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Engineering Design Project-II (UTA 024)

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
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Engineering Design Project-II
(UTA 024)
Buggy Lab

Dr. Amit Mishra

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- Component list
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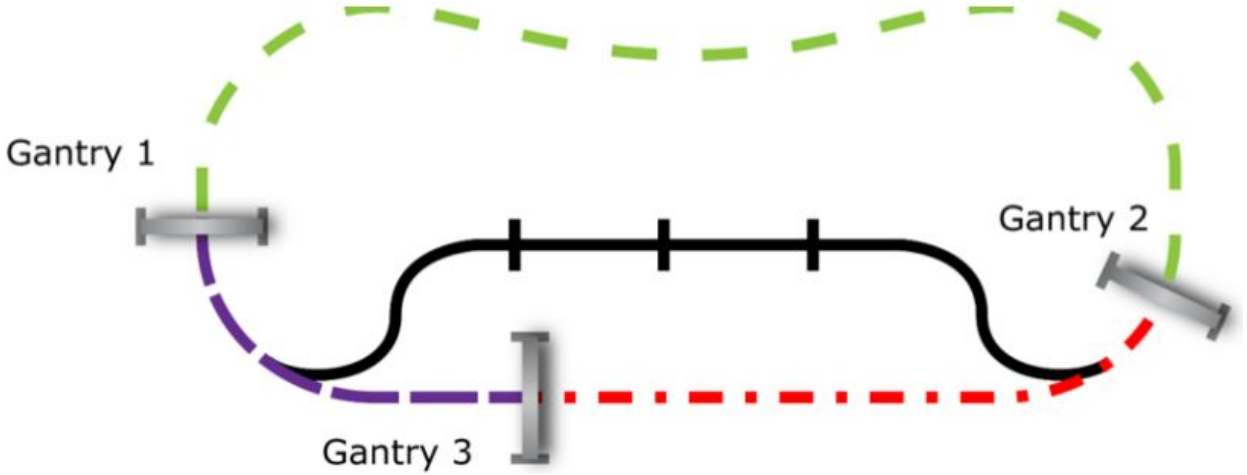
Objective

Design and testing of transmitter circuit which generates rectangular pulses of specific pulse width for IR emitter corresponding to each Gantry.

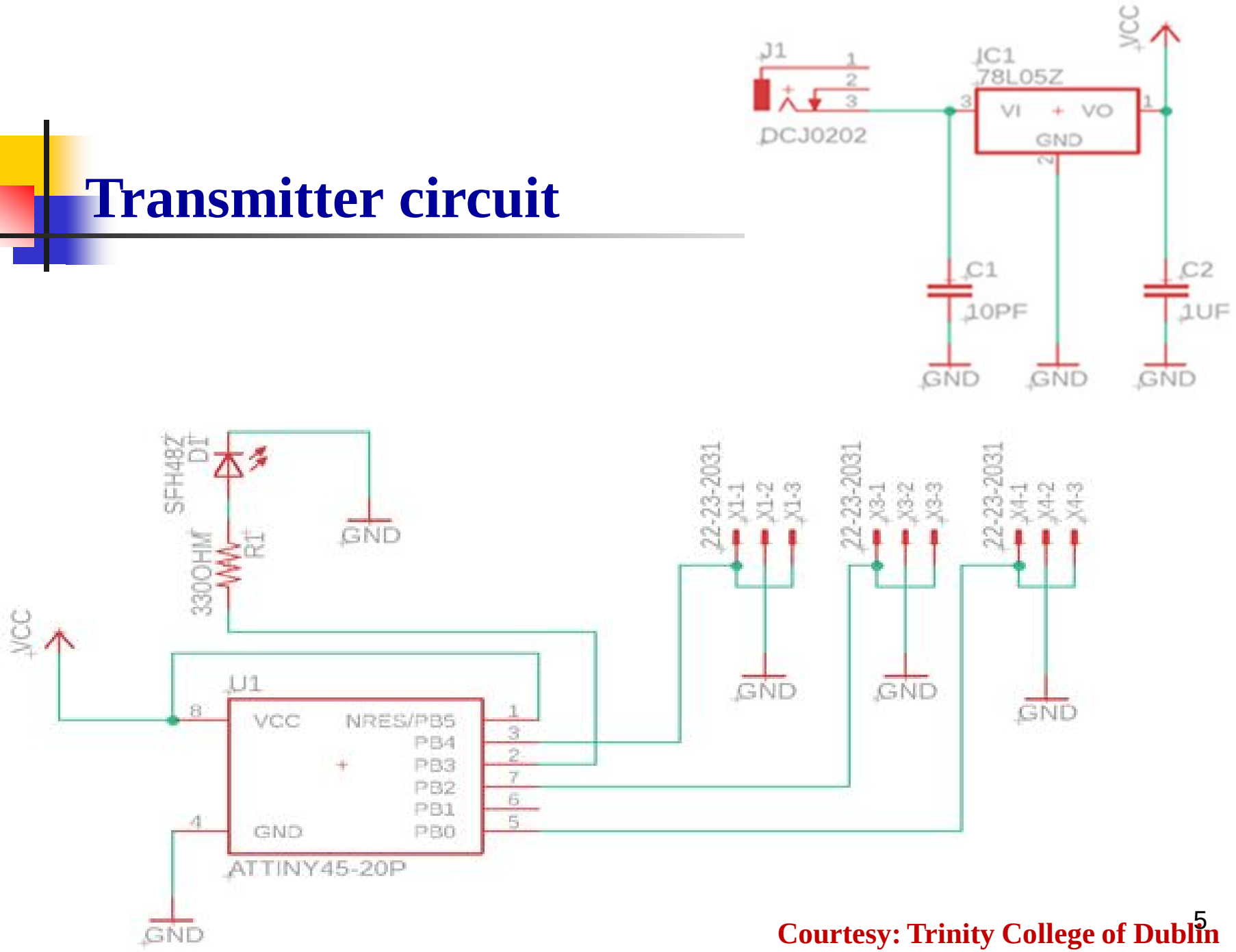
❖To solder IR transmitter circuit on a general purpose PCB.

❖To write a Program and upload it on the Attiny-45 based microcontroller through Arduino boot-loader circuit.

❖To test the output pulses on CRO generated through IR transmitter circuit.



