MINI PROJECT REPORT

Entitled

" ELECTRONIC DECISION MAKER "

Submitted in partial fulfillment for the Subject

"ELECTRONIC DEVICES & CIRCUITS"
(EC108)

: Submitted By :

Ms. Ekta Kumari Khanda
Admission No. U23EE003
Ms. Vedika Tomar
Admission No. U23EE001

B. TECH. I (Electrical) 2nd Semester

: Mini Project Guide :

Prof. N. B. Kanirkar
Associate Professor, DoECE.
&

Mr. Amit Verma	**Mr. Ashok Parmar**
Lab Teacher & PhD Scholar	**Lab Teacher & PhD Scholar**

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DEPARTMENT OF ELECTRONICS ENGINEERING
Sardar Vallabhbhai National Institute of Technology
Surat-395 007, Gujarat, INDIA.

Chapter 1-ACKNOWLEDGEMENT

In recognition of their invaluable contributions,We would like to express our sincere gratitude to Prof. N. B. KANIRKAR(Subject coordinator) for providing insightful guidance and technical expertise throughout the project.

We are also indebted to the Electronics Department for their generous support in the form of essential resources and facilities that made this project possible.

CHAPTER 2- INTRODUCTION

ELECTRONIC DECISION MAKER

In the realm of playful electronics, We would like to introduce the electronic decision maker.

This innovative device utilizes the principles of electronics and probability to provide random “yes” or “no” output. Ideal for setting minor dilemmas or injecting a touch of whimsy into decision making this project demonstrates the fascinating intersection of technology and chance.

Chapter 3: ELECTRONIC DECISION MAKER

Figurative term:

This refers to any device or program that helps you make decisions. This could be anything from a simple coin flipper app to complex decision-making software used in businesses.

Components:

They typically include resistors, capacitors, a timer chip (like the 4046), LEDs labeled "YES" and "NO", a push button, and a power source (battery or adapter).

Functionality:

When you press the button, the circuit activates, causing the YES and NO LEDs to flash rapidly. A timer chip controls the flashing, gradually slowing it down. Eventually, due to the circuit's design, one LED stays lit, indicating your random decision.

Applications:

These kits are primarily for educational purposes and entertainment. They provide a fun introduction to basic electronics and the concept of random number generation using circuits.

A] COMPONENTS USED IN THE CIRCUIT

SR.No	NAME OF COMPONENT	SPECIFICATION	AMOUNT USED IN CIRCUIT
1.	4046 IC	PPL	1
2.	16 PIN DIP Socket	-----	1
3.	3.6V Zener Diode	-----	1
4.	BC557	PNP Transistor	1
5.	BC547	NPN Transistor	1
6.	1N4148	General purpose diode	1
7.	Tactile switch	-----	1
8.	9V DC Battery	-----	1
9	$22\mu F$/25V Electrolytic Capacitor	-----	2
10.	100nF Ceramic Capacitor	-----	1
11.	1kΩ Resistor	-----	2
12.	2.2kΩ Resistor	-----	1
13.	10kΩ Resistor	-----	2
14.	100kΩ Resistor	-----	2
15.	220kΩ Resistor	-----	1
16.	1MΩ Resistor	-----	1
17.	General Purpose PCB	-----	1

