A Practical activity Report submitted

for Engineering Design Project-II (UTA-024)

by

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Submitted to

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INDIA

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Experiment No. 1

Objective:

To solder a Reciver Circuit circuit t receive IR signals from gantries connected to transmitter circuit on a printed circuit board

Software Used: Eagle Software

Component Used:

Sr. No.	Name of Component	Value	Specifications
1.	Resistor	330 Ω	Carbon Resistor with 5% Tolerance
2.	Capacitor	1uF	Electrolytic Capacitor
3.	Capacitor	10pF	Electrolytic Capacitor
4.	DCJ0202		DC Power Jack
5.	HLMP6	5V	. Dome Lamp
6.	IC 78L05Z	+5V	Positive Voltage Regulator
7.	22-23-2031		PCB Header
8.	ATtiny 45		Microcontroller

Theory:

1. *Resistor:* Resistor is a passive two-terminal device designed to have the property of electrical resistance. In electronic circuits resistors are used to reduce the current flow. It is usually desirable that a resistor should obey Ohm's law and have a resistance that is fairly stable against temperature changes. The behaviour of an ideal resistor is given by Ohm's law:

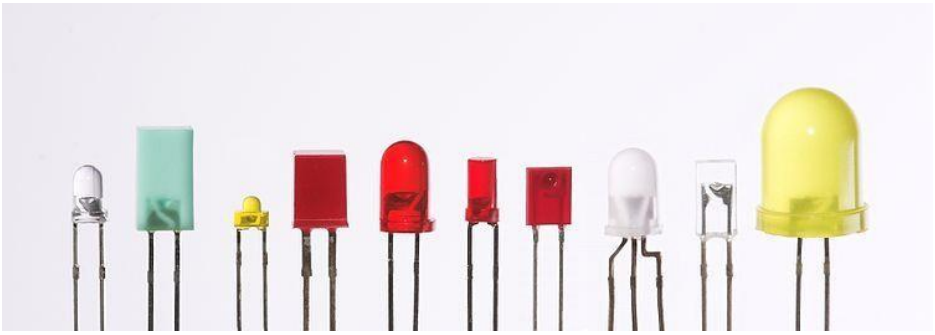
$$V = I.R$$

Various type of Resistors

2. *Capacitor:* A capacitor is an electrical component used to control the flow of charge in a circuit. Capacitors consist of two conducting surfaces separated by an insulator; a wire lead is connected to each surface. One plate accumulates positive charge and the other negative charge. A capacitor can store electric energy and discharge it at a determined rate.

Various types of Capacitors

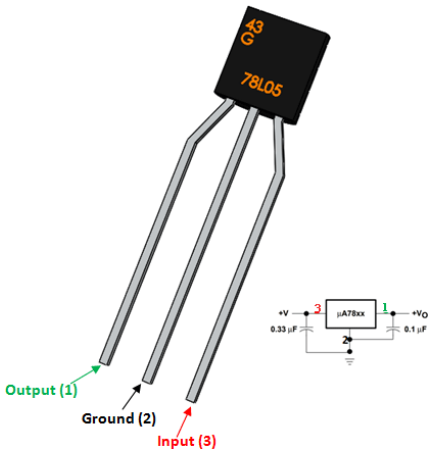
3. *HLMP6:* HLMP 6 is a sub miniature standard red LED lamp with tinted/diffused lens. They emit a light with a wavelength that is red in colour and goes from approximately 610-760nm on the dominant wavelength scale.



Various types of sub miniature standard LEDs

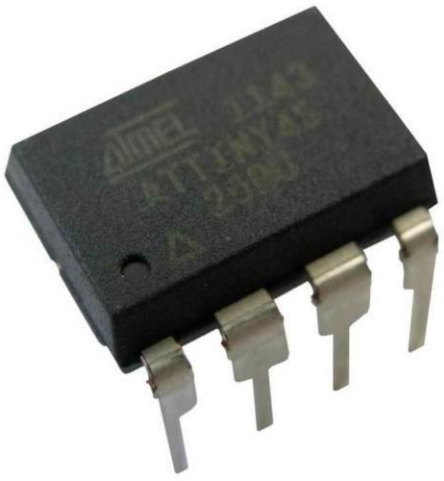
4. *IC 78L05Z:* 78L05Z is a fixed positive voltage regulator that:

    - Constant +5V output regulator to power small loads of less than 100mA
    - Adjustable Output Regulator
    - Current Limiter for certain applications
    - Output Polarity-Reversal-Protection Circuit
    - Output booster circuit



Voltage regulator 78L05Z

5. *ATtiny 45:* ATtiny 45 is a low-power easy to program CMOS 8-bit microcontroller device based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATtiny 45 achieves throughputs approaching 1MIPS per MHz allowing to optimize power consumption versus processing speed.