Transmitter circuit



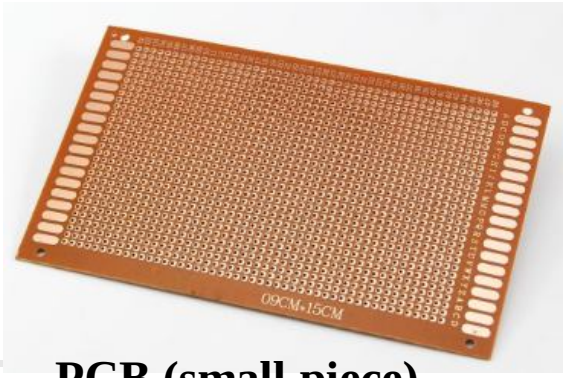
Courtesy: Trinity College of Dublin

Component List

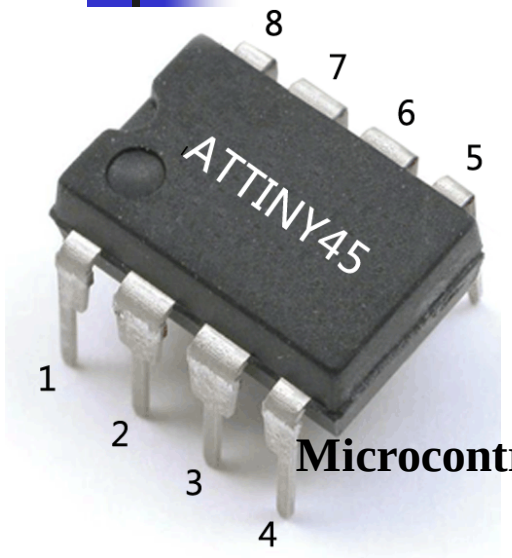
Sr. no	Component	Count	specification
1	Microcontroller	01	ATtiny-45
2	Voltage regulator	01	7805
3	LED	01	Any colour
4	Resistor	01	330 Ω
5	Capacitors	02	10 pf, 1µf
6	Male Header connector	03	
7	DC battery	01	9V Hi-Watt Battery, Battery Clip Connector
8	PCB (small piece)	01	General purpose

Components Required

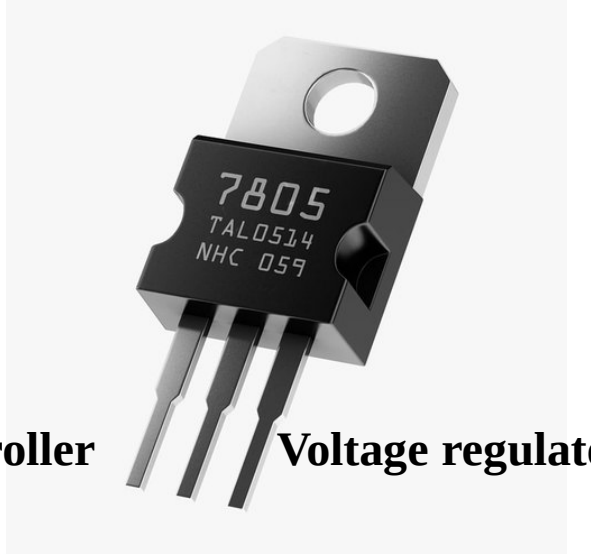
LED



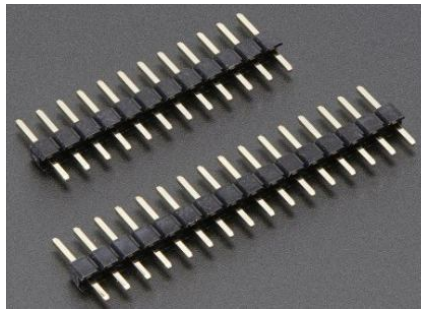
PCB (small piece)



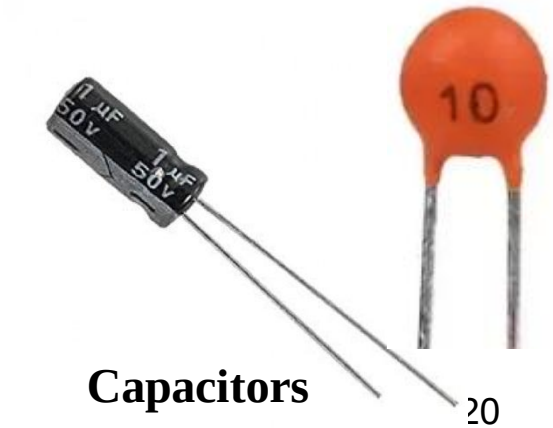
Microcontroller



Voltage regulator



Male Header connector



Capacitors

Resistor

DC battery

Image source: Google

Design Specification and selection of components

- Selection criterion for **voltage regulator**.
- Selection of a **microcontroller**

Selection criterion of Voltage Regulator

Image Source: Google

7800/7900 Voltage Regulator Variants

PARAMETER	IC NUMBER	MIN	MAX	UNIT
nput voltage	7805	7	25	V
	7808	10.5	25	V
	7810	12.5	28	V
	7812	14.5	30	V
	7815	17.5	30	V
	7824	27	38	V

Specifications for 7800 Series Voltage Regulator

PARAMETER & CONDITIONS	MIN	TYPICAL	MAX	UNIT
Output voltage @ 25°C	4.8	5.0	5.2	V
Output voltage 0°C to 125°C	4.75		5.25	V
Input voltage regulation @° 25°C V_I = 7V to 25V		3	100	mV
Ripple rejection, V_I 8V to 18V f=120Hz	62	78		dB
Output voltage regulation, Io 5mA to 1.5A		15	100	mV
Output resistance, f=1kHz		0.017		Ω
Peak output current @25°C		2.2		A

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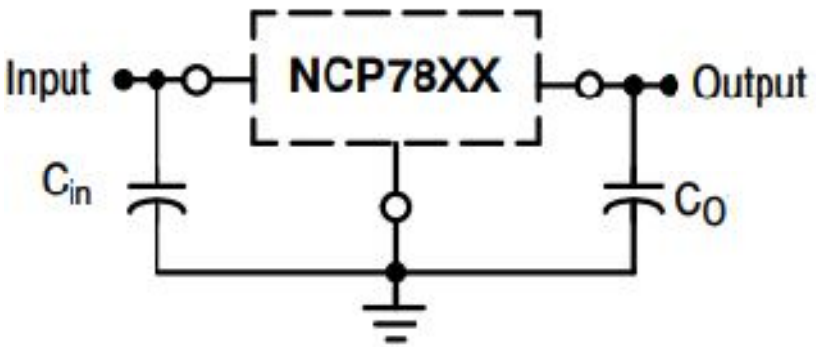
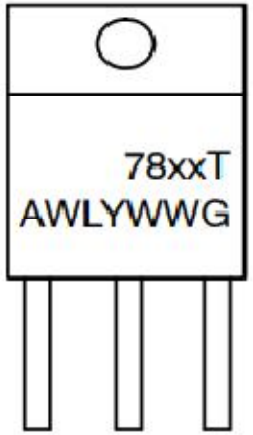




MARKING DIAGRAM

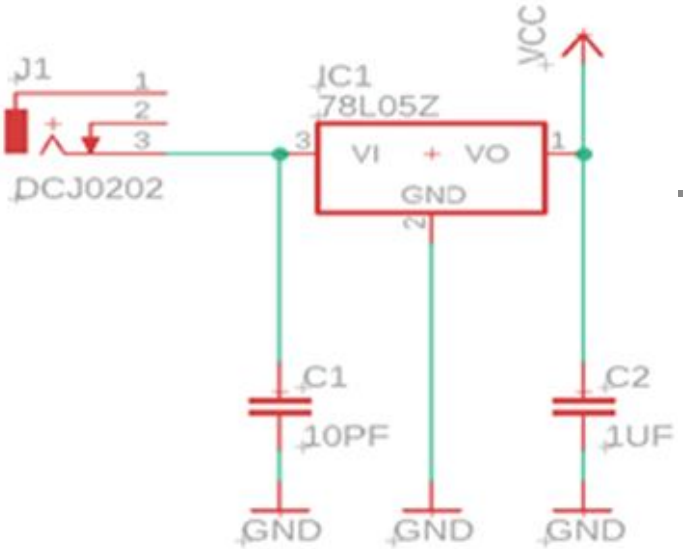
xx	= 05, 08, 12 or 15
A	= Assembly Location
WL, L	= Wafer Lot
Y	= Year
WW	= Work Week
G	= Pb–Free Device