Table A

B]ADDITIONAL EQUIPMENTS

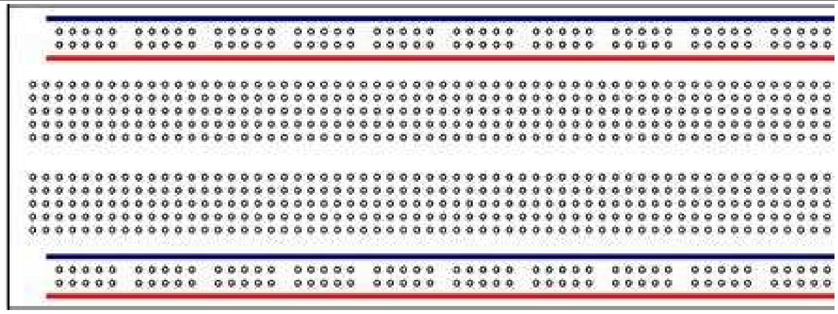
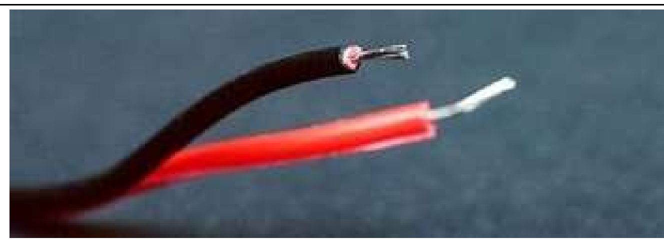
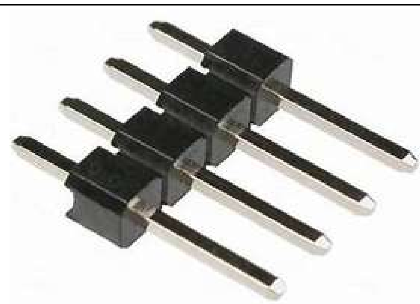
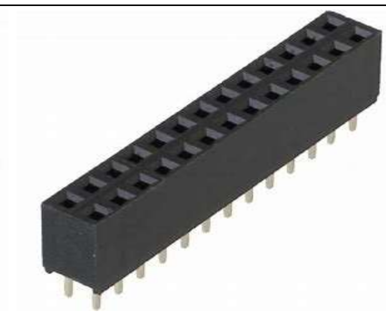
Breadboard	
Connecting wires	
Battery cap	
Male to female headers	  Male headers Female headers
Male to female jumper wires	

Table B

1] IC 4046

The 4046 IC, also commonly referred to as the CD4046B, is an integrated circuit (IC) known as a Phase-Locked Loop (PLL).

- Function:
  A PLL synchronizes the frequency (rate of change) of an output signal to a reference signal.
- The 4046 IC helps electronic circuits achieve this synchronization.
- The 4046 IC integrates several functional blocks on a single chip:
  - Voltage-Controlled Oscillator (VCO):
    This circuit generates an output signal whose frequency can be controlled by a voltage.
  - Phase Detector (PD):
    This compares the phase (timing) of the output signal to the reference signal.
  - Charge Pump (CP):
    Based on the PD's output, the CP adjusts the voltage controlling the VCO, pushing it towards synchronization with the reference.
  - Other Circuitry:
    The 4046 IC may also include a voltage regulator and additional components for fine-tuning its operation.
- Applications:
  Due to its ability to synchronize frequencies, the 4046 IC has various applications in electronic circuits, including:
  - Frequency Synthesis:
    It can generate precise frequencies based on a reference signal, useful for creating clock signals or radio transmitters.
  - FM Demodulation:
    It can extract the audio signal from a frequency-modulated (FM) radio wave.
  - Frequency Multiplication:
    It can multiply the frequency of a reference signal.
  - Signal Conditioning:
    It can help shape and stabilize the characteristics of a signal.