ATtiny 45

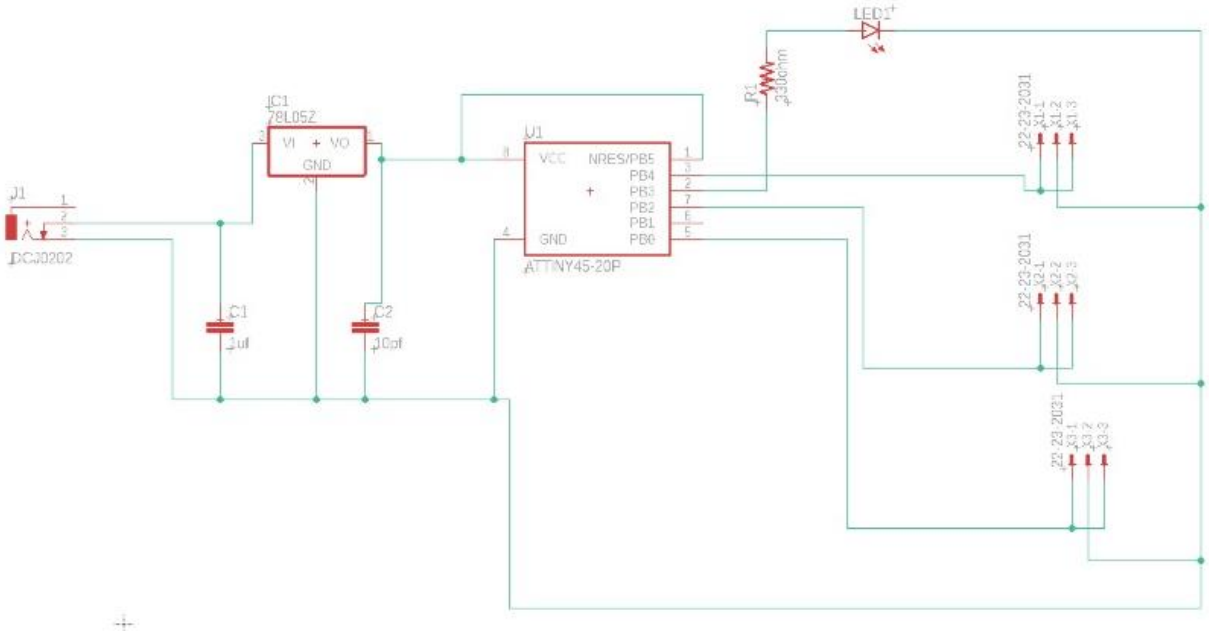
6. *DCJ0202:* This is a common barrel-type DC connector/power jack that supplies directcurrent. These have a 5.5mm jack with a 2.1mm centre pole diameter.

DCJ0202

7. *22-23-2031:* 22-23-2031 is a 2.54 mm pitch wire to board connectors and three contacts. It has nylon housing material.