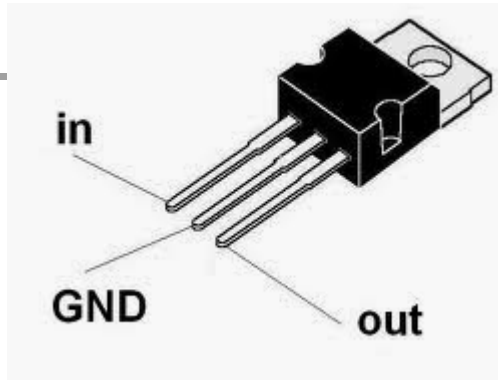
T = Through hole packaging

C_{in} is required; if regulator is located an appreciable distance from power supply filter. Typical range of value vary from **0.33 µF to 10 pF.**

C_O is needed for stability; however, it does improve transient response. Values of less than **0.1 µF** could cause instability.

Voltage regulator using LM 7805





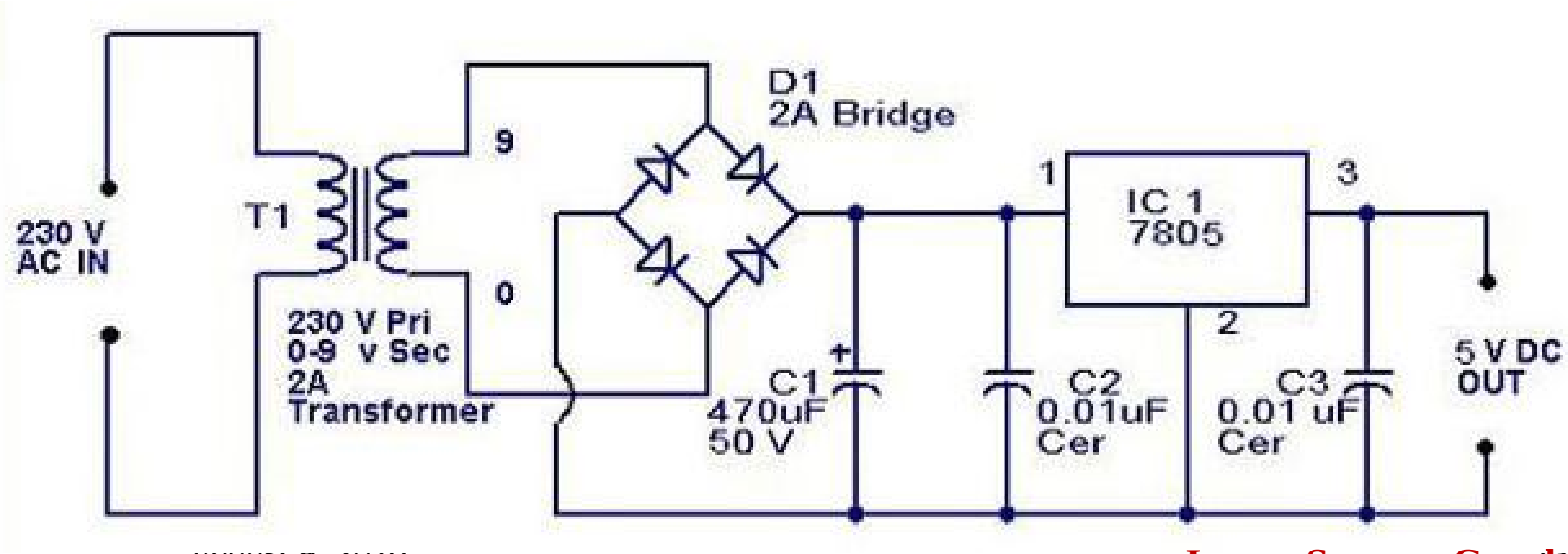


Image Source: Google

Selection criterion of Microcontroller

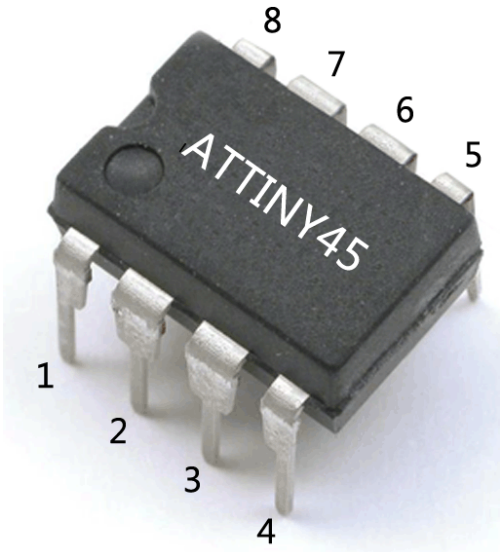


Image Source: Google

Microcontroller options available

- **8051 microcontroller**
- **PIC microcontroller**
- **ATtiny-AVR (Atmel tiny-A**lf-Egil Bogen **V**egard Wollan **R**ISC)
- **Arduino-ATmega328**

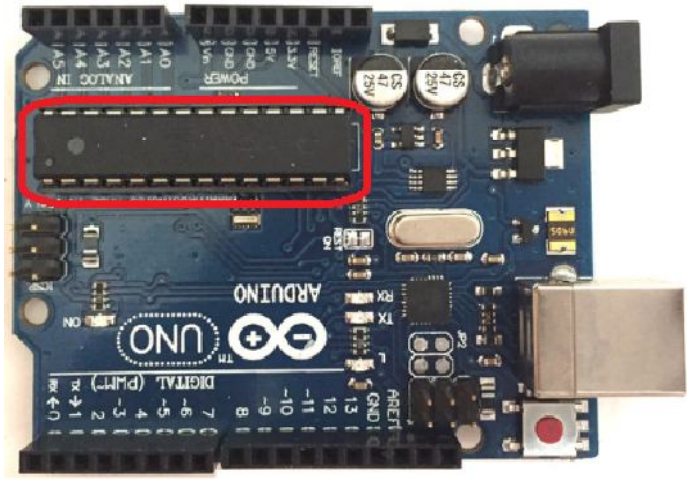
Parameter	Microcontrollers			
	8051	**PIC**	**AVR (ATtiny)**	**ARM (Arduino-ATmega328)**
Architecture type	Harvard	Harvard	Harvard	von Neumann
Word size	8 bit	8 bit	8 bit	16 and /or 32 bit
Memory space	128 byte	Less than 128 byte	Between 256 bytes to 32KB	SRAM:2 KB, EEPROM: 1KB, Flash memory:32 KB
Clock cycle required for Execution per instruction	Multiple clock cycles	Multiple clock cycles	single clock cycle	single clock cycle
Power supply voltage	5V	5V	1.8 to 5V	3.3 V

•Harvard architecture: separate space for RAM and program memory
•von Neumann architecture: program and RAM in the same space

Selection criterion of Microcontroller

8051 microcontroller

Arduino-ATmega328



PIC microcontroller

Attiny-45

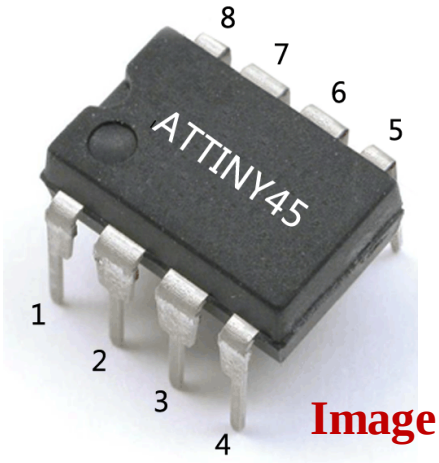


Image Source: Google

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Drawbacks of Using an Arduino

- First, compared to the microcontroller IC itself, Arduino boards are **very large**. This makes it **difficult to integrate** or embed Arduino boards into projects.
- Second, Arduino boards are **relatively expensive**, compared to the cost of building a custom board with a microcontroller IC and associated passive components.