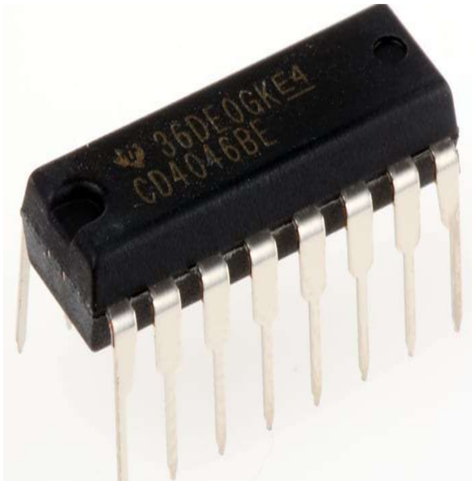


Fig 1.1

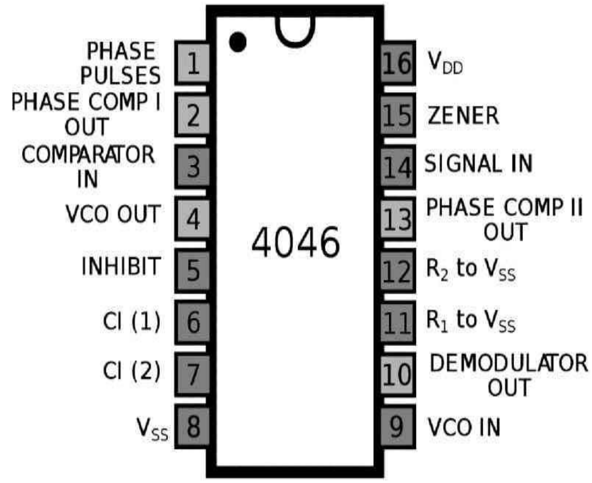


Fig 1.2

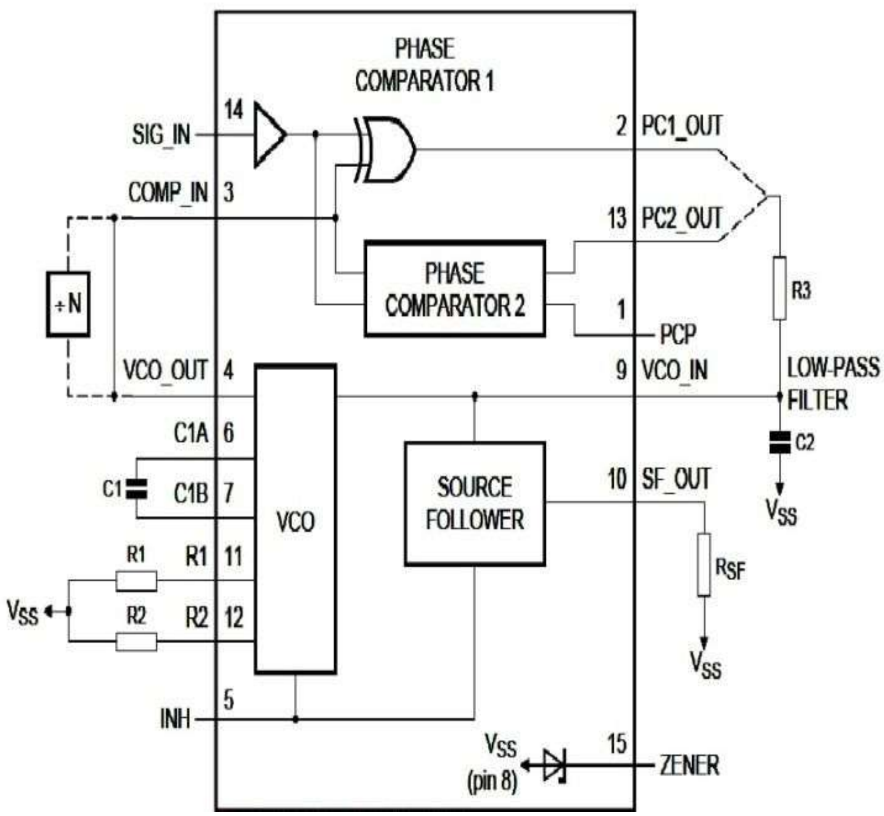


Fig 1.3

DATA SHEET FOR IC4046

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS V_O (V)	V_{IN} (V)	V_{DD} (V)	LIMITS AT INDICATED TEMPERATURES (°C) −55	−40	+85	+125	+25 Min.	+25 Typ.	+25 Max.	UNITS
VCO Section											
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	–	
Output High (Source) Current, I_{OH} Min.	4.6	0,5	5	−0.64	−0.61	−0.42	−0.36	−0.51	−1	–	
	2.5	0,5	5	−2	−1.8	−1.3	−1.15	−1.6	−3.2	–	
	9.5	0,10	10	−1.6	−1.5	−1.1	−0.9	−1.3	−2.6	–	
	13.5	0,15	15	−4.2	−4	−2.8	−2.4	−3.4	−6.8	–	
Output Voltage: Low-Level, V_{OL} Max.	Term. 4 driving CMOS	0,5	5	0.05				–	0	0.05	V
		0,10	10	0.05				–	0	0.05	
		0,15	15	0.05				–	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	e.g. Term.3	0,5	5	4.95				4.95	5	–	
		0,10	10	9.95				9.95	10	–	
		0,15	15	14.95				14.95	15	–	
Input Current I_{IN} Max.	–	0,18	18	±0.1	±0.1	±1	±1	–	$\pm10^{-5}$	±0.1	μA
Phase Comparator Section											
Total Device Current, I_{DD} Max. Term. 14 open, Term. 5 = V_{DD}	–	0,5	5	0.2				–	0.1	0.2	mA
	–	0,10	10	1				–	0.5	1	
	–	0,15	15	1.5				–	0.75	1.5	
	–	0,20	20	4				–	2	4	
Term. 14 = V_{SS} or V_{DD}, Term. 5 = V_{DD}	–	0,5	5	20				–	10	20	μA
	–	0,10	10	40				–	20	40	
	–	0,15	15	80				–	40	80	
	–	0,20	20	160				–	80	160	
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	–	
Output High (Source) Current I_{OH} Min.	4.6	0,5	5	−0.64	−0.61	−0.42	−0.36	−0.51	−1	–	
	2.5	0,5	5	−2	−1.8	−1.3	−1.15	−1.6	−3.2	–	
	9.5	0,10	10	−1.6	−1.5	−1.1	−0.9	−1.3	−2.6	–	
	13.5	0,15	15	−4.2	−4	−2.8	−2.4	−3.4	−6.8	–	
DC-Coupled Signal Input and Comparator Input Voltage Sensitivity Low Level V_{IL} Max.	0.5,4.5	–	5			1.5		–	–	1.5	V
	1,9	–	10			3		–	–	3	
	1.5,13.5	–	15			4		–	–	4	
High Level V_{IH} Min.	0.5,4.5	–	5			3.5		3.5	–	–	
	1,9	–	10			7		7	–	–	
	1.5,13.5	–	15			11		11	–	–	