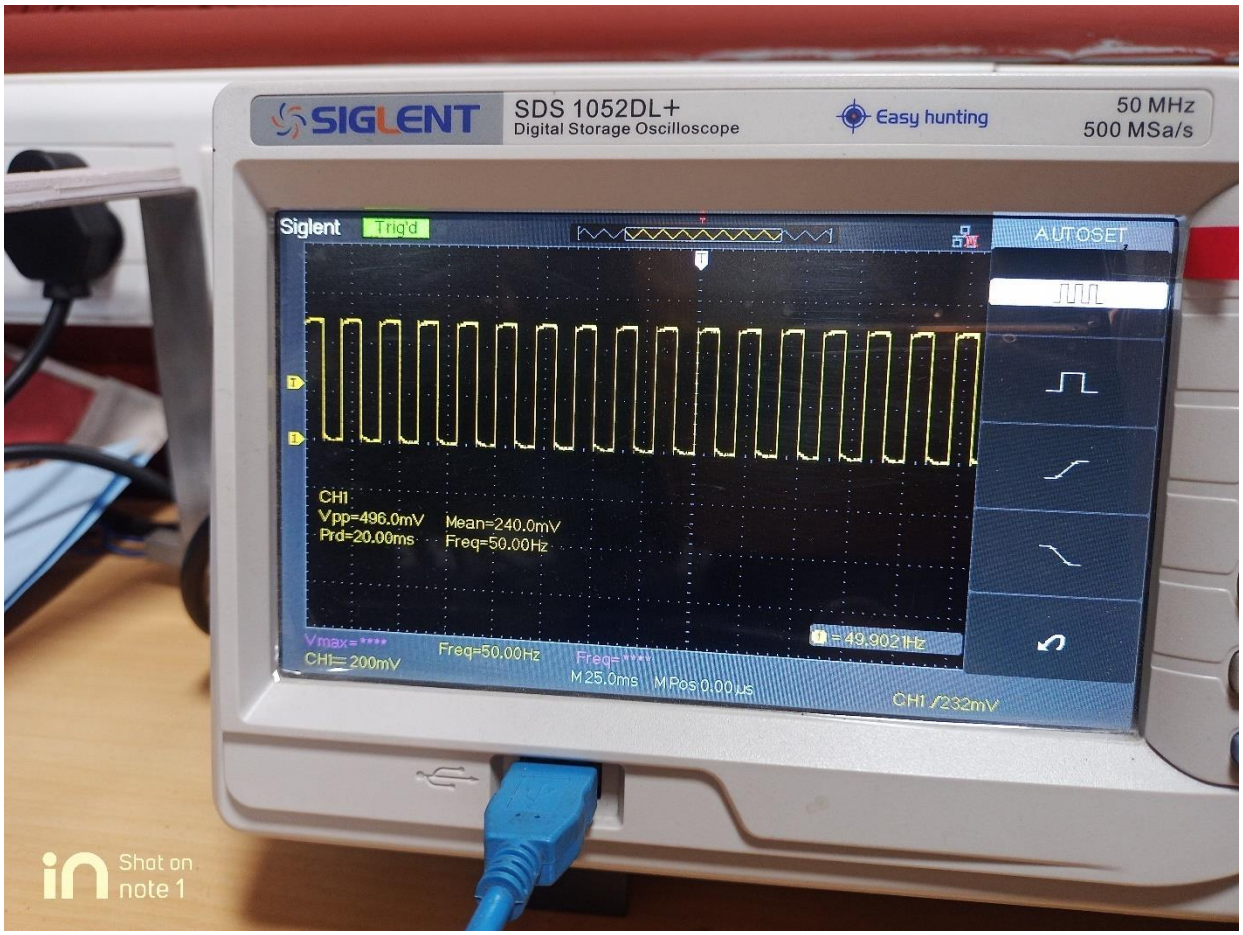
22-23-2031

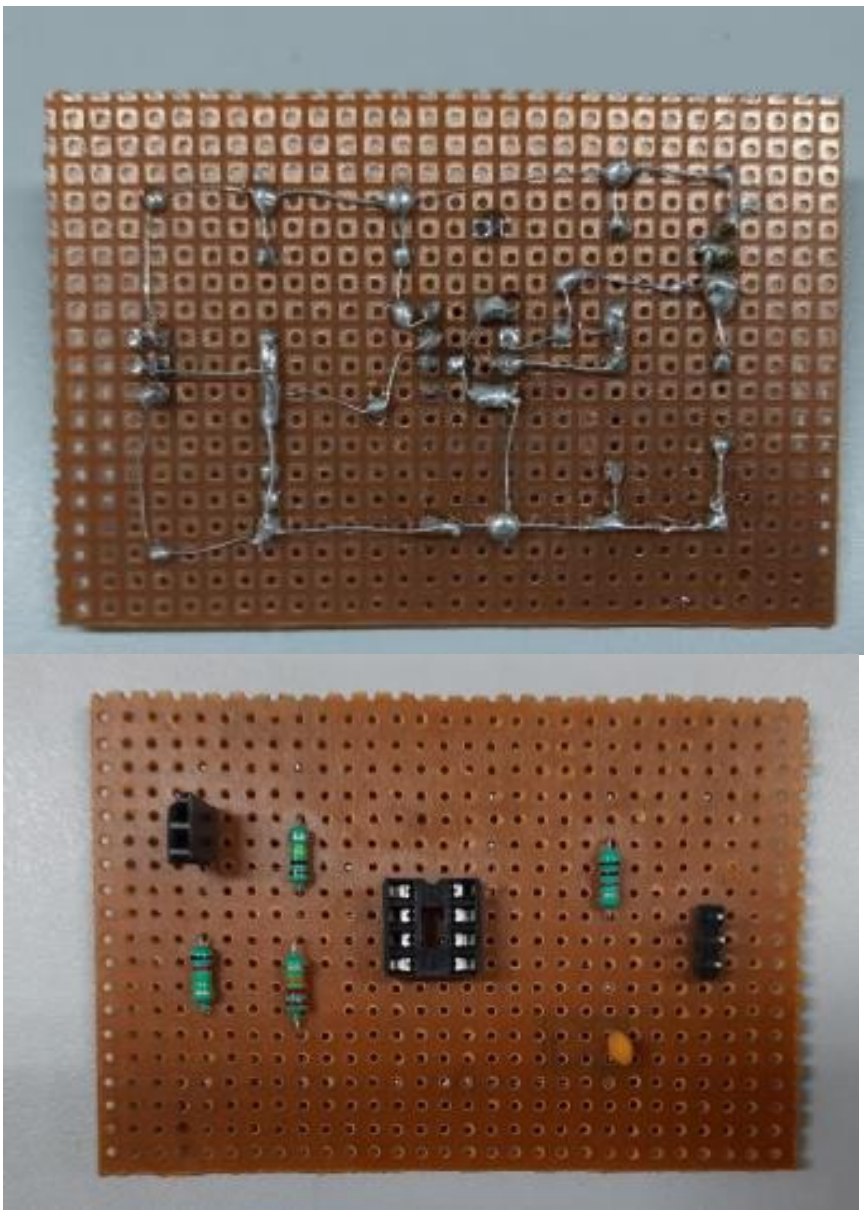
Schematic diagram:



Schematic diagram of Transmitter circuit

Circuit image and result:





Discussion:

In this experiment, we have learnt about a new microcontroller i.e., ATtiny45 and different electrical components. We learnt about pulse width modulation and how to make schematic design of the circuit and PCB layout of the PWM transmitter on EAGLE software. This circuit design will be used in the project buggy using different electrical components such as resistors and capacitors.

Signature of Faculty member

Experiment No. 2

Objective:

To solder and test and verify pulse width modulation (PWM) based transmitter circuit(for gantries placed at different location on the path to b followed by buggy robot) on a printed circuit board(PCB.)

Component Used

Sr. No	Name of Components	Value	Specifications
1.	Resistor	120K Ω	Carbon Resistor with 5% Tolerance
2.	Resistor	100KΩ	Carbon Resistor with 5% Tolerance
3.	Resistor	22 KΩ	Carbon Resistor with 5% Tolerance
4.	Resistor	1 KΩ	Carbon Resistor with 5% Tolerance
5.	Capacitor	10pF	Ceramic Capacitor
6.	LM311D		Voltage Comparator
7.	MBD701		Schottky diode

Table 5.1 List of components used

Theory:

This circuit receives the signal and the voltage comparator analyses the signal to either carry forward the current or to cut the supply to the further circuit. The diode used is for faster operation of the circuit as this diode has fast switching speeds. We also the use of PCB headers and how it helps connect different components on to one circuit board.

Components Used:

1. **Resistor:**

   A resistor is a 2-terminal electric component which is used to reduce the flow of current in an electric circuit. It is also used in Integrated Circuits and is used to avoid any damage to other low voltage components like a LED. The electrical function is defined by its magnitude of resistance and its units are in Ohm (Ω).

Resistor

2. Capacitor:

A capacitor is a passive 2-terminal electrical component and it stores potential energy in an electric field. It charges initially but even after the power supply is shut, the capacitor can still provide charge to other components in the electric circuit.

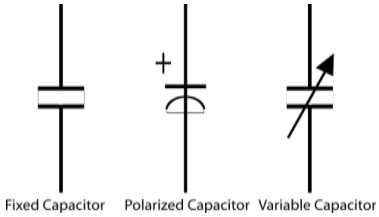


Fig 5.2 Capacitors

3. Schottky Diode:

This diode has very high switching speeds due to its low forward voltage requirement. It is actually a semiconductor diode and compared to a silicon diode, it has very low voltage drop so it is more efficient. This diode is used as a rectifier as it has very less power loss.

Fig 5.3 Schottky Diode

4. Voltage Comparator:

This device compares the values of the input voltages and gives the output as which is bigger in magnitude. It has two analog input terminals V+ and V- and one binary digital output Vo. The most common used comparator is a high-gain differential amplifier. The outputs can be open-drain output or push-pull output. We get the outputs near to the supply voltage which in our case is +5V.