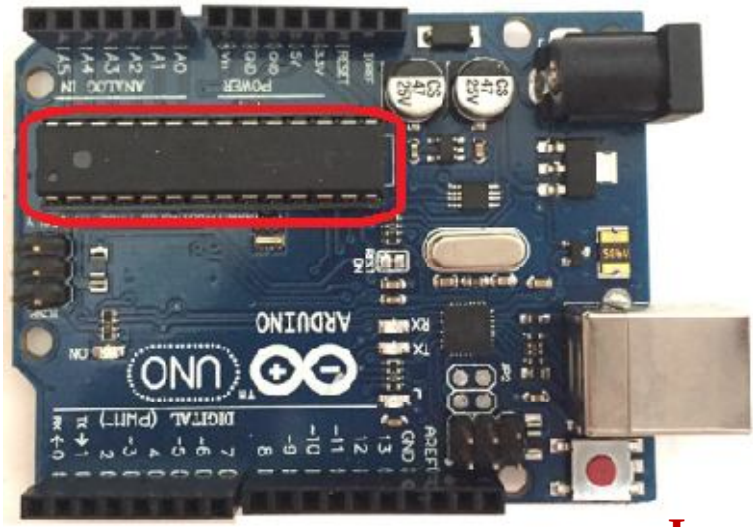
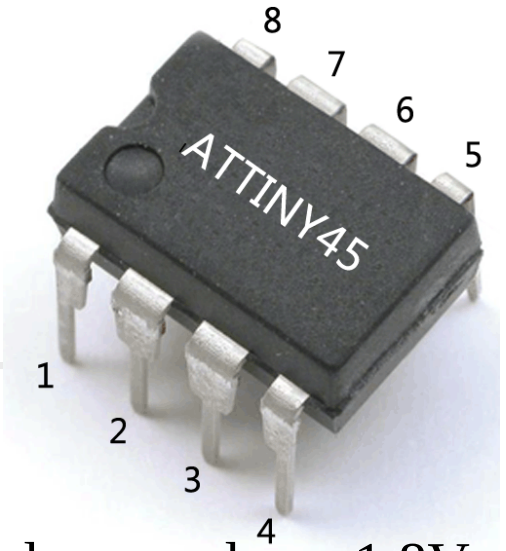


Image Source: Google

ATtiny45 PU20 Technical Specifications



- Low current consumption 300uA in use & 0.1uA in sleep mode on 1.8V.
- Operating voltage as low as 1.8V DC to 5.5V DC max.
- Total six analog I/O pins
- built in 4 Kbytes of flash memory
- built in 256b of SRAM
- Built in 256b of EEPROM
- Circuitry contains 32 Registers
- Universal Serial Interface feature

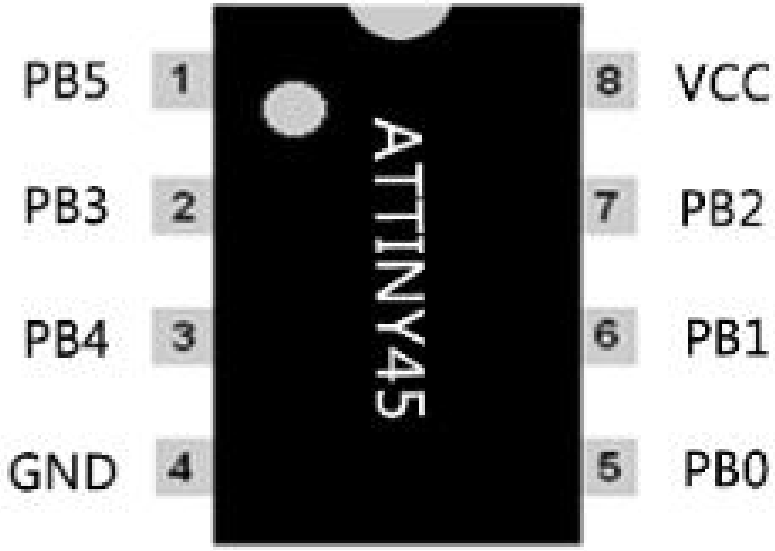
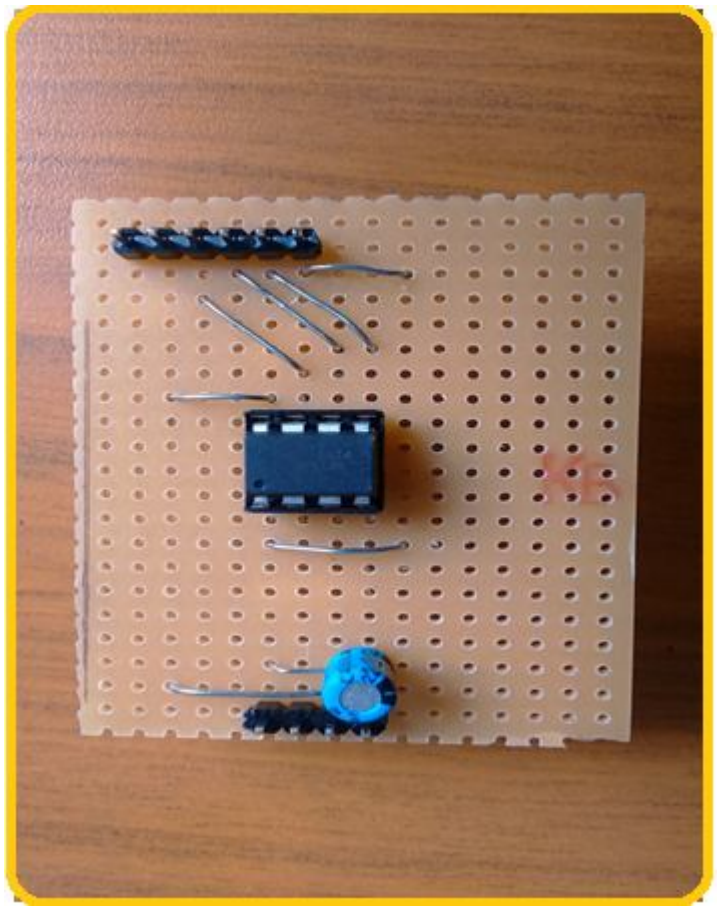
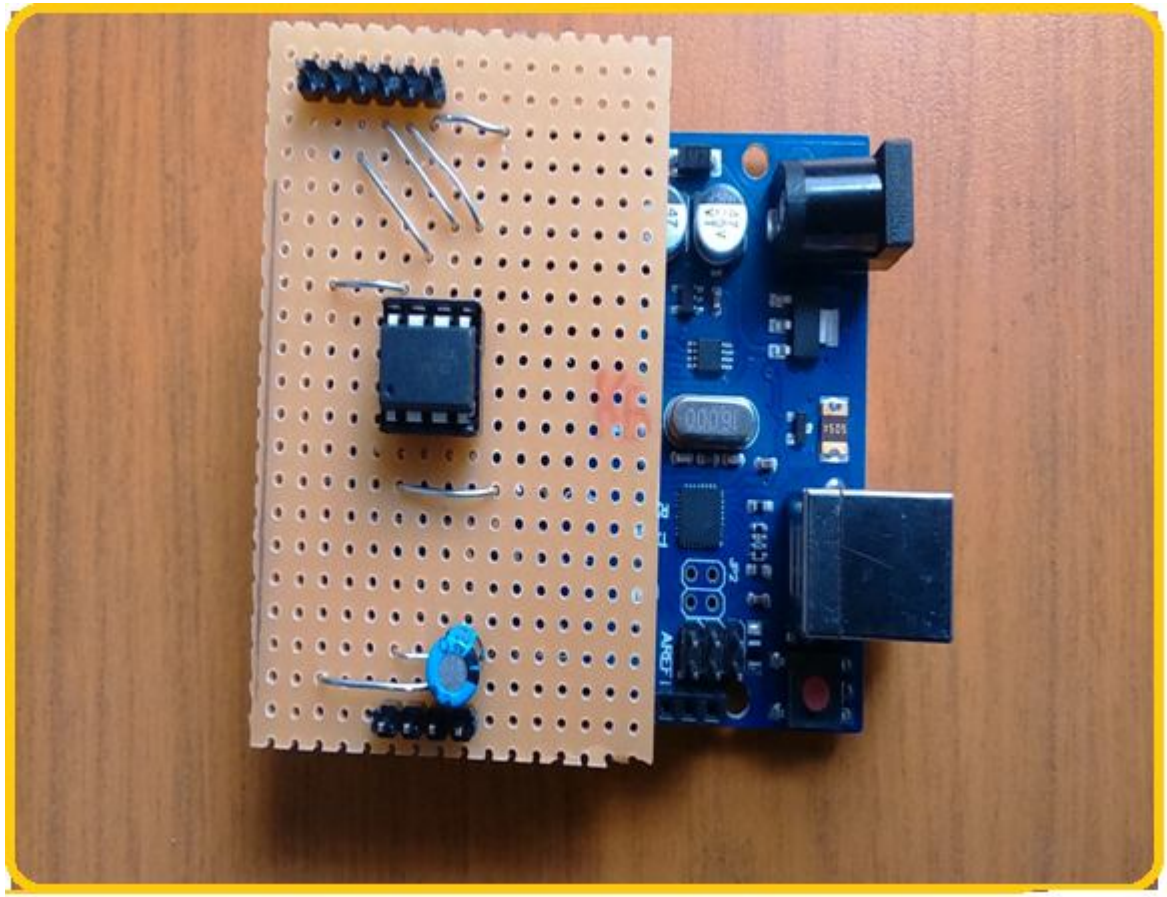