2] ZENER DIODE

Zener diodes are commonly used in electronics circuits for voltage regulation. They work by allowing current to flow in the forward direction like a normal diode. However, unlike a normal diode, when the voltage applied in the reverse direction reaches a certain level, the Zener didoe conducts current in the reverse direction as well. This breakdown voltage is what the Zener diode is designed to regulate.

2.A] 3.6V ZENER DIODE

- A 3.6V Zener diode is a type of semiconductor diode that allows current flow in only one direction and regulates voltage to a specific value when the voltage exceeds that level.
- Breakdown voltage: 3.6V
- Power dissipation: Ranges from 250mW to 1.5W depending upon specification.
- Applications: Voltage regulation, Voltage clipping, Voltage referencing etc.

Fig 2.A.

2.B] 1N 4148

- The 1N 4148 is a very common and popular type of diode known as a small signal fast switching diode.

▪ Type	▪ Silcon switching signal diode
▪ Appliction	▪ Useful in circuits upto about 100Mhz frequency due to its fast switching speed.
▪ Package	▪ Comes in a small DO-35 leaded glass package
▪ Current limitations	▪ Not intended for high current applications.
▪ Forward biasing	▪ Current upto 450mA

Table 2.B

Fig 2.B.

3]TRANSISTORS

3.A] BC557

The BC557 is a very popular type of bipolar junction transistor categorized as a general purpose PNP transistor.

Package	TO-92 (Small plastic)
Ratings	• Collector-Emitter Voltage : -45V • Collector-Base Voltage : -50V • Emitter-Base Voltage :-5V • Collector Current (Ic): -100mA (DC) • Peak Collector Current (Icm): -200mA • Total Power Dissipation (Pd): 500mW (@ Ta = 25°C) • Operating Junction Temperature Range (Tj): -65°C to +150°C • Storage Temperature Range (Ts): -65°C to +150°C
Benefits	• Versatility: It can be used in various applications due to its ability to amplify and switch electronic signals. • Low cost: Widely available and affordable • Easy to use.
Applications	• Amplification • Switching • Robotics

Table 3.A

Fig 3.A

3.B] BC547

The BC547 is another type of general purpose bipolar junction transistor, similar to BC557.

Package	TO-92 (Plastic package)
Rating	• Collector-Emitter Voltage (Vce): -45V • Collector-Base Voltage (Vcb): -50V • Emitter-Base Voltage (Vbe): -5V • Collector Current (Ic): -100mA (DC) • Peak Collector Current (Icm): -200mA • Total Power Dissipation (Pd): 500mW (@ Ta = 25°C) • Operating Junction Temperature Range (Tj): -65°C to +150°C • Storage Temperature Range (Ts): -65°C to +150°C

Table 3.B.

Fig 3.B.

Similarities to BC557	Differences between both
• Both are general purpose BJTs • Both have similar current ratings and gain ranges. • Both come in TO-92 Package • Both are suitable for low power amplification and switching applications.	• BC 547 is NPN, While BC557 is pnp. • The voltage rating for BC547 has a higher collector-emitter voltage rating(65V vs 45V for BC557).