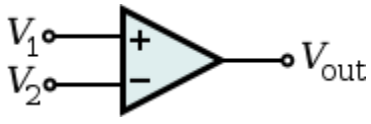
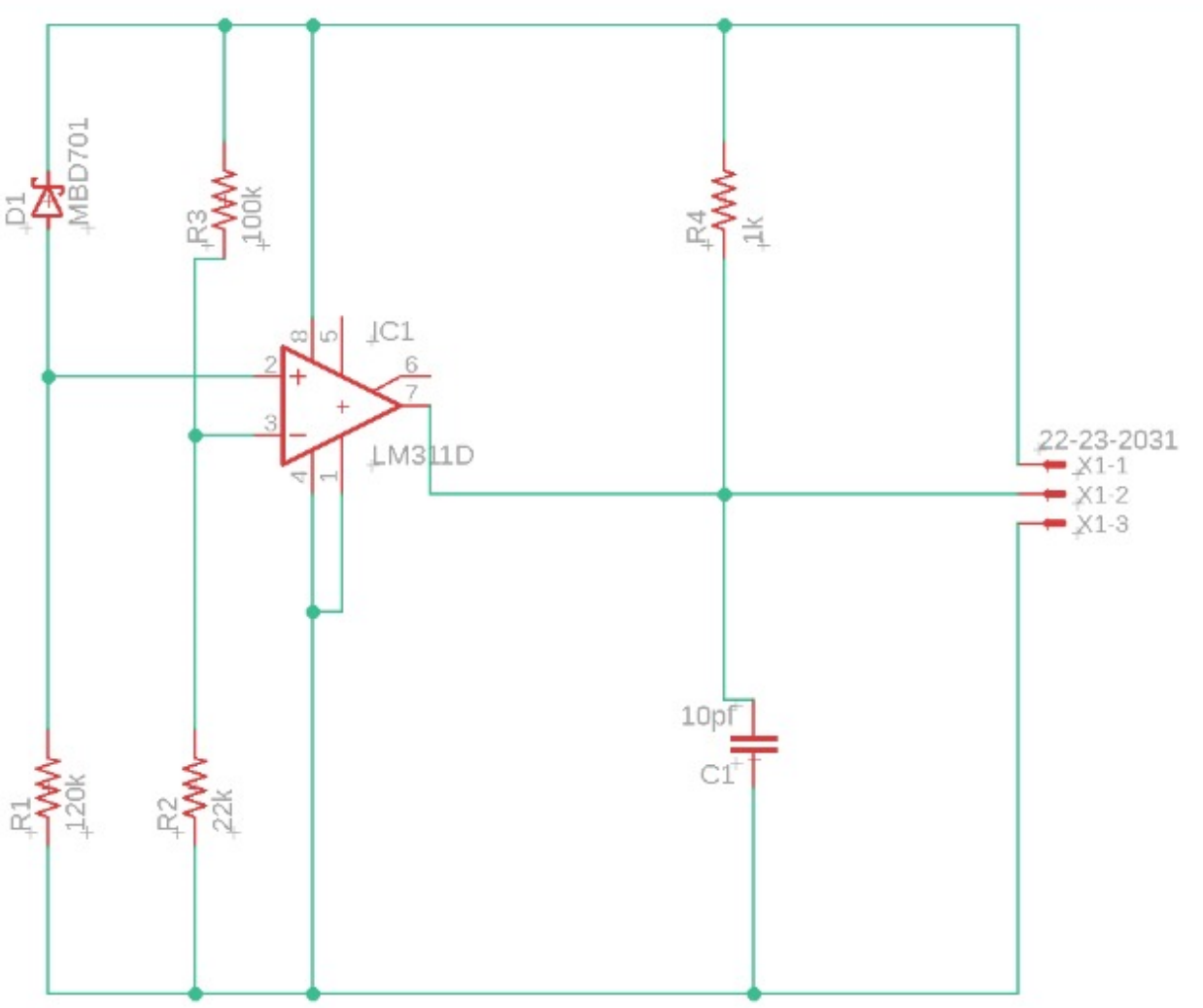


