

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 :

Resistor: Resistors are electronic components which play several crucial roles in shaping the electrical characteristics of the circuit and ensuring proper operation. Here are some common uses of resistors in a transmitter circuit:

1. **Biasing and DC Stabilization:** Resistors are often used to establish biasing points for transistors or other active components within the transmitter circuit. This helps to ensure that these components operate within their linear and stable regions.
2. **Load Resistor:** In the output stage of a transmitter, resistors are used as load resistors to control the current and voltage levels. This ensures proper matching between the output stage and the subsequent stages.
3. **Temperature Stabilization:** In some cases, resistors with specific temperature coefficients are used to stabilize the temperature-dependent characteristics of certain components.
4. **Filtering:** Resistors are used in conjunction with capacitors to create RC (resistor-capacitor) filter networks. These networks help in filtering out unwanted noise and signals, providing a smoother response.

5. Termination: Resistors are used for impedance matching and termination. Matching the impedance of various stages of the circuit ensures maximum power transfer and prevents signal reflections.

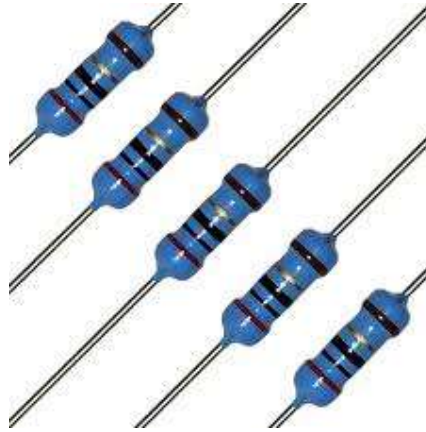


Fig. 3.1 Various types of resistors [1]

Capacitors play several crucial roles in transmitter circuits, depending on the specific type of transmitter and its intended purpose. Here are some common functions:

Tuning:

- 1 Resonant circuits: In oscillators, capacitors are paired with inductors to create resonant circuits that determine the operating frequency of the transmitter. By adjusting the capacitance, you can fine-tune the transmitted signal to a specific frequency.
- 2 Matching networks: Capacitors and inductors can be used together to create matching networks that ensure efficient transfer of power from the transmitter to the antenna. This minimizes signal reflections and maximizes power reaching the receiver.

Filtering:

Power supply filtering: Capacitors smooth out fluctuations in the power supply voltage, providing a clean and stable power source for the transmitter's electronics.

- 1 Signal filtering: Capacitors can filter out unwanted noise or harmonics from the transmitted signal, improving its quality and reducing interference with other signals



Fig. 3.2 Various types of capacitors [2]

Led3mm: Led3mm is a sub miniature standard red . its main purpose are

- 1 **Signal Strength Indicator:** LED brightness can be controlled based on the received signal strength, offering a visual indication of reception quality. This helps users tune the antenna or adjust gain for optimal reception.
- 2 **Power Indicator:**
A simple LED connected to the power supply indicates if the transmitter is turned on and receiving power. This is a basic but helpful visual clue.
- 3 **Fault Indicator:**
LEDs can light up or blink in a specific pattern to indicate potential problems within the transmitter circuit, such as low battery, overheating, or signal overload. This helps users identify and troubleshoot issues.
- 4 **Decorative Lighting:**
In some designs, LEDs are used for purely aesthetic purposes, adding a visual element to the transmitter



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

IC 78L05Z: The IC 78L05Z is a voltage regulator integrated circuit (IC) commonly used in electronic circuits to provide a stable 5-volt DC output voltage. Here are some common uses of the 78L05Z are:

- 1 **Voltage Regulation:** The primary purpose of the 78L05Z is to regulate an input voltage (which

can range from around 7 to 30 volts typically) down to a steady 5 volts. This stable voltage output is essential for powering various components in a circuit, such as microcontrollers, sensors, and other integrated circuits.

- 2 **Power Supply:** The 78L05Z can be used as a building block for creating a simple, low-current power supply. When combined with appropriate input and output capacitors, it can provide a reliable and regulated voltage source for powering small electronic devices or circuits.
- 3 **Voltage Conversion:** In some cases, the 78L05Z may be used for voltage conversion purposes, stepping down a higher input voltage to a lower, more manageable level for specific components or subsystems within a larger circuit.
- 4 **Voltage Stabilization:** It helps stabilize the voltage supply in systems where a stable and consistent voltage level is required for proper operation. This is particularly important in sensitive electronic circuits to ensure reliable performance and prevent damage to components.