Table 3.3

4] TACTILE SWITCH

- A tactile switch is a pushbutton that provides a physical click or bump whem pressed. It has 2 main steps : OPEN(Not pressed) and CLOSED(Pressed).

Fig 4.1

5] 9V DC BATTERY

Fig 5.1

6] CAPACITORS

22µF/25V Electrolytic Capacitors	100nF Ceramic capacitors
 Fig 6.1	 Fig 6.2

Table 6.1

7] GENERAL PURPOSE PCB

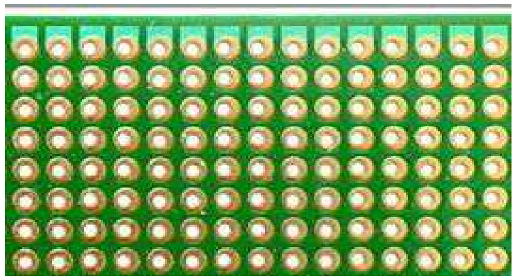


Fig 7.1

8] RESISTORS

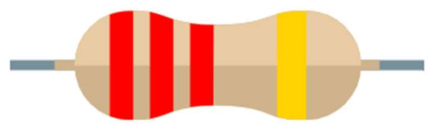
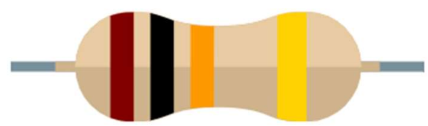
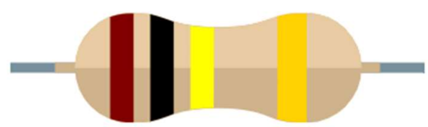
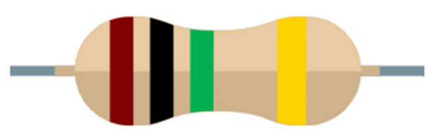
RESISTOR VALUE	COLOUR CODED DIAGRAM
1kΩ	
2.2kΩ	
10kΩ	
100kΩ	
220kΩ	
1MΩ	

