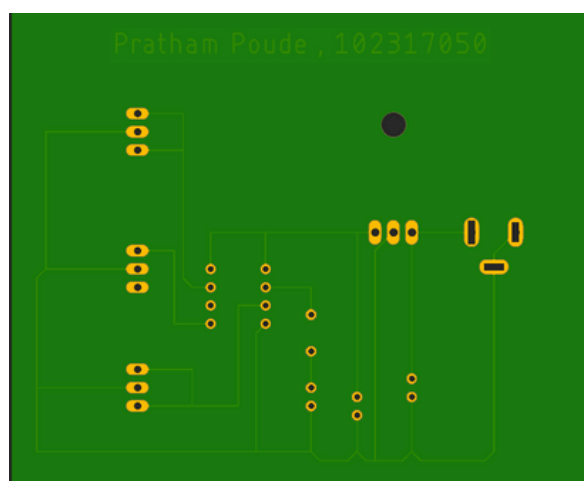
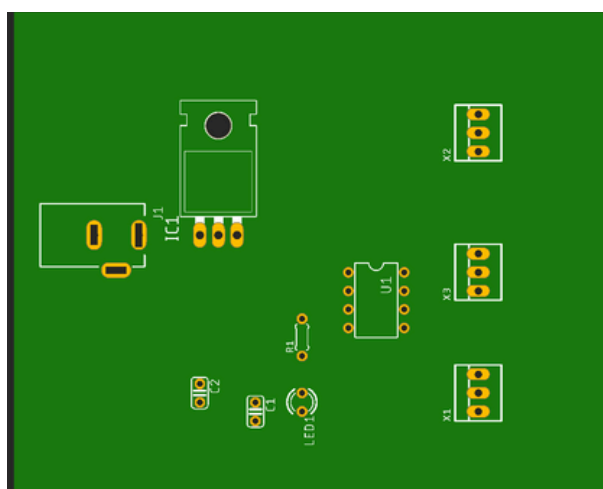


Fig. 3.9 PCB layout of Transmitter circuit [9]



Discussion:

In this experiment, we have learnt how to draw a schematic diagram of pulse width modulation (PWM) based transmitter for generating specified pulse width waveforms for gantries placed at different locations on the path using CAD tool (Eagle) and to design a printed circuit board layout of pulse width modulation (PWM) based transmitter using CAD tool (Eagle).

Reference:

- [1] <https://www.electricaltechnology.org/2015/01/resistor-types-resistorsfixed-variablelinear-non-linear.html>
- [2] <https://gct.co/dc-power-jack>
- [3] <https://www.electromaker.io/>
- [4] <https://byjus.com/jee/capacitor-types-and-capacitance/>
- [5] <https://www.amazon.in/attiny85-ic/s?k=attiny85+ic>
- [6] <https://robu.in/product/male-female-2-15-5mm-dc-power-jack-adapter-connector-plug-cctv-camera/>
- [7] <https://www.ktron.in/product/4-pin-2510-series-female-cable-11-inch/?v=c86ee0d9d7ed>
- [8] CAD tool (Eagle Software)
- [9] CAD tool (Eagle Software)

Signature of Faculty member