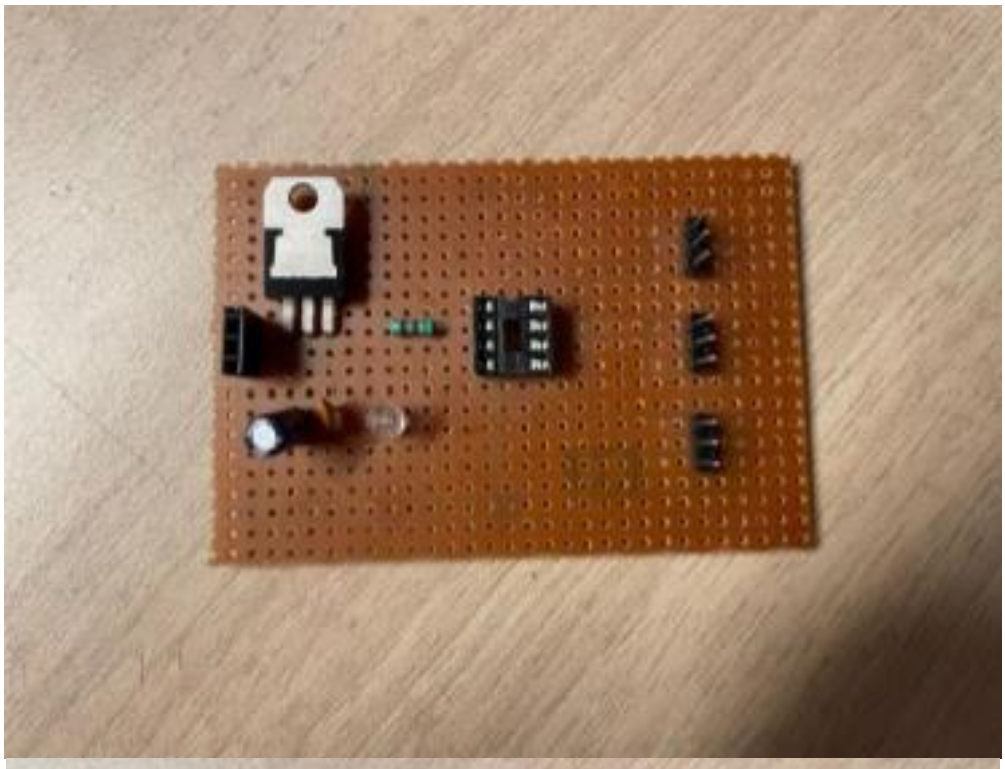
Fig 5.4 Voltage Comparator

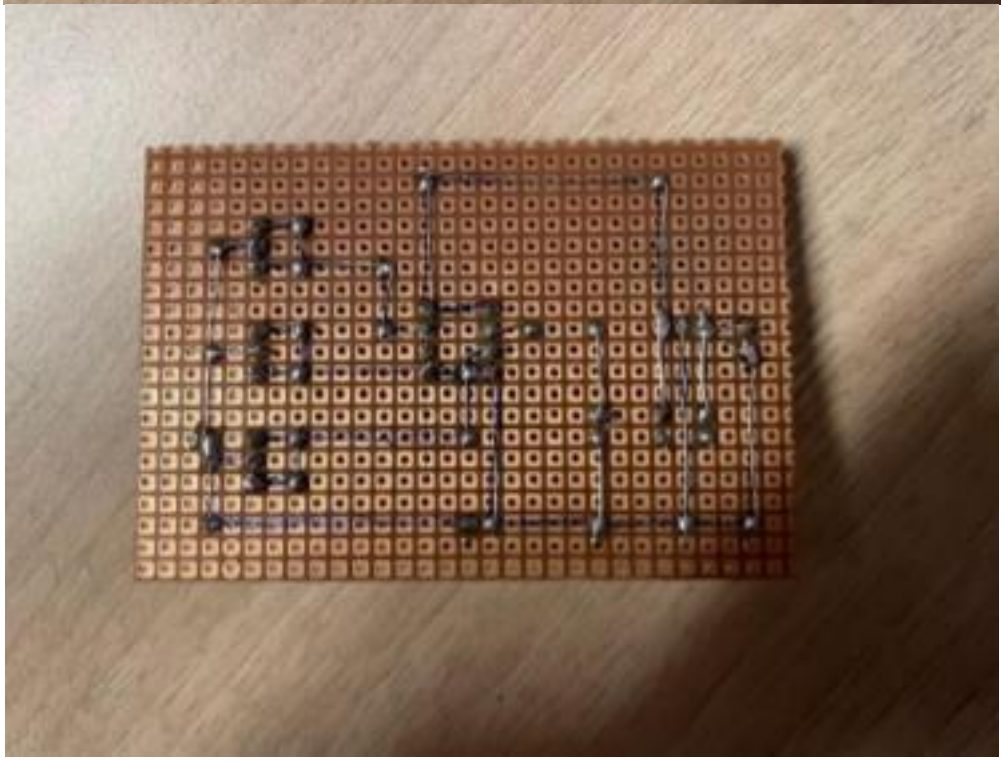
Schematic Diagram:



Schematic diagram of Receiver circuit

CIRCUIT IMAGE:





Discussion:

In this experiment we have learnt:

- Soldering of components onto a printed circuit board.
- Validating the connections using a multimeter.
- The use of this particular circuit on buggy and how it interacts with the receivercircuit.

Signature of Faculty member

Experiment No. 3

Objective: To solder and test an IR sensor module (which helps Buggy robot to move on a predefined path) on a printed circuit board (PCB).

Components Used:

Sr. No.	Name of Components	Value	Specifications
1.	Resistor	10K ohm	Carbon Resistor with 5% Tolerance
2.	Resistor	330 ohm	Carbon Resistor with 5% Tolerance
3.	LMV358MM		Operational Amplifier
4.	BPX65		Photodiode
5.	SFH482		Photodiode
6.	Potentiometer		3-terminal resistor
7.	MTA02-100		AMP Connector
8.	LED		A two-lead semiconductor light source

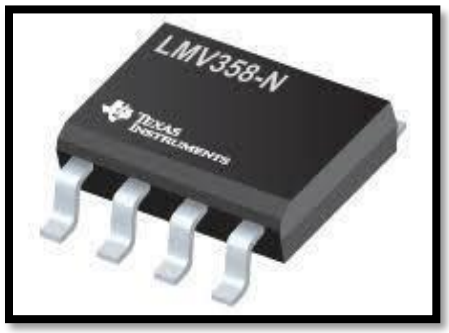
List of components used

Theory:

1. Resistor: Resistors are electronic components which have a specific, never-changing electrical resistance. They only consume power and cannot generate it, meaning they are passive components. They are used mainly to limit current, divide voltages, and pull-up I/O lines. They are usually added to circuits where they complement active components.

Resistor

2. LMV358MM: LMV358 is a single or dual low-voltage op amp with rail-to-rail output swing. This device is a cost-effective solution for applications where low-voltage operation, space-saving, and low cost are needed. This amplifier is designed specifically for low-voltage (2.7 V to 5 V) operation.