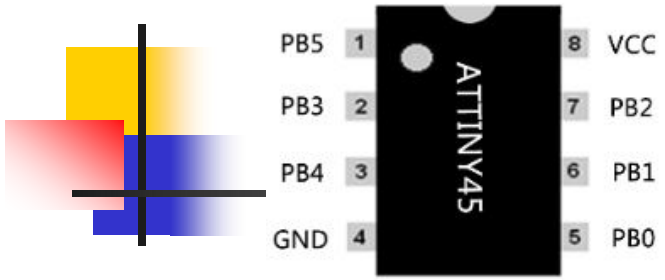
Image Source: Google

Programming of ATtiny-45 using Boot loader/Shield circuit for transmitter module





PWM generation using ATtiny45

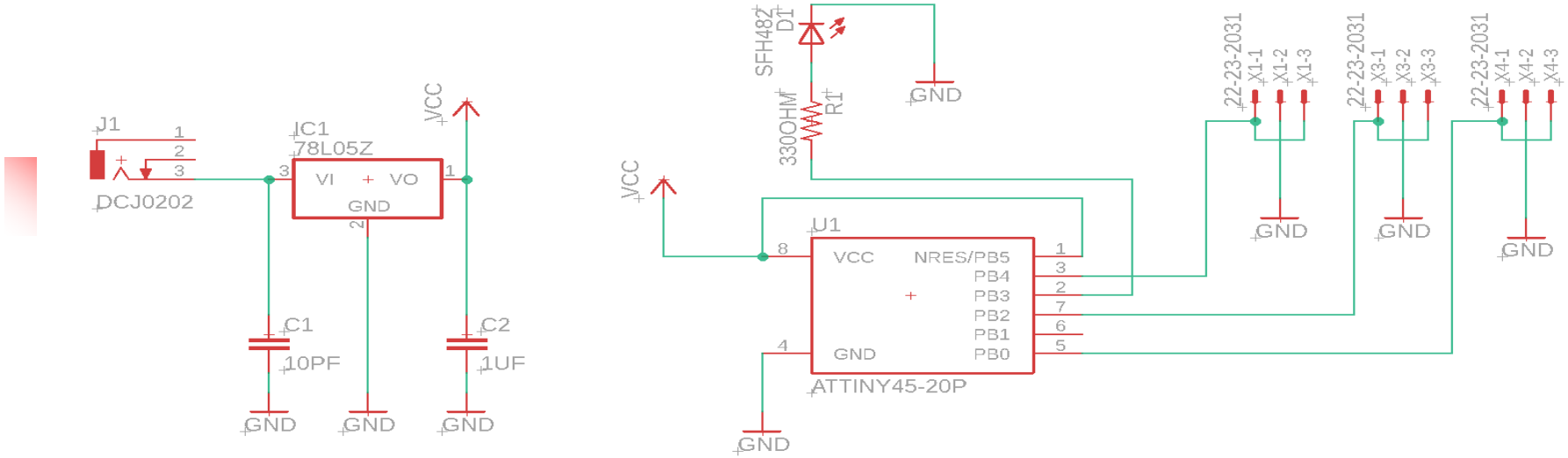


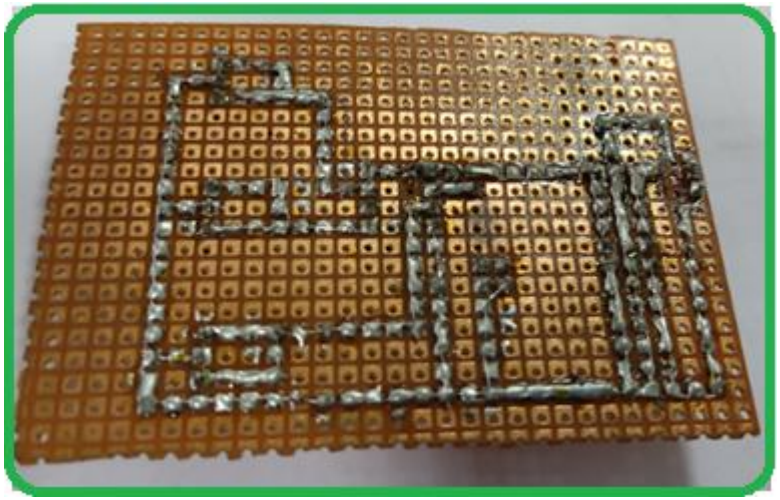

```
const int  gantryPin1 = 0;
const int  gantryPin2 = 2;
const int  gantryPin3 = 4;
const int  gantryPin4 = 3;

void setup() {
pinMode(gantryPin1,OUTPUT);
pinMode(gantryPin2,OUTPUT);
pinMode(gantryPin3,OUTPUT);
pinMode(gantryPin4,OUTPUT);
 }
```