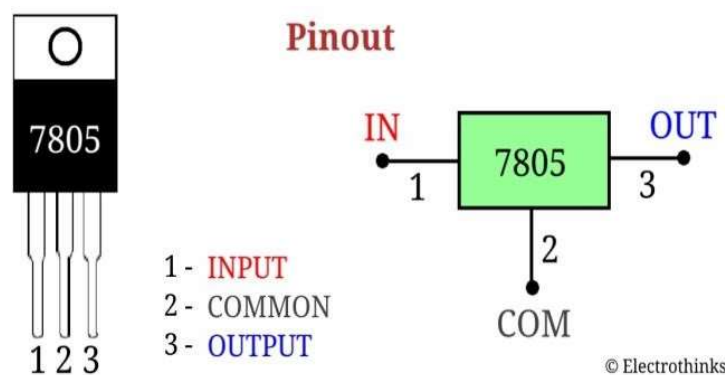


Fig. 3.4 Voltage regulator 78L05Z [4]

ATTINY85: The ATTiny85 is a versatile little microcontroller used in various circuits due to its low power consumption, small size, and reasonable processing power. Here are some common applications:

Basic Circuits:

- 1 **LED Blinking:** This is a beginner-friendly project to get familiar with the ATTiny85. You can connect LEDs to its I/O pins and program it to blink them in different patterns.
- 2 **Simple Sensors:** Interface sensors like temperature sensors, light sensors, or pushbuttons to your ATTiny85 and read their values. You can then use this information to control LEDs or other outputs.
- 3 **PWM Control:** Use Pulse Width Modulation (PWM) to control the brightness of LEDs, the speed of motors, or the volume of speakers.
- 4 **Data Logging:** Use the ATTiny85 to collect data from sensors and store it in its internal memory or external storage like an SD card.

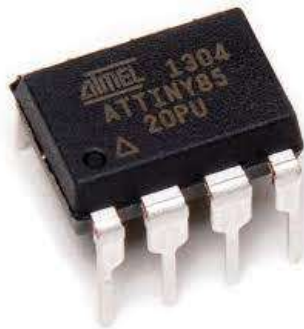


Fig. 3.5 IC ATTINY85 [5]

DCJ0202: This is a common barrel-type Here are some potential general uses for a component like DCJ0202 in a transmitter circuit:

- 1 Connector: DCJ0202 could be a type of connector used for external connections to the transmitter circuit, such as for antenna connections, power input, or data connections.
- 2 DC Jack: The "DCJ" in the designation might indicate that it's a DC jack, which could be used for supplying power to the transmitter circuit from an external DC power source.
- Switching Component: It could be a type of switch or relay used for controlling different
- 3 modes or functions within the transmitter circuit, such as switching between transmit and receive modes.
- 4 Protection Diode: It might serve as a protection diode to prevent reverse voltage or current flow in the circuit, safeguarding sensitive components from damage.



Fig. 3.6 IC DCJ0202 [6]

22-23-2031(MTA02-100): Series female wire connectors are commonly used in electrical circuits to securely connect wires together. These connectors typically consist of a housing with slots or receptacles where wires can be inserted, and they may feature mechanisms such as screws or clamps to hold the wires in place.

Here are some general uses of series female wire connectors in circuits:

1. Wire Splicing: Female wire connectors can be used to splice together two or more wires, allowing electrical current to flow between them. This is useful for extending wires or connecting wires of different colours or gauges.
2. Component Connection: They can be used to connect wires to electrical components such as

switches, relays, sensors, or terminals on circuit boards. This facilitates the connection and disconnection of components without soldering.

3. **Branching:** Female wire connectors can also be used to create branches in a circuit, allowing one wire to split into multiple paths. This is common in situations where multiple devices need to be powered from a single source.
4. **Repair and Maintenance:** They are often used in repair and maintenance work to replace damaged connectors or to modify existing wiring configurations.



Fig. 3.7 Series female wire connector[7]

Schematic diagram:

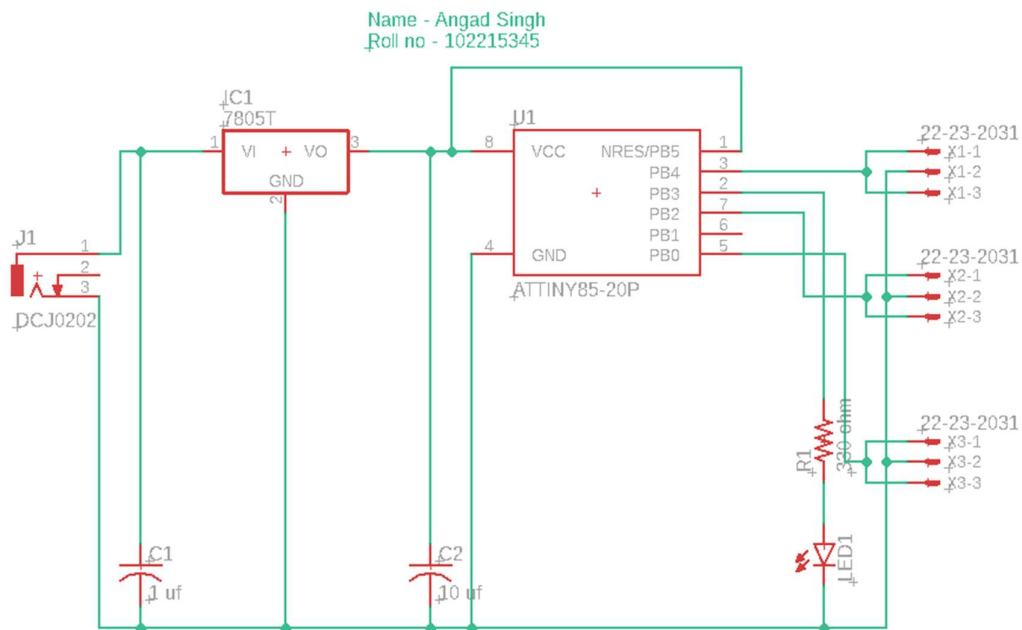


Fig. 3.8 Schematic diagram of Transmitter circuit

Printed Circuit Board layout:

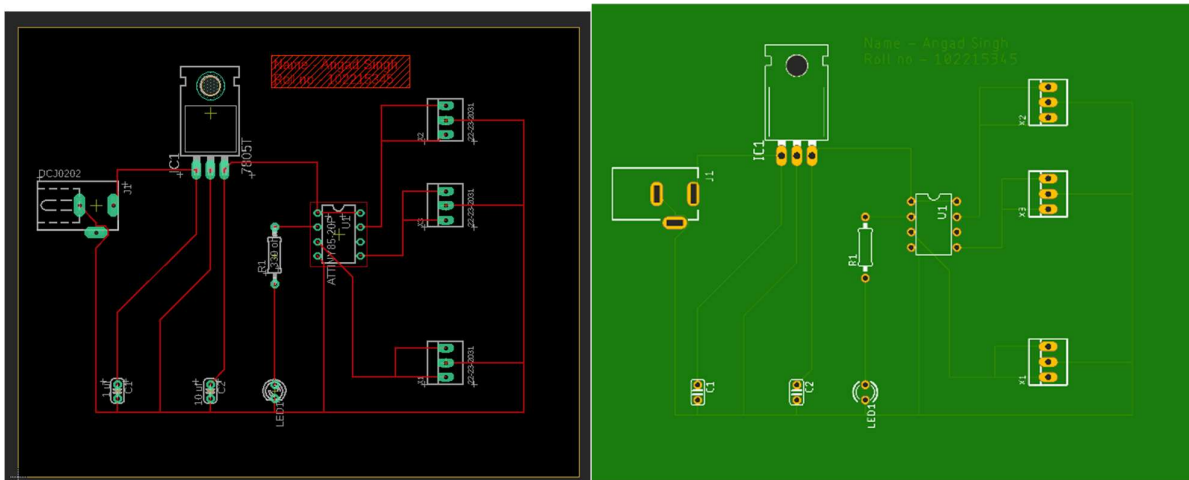


Fig. 3.9 PCB layout of Transmitter circuit

Discussion:

In this experiment, we have learnt how to use Eagle software and to draw a schematic diagram of circuit and printed circuit board layout of circuit. we also get to know about various components used in the circuits and their utilization and also learned how to interface them

Key aspects are:

- Pulse Width Modulation (PWM): This technique regulates the average power of a signal by altering the pulse width within a fixed period. In this case, it will be used to modulate the signal sent to the gantries.
- Gantries at different locations: This suggests a multi-point communication system where each gantry receives a unique pulse width signal.
- CAD tools (Eagle): You plan to use Eagle software to design both the schematic and PCB layout of the transmitter.

Reference:

[1] <https://learnabout-electronics.org/Digital/dig57.php>

[2] <https://forum.allaboutcircuits.com/threads/resistors-in-receivers.15002/>

[3] <https://circuitbasics.com/what-are-light-emitting-diodes-led/>

[4] <https://components101.com/regulators/78l05-pinout-equivalent-datasheet>

[5] <https://www.microchip.com/en-us/product/attiny85>

[6] <https://www.mouser.com/ProductDetail/Amphenol>

[7] <https://in.element14.com/molex/22-23-2031/connector-header-3pos-1row-2-54mm>

Signature of Faculty member