LMV358MM

3. BPX65: A device that converts light into an electrical current. The current is generated when photons are absorbed in the photodiode. They may contain optical filters, built-in lenses, and mayhave large or small surface areas.

BPX65

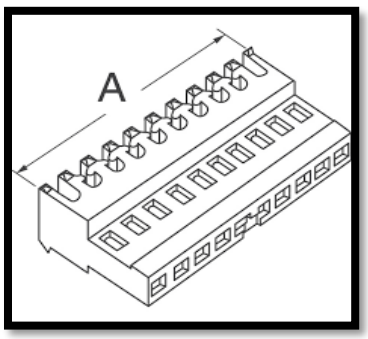
4. SFH482: It is used as a transmitter to make the schematic circuit complete in the IR receiver circuit.

SFH482

5. Potentiometer: A three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

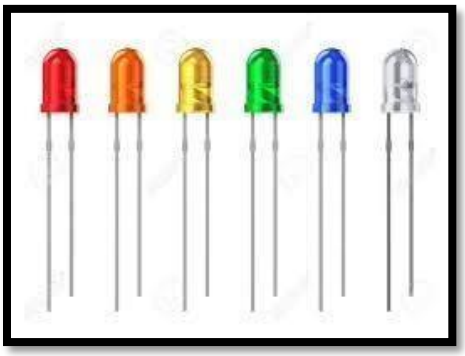
Potentiometer

6. MTA02-100: The MTA connector system is a wire-to-board and wire-to-wire system basedon insulation displacement contact (IDC) technology.