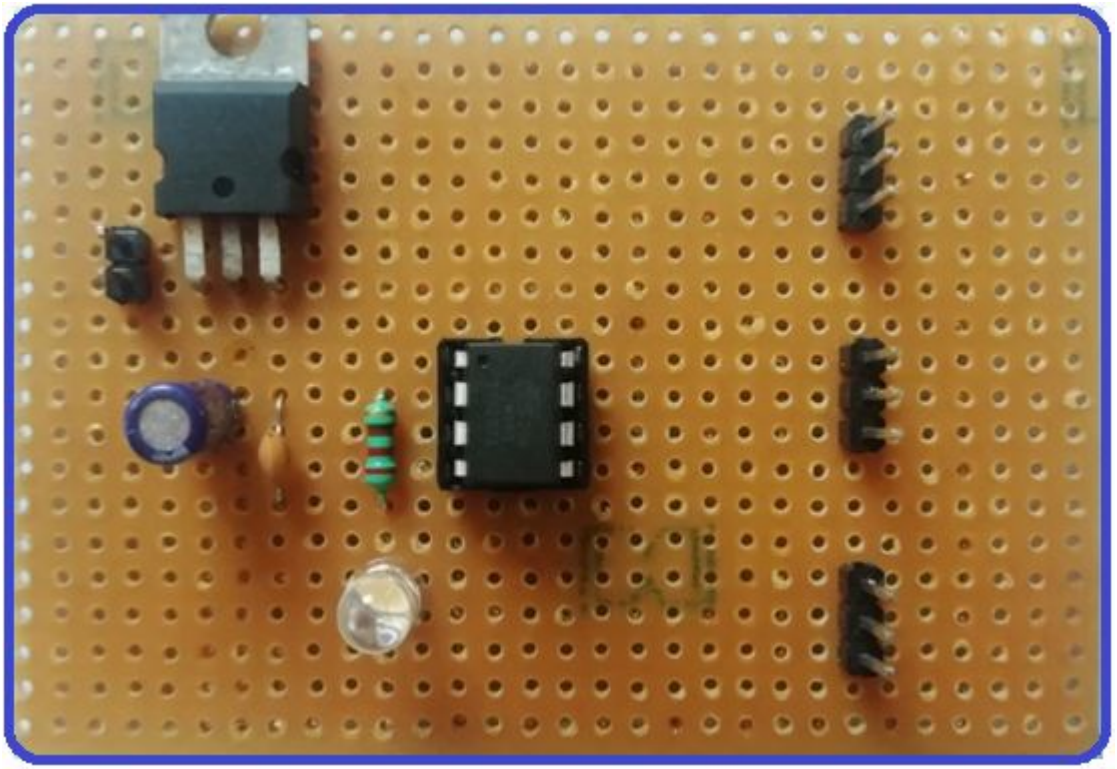
```
void loop() {
digitalWrite(gantryPin1,HIGH);
digitalWrite(gantryPin2,HIGH);
digitalWrite(gantryPin3,HIGH);
digitalWrite(gantryPin4,HIGH);

delayMicroseconds(1000);

digitalWrite(gantryPin1,LOW);
delayMicroseconds(1000);
digitalWrite(gantryPin2,LOW);
delayMicroseconds(1000);
digitalWrite(gantryPin3,LOW);
delayMicroseconds(1000);
digitalWrite(gantryPin4,LOW);
delayMicroseconds(1000);
}
```