Table 8.1

Chapter 4- CIRCUIT DIAGRAM FOR THE ELCETRONIC DECISION MAKER

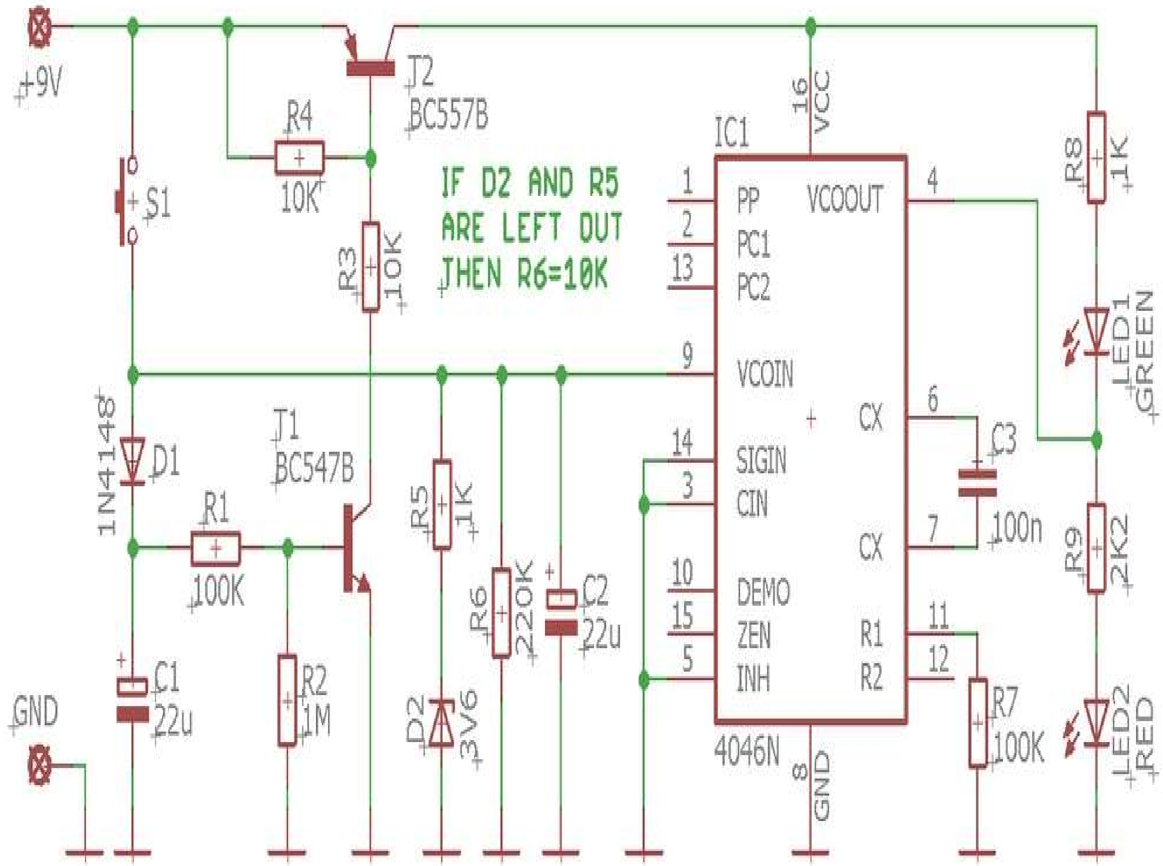


Fig 9

Chapter 5.A- BREADBOARD CONNECTIONS

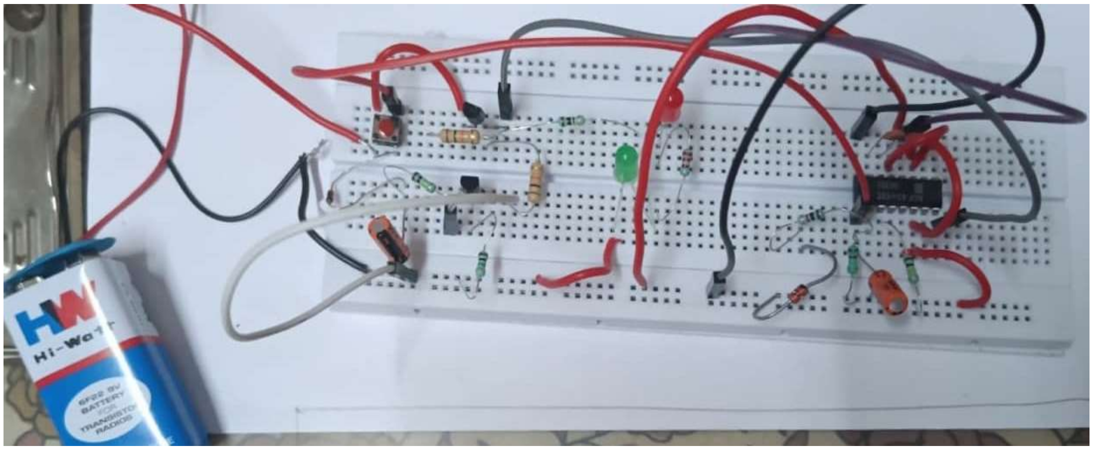


Fig 5.A

Chapter 5.B- PCB CONNECTIONS

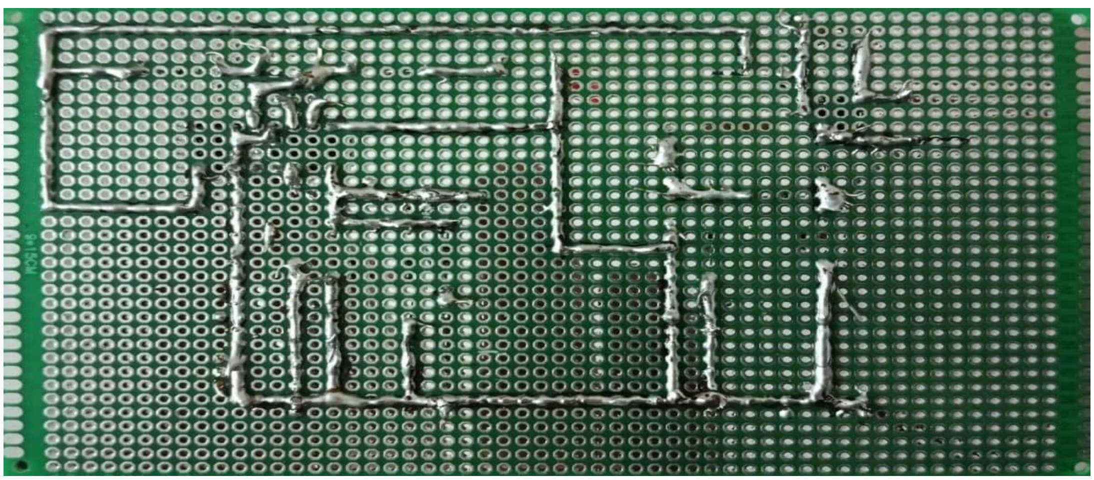


Fig 5.B.1- Soldering at back of PCB

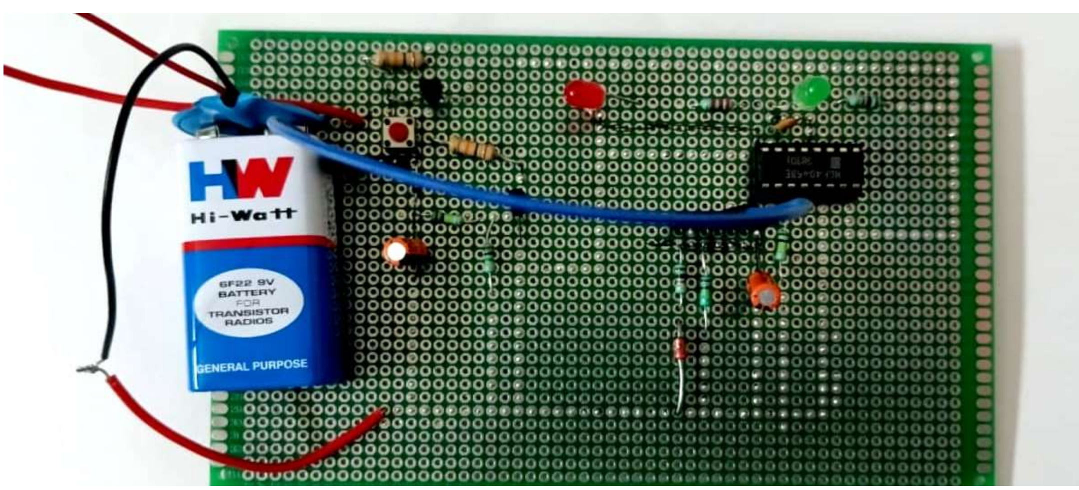


Fig 5.B.2- front of the PCB

Chapter 5.C- WORKING OF EDM

WORKING OF IC

- Voltage controlled oscillator (VCO):
  Internal circuit within the CD4046 genetrates the oscillating signal. By applying a voltage to the control pin, we can adjust the frequency of the oscillation, which in turn controls the flashing speed of the LEDs.
- Charge Pump and Filter:
  This section of the IC refines tho ouput of VCO by ensuring a clean and stable oscillation.

CONTROLLING THE FLASHING

- LEDs and Resistors:
  We have two LEDs(yes/no) connected to the circuit. Each LED has a current-limiting resistor in series to prevent damage.
- Output Buffers:
  The CD4046 provides output pins that can drive current to light the LEDs. These output acts as buffers, amplifying the signal from the VCO to a level suitable for LEDs.

The RANDOM DECISION MAKING MOMENT

- Push button:
  When you press the button, it discharges a capacitor within the circuit. This sudden change in voltage disrupts the stable oscillation of the VCO, introducing some randomness into its frequency.
- Flashing frenzy:
  Once you release the button, VCO resumes oscillation, but due to the initial disruption, the frequency might be slightly different. This change in frequency causes the LEDs to flash with a particular speed. This speed can also be regulated using a potentiometer.
- The final choice:
  As the capacitors slowly recharges, the VCO's frequency stabilizes.The random change in frequency caused by the button press determines which LED will stay lit when the flashing goes down and stops ultimately.

CHAPTER 6- CONCLUSION

The electronic decision maker utilizes a phase locked loop (PPL) circuit, like the CD4046, to generate a precise oscillating signal.When triggered, the circuit introduces a controlled element of randomness through factors like capacitor discharge and component variation. This randomness manifests in the flashing of LEDs, ultimately determining the "yes" or "no" output. While not a flawless tool, it offers a Gimple into the fascinating intersection of electronics, probability, and the concept of random decision—making.