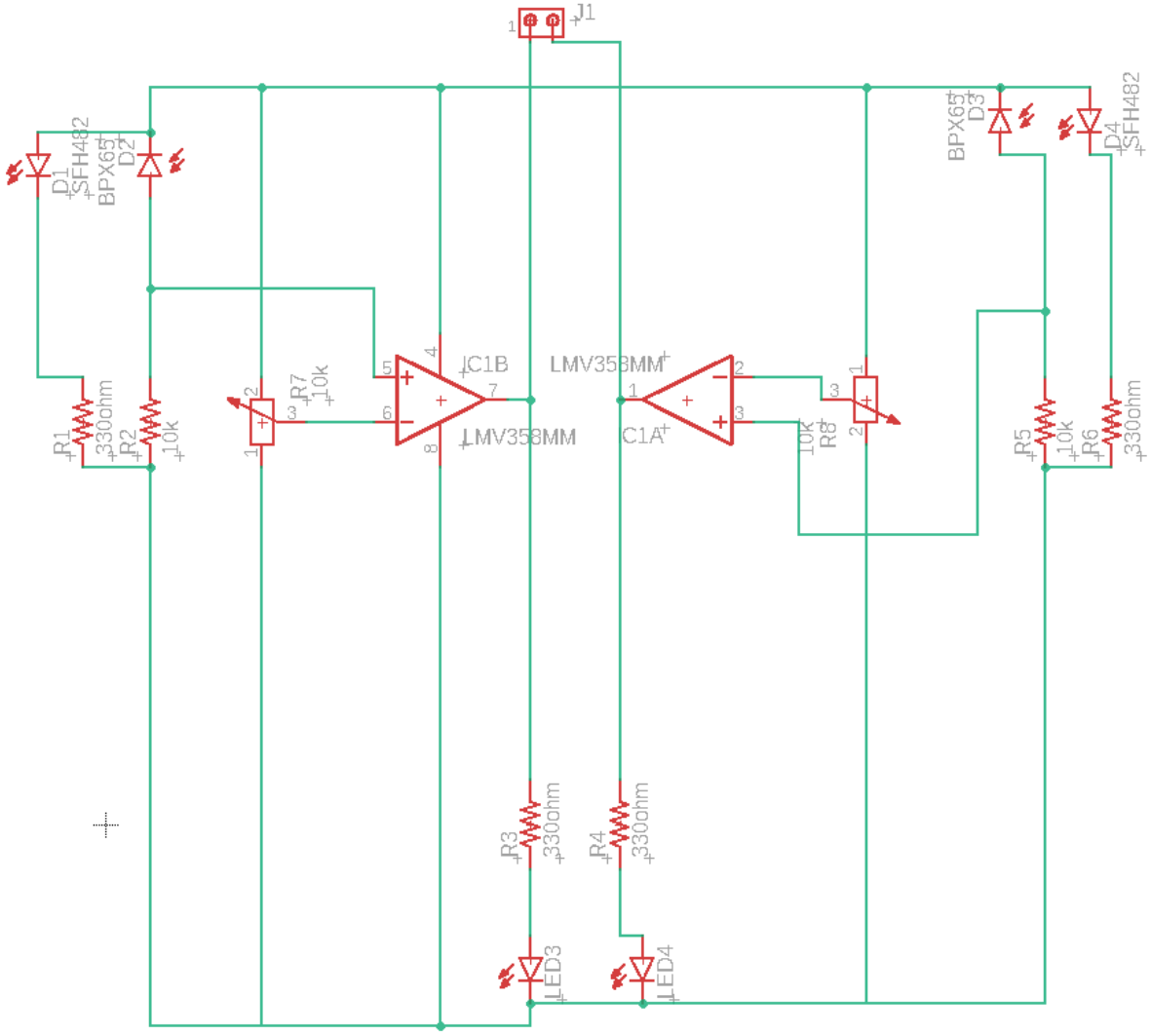
MTA02-100

7. LED: An LED (light-emitting diode) is a semiconductor light source that emits light when current flows through it.



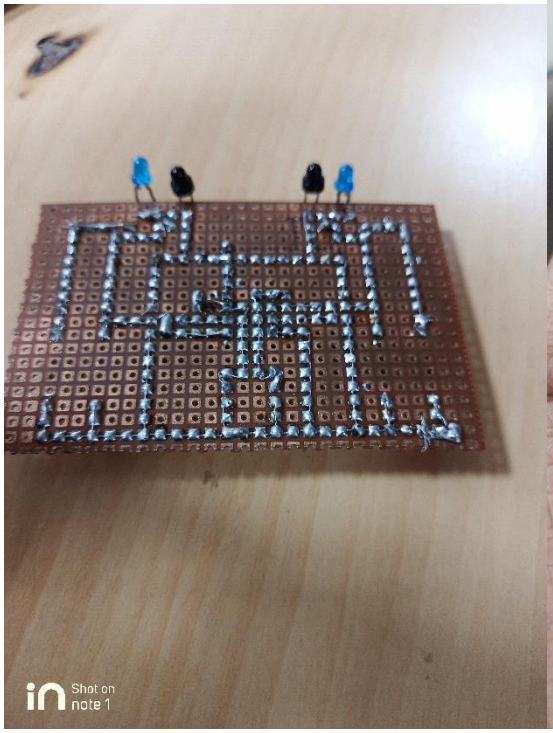
LED

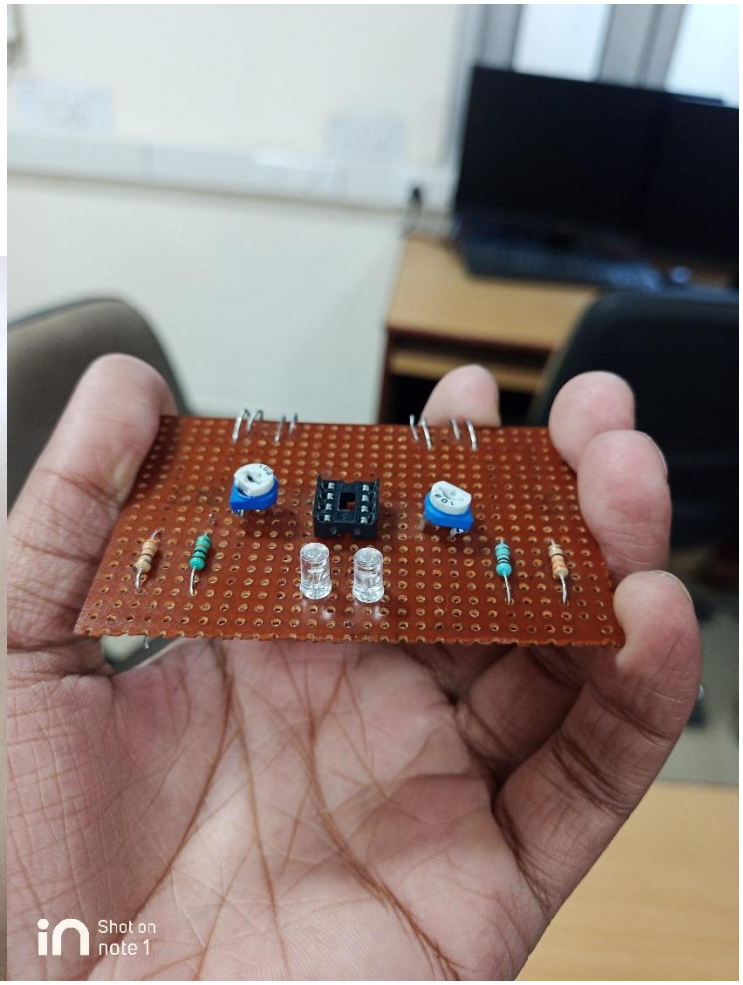
Schematic Diagram:



Schematic diagram of IR Sensor Circuit

CIRCUIT IMAGE:





Discussion: In this experiment, we learnt how to place and solder the IR Sensor circuit on the Printed Circuit Board layout.

Signature of Faculty member