Transmitter circuit on PCB

Transmitter circuit on PCB

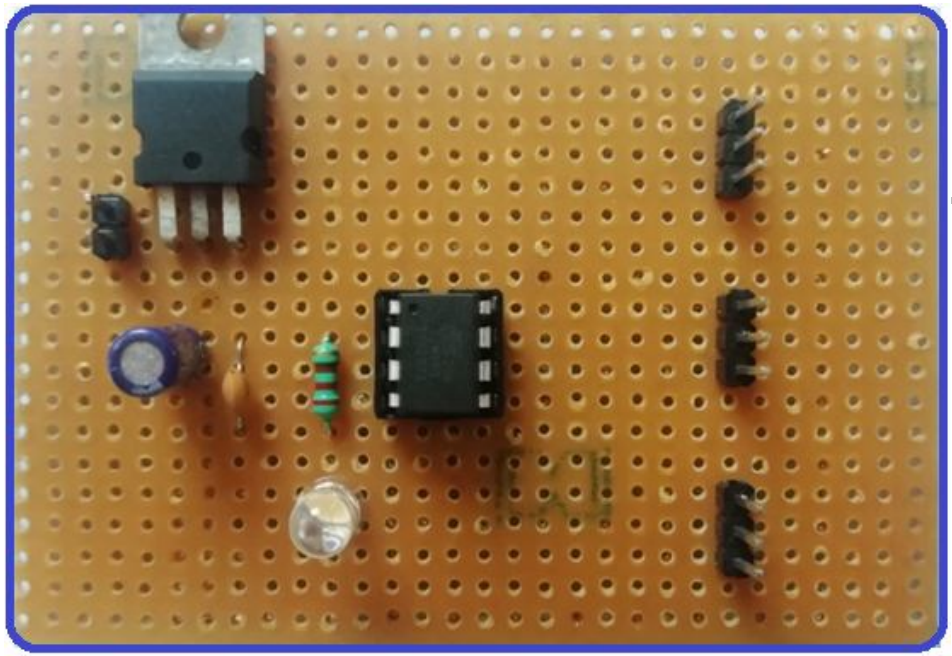






August 9, 2020

Transmitter circuit with Attiny-45 and Gantry



August 9, 2020

Transmitter circuit Testing

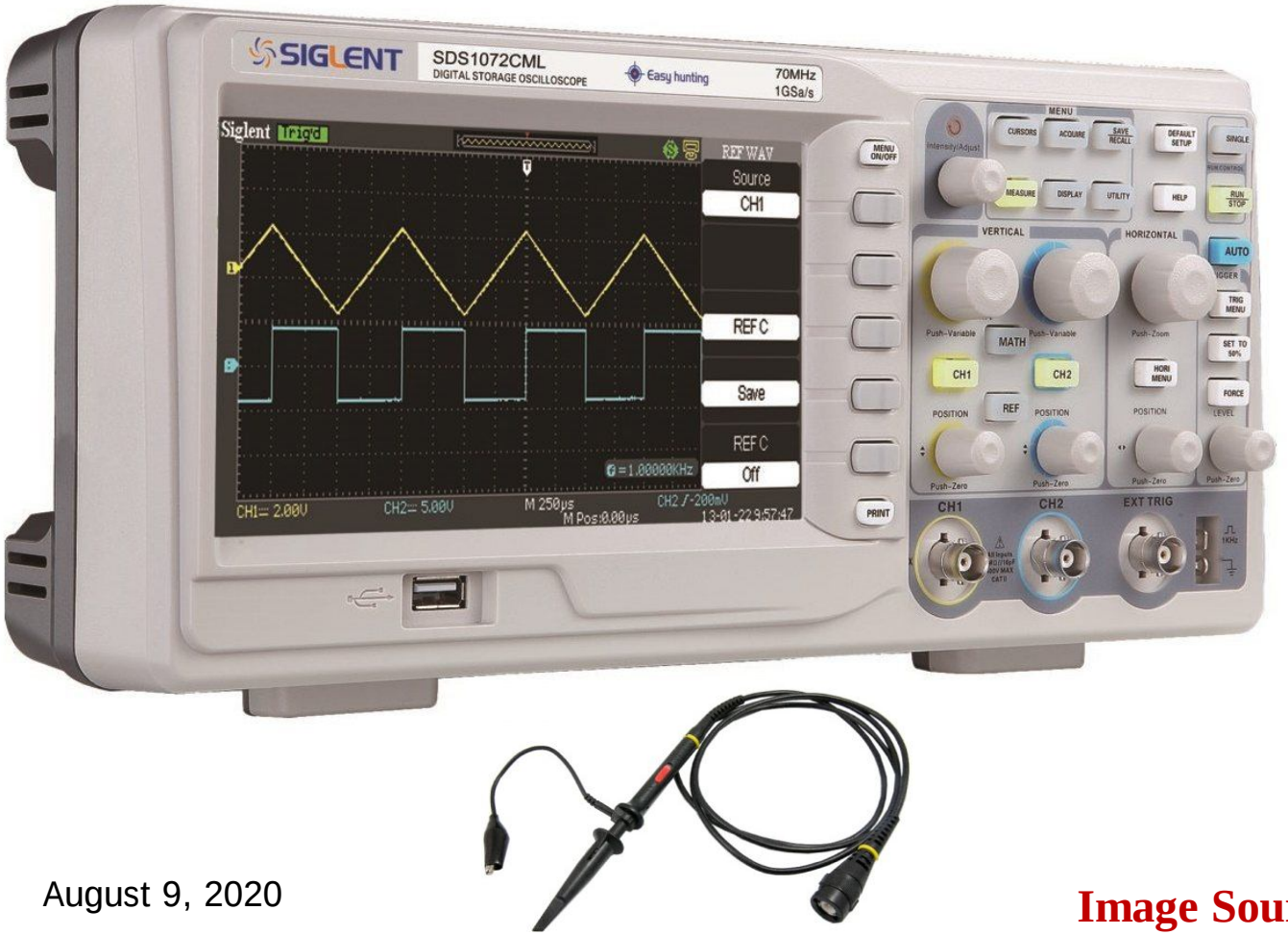
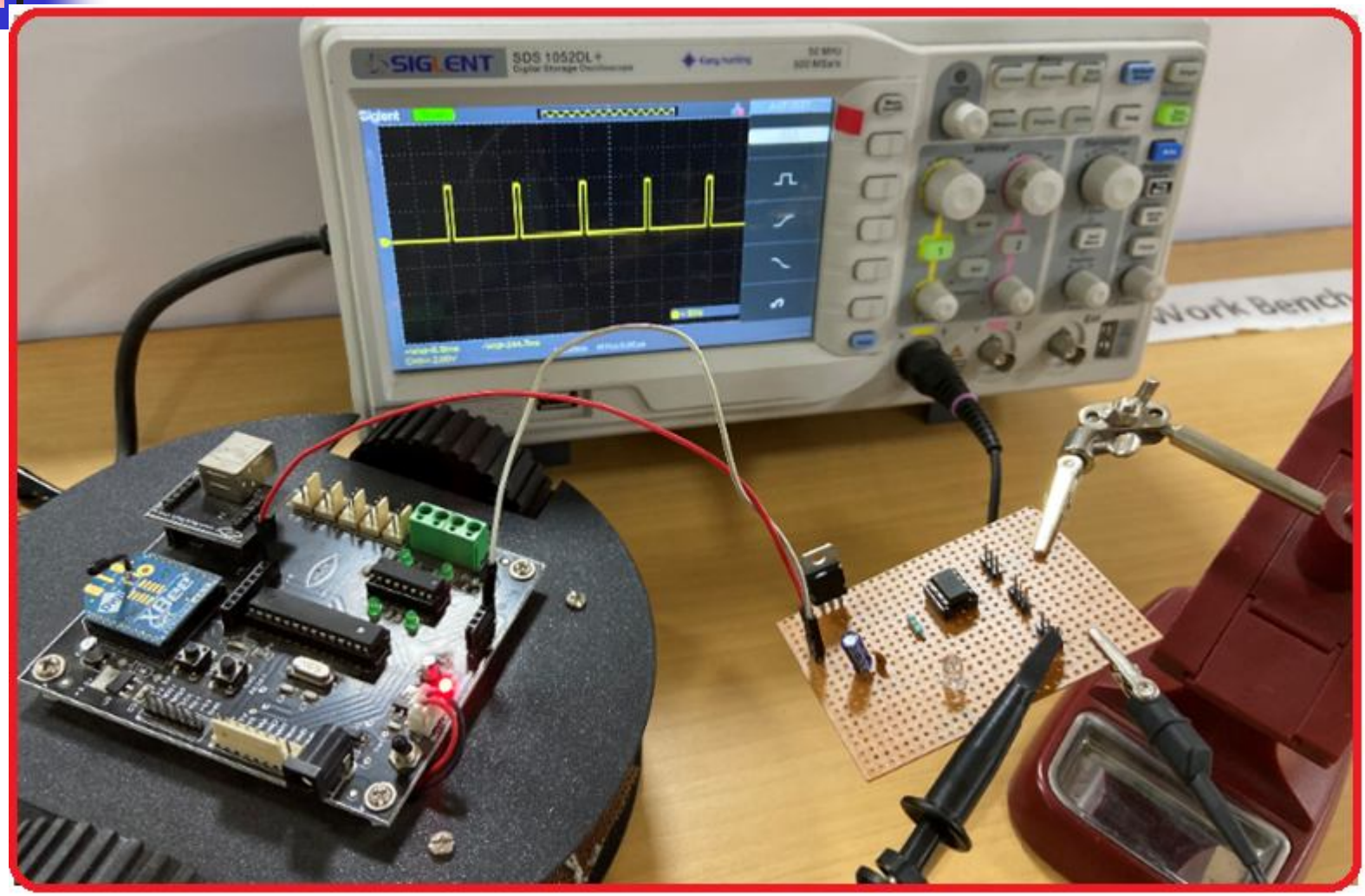


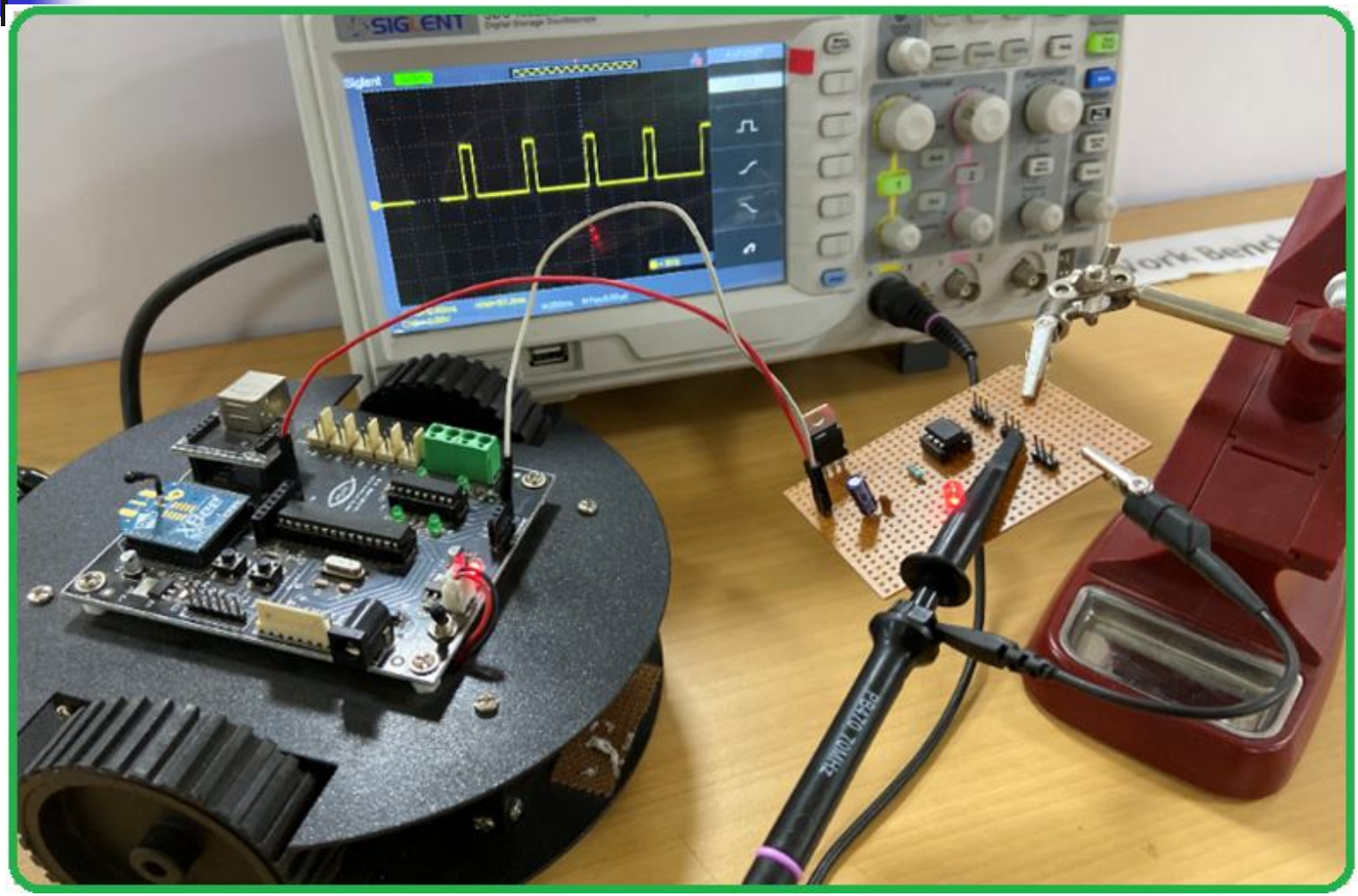
Image Source: Google

Testing: Transmitter Circuit

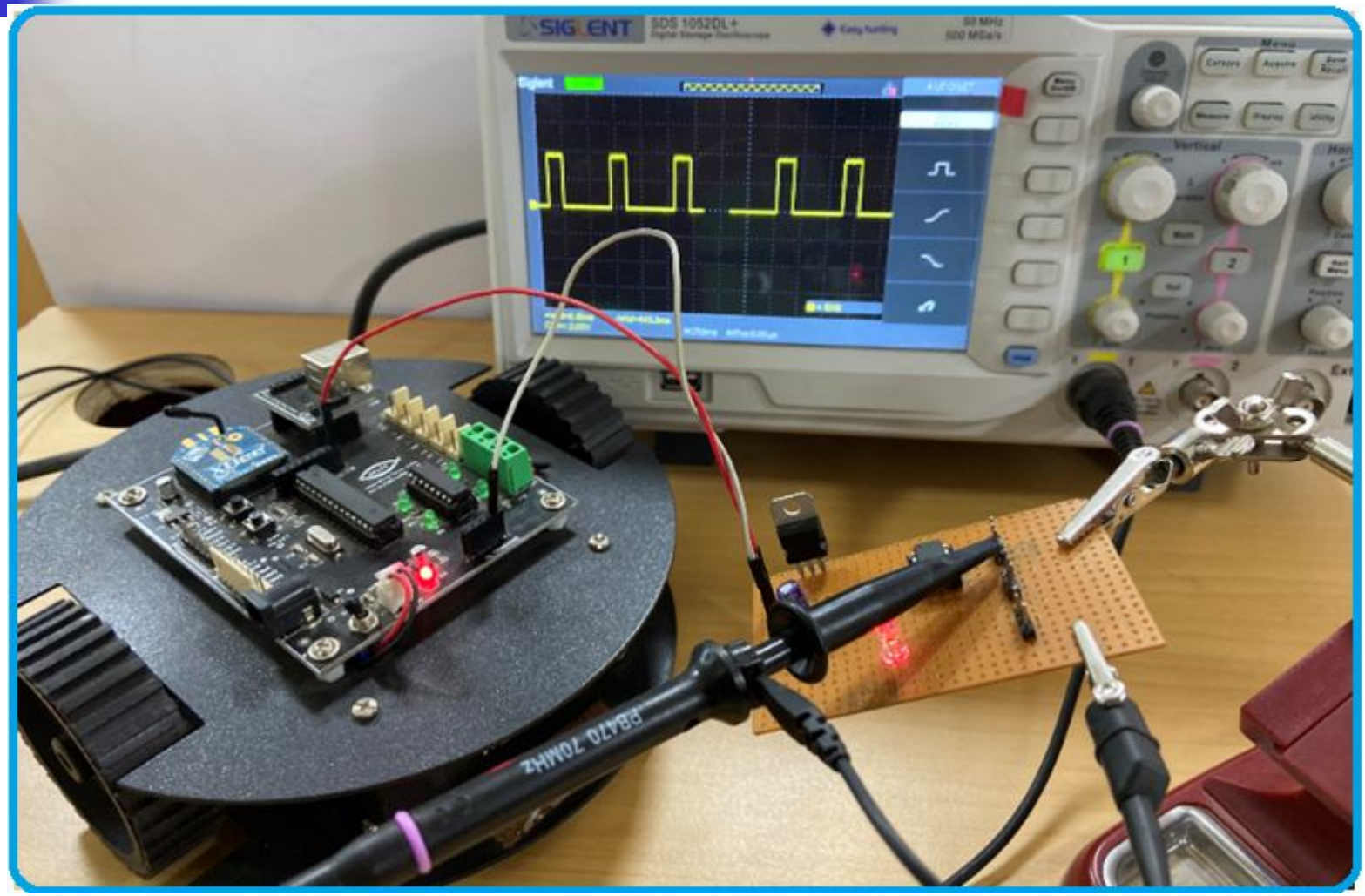
Gantry-1



Gantry-2



Gantry-3



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Thanks !