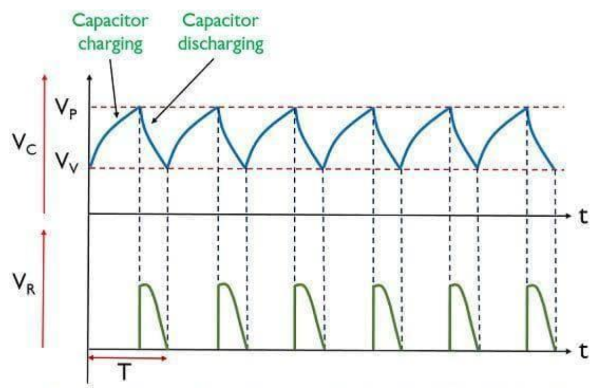
Asyut University

Faculty of Engineering

Electrical Engineering Department

Relaxation oscillator



Team

Mohamed Sameh Abdelhamed sec: 4

Mohamed Saber Mohamed sec: 4

Mohamed Rashad Rashad sec: 4

Mohamed Ahmed Hammouda sec: 4

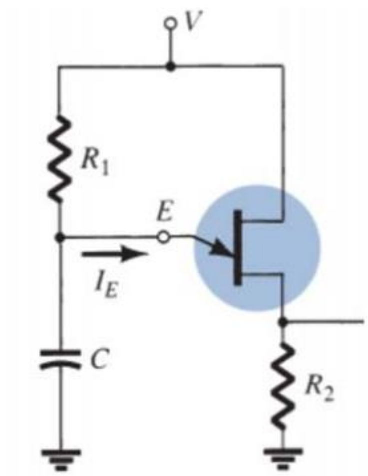
Majormody1@gmail.com

Introduction:-

Relaxation oscillators are used to produce low frequency signals for applications such as blinking lights integrated circuits equipped with timers and analog to digital converters

Theory of operation:-

Originally we wanted to use programmable UJT In our project to work with various frequencies and further clarify the operation and its application, but due to the lack of some components we had to work with ordinary UJT



The resistance R1 was selected under conditions that :

$$\frac{V - V_V}{I_V} < R_1 < \frac{V - V_P}{I_P}$$

Unless it satisfies these conditions the oscillator wouldn't function properly

The operation:-

At first, the Capacitor starts charging until it reaches 15 V, when it reaches the voltage that is > or = $15(R_{B1}/(R_{B1}+R_{B2}+550)$ +0.7 It fires a pulse Towards the UJT discharging the charge in it. This pulse passes through R_{B1} and the 1k resistance in series with it.

Analysis:- *(values were gathered from 2N2647 Datasheet)*

I_v =18 mA I_p= 2 μA η=0.82 V_p= 12.75 V $V_v \approx 0$ V

$R_{min}= (V-V_v)/I_v = 833.33\ \Omega$ $R_{max}= (V- V_p)/I_p= 1125\ k\Omega$

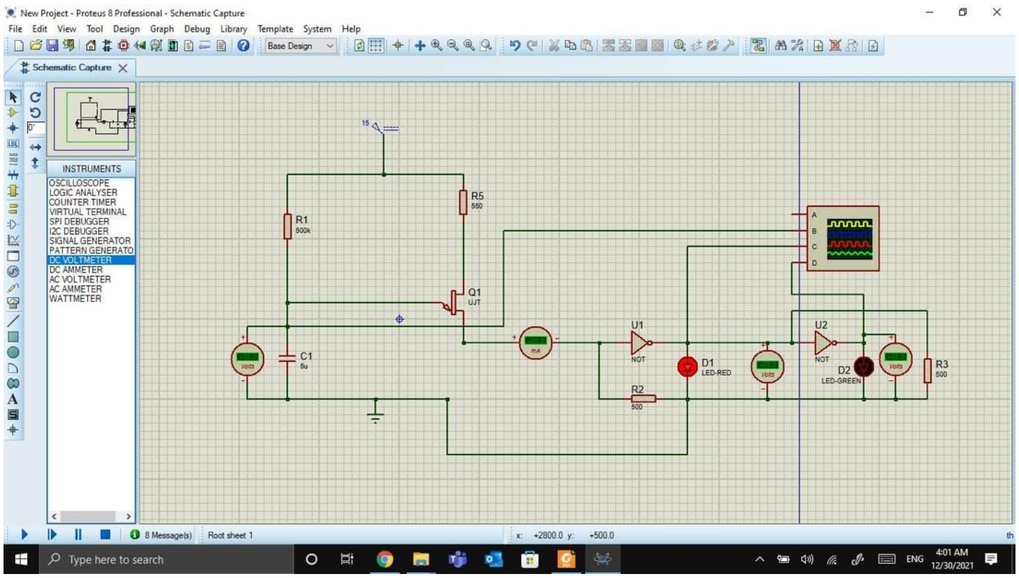
Selected R_1=500 kΩ C=4.7 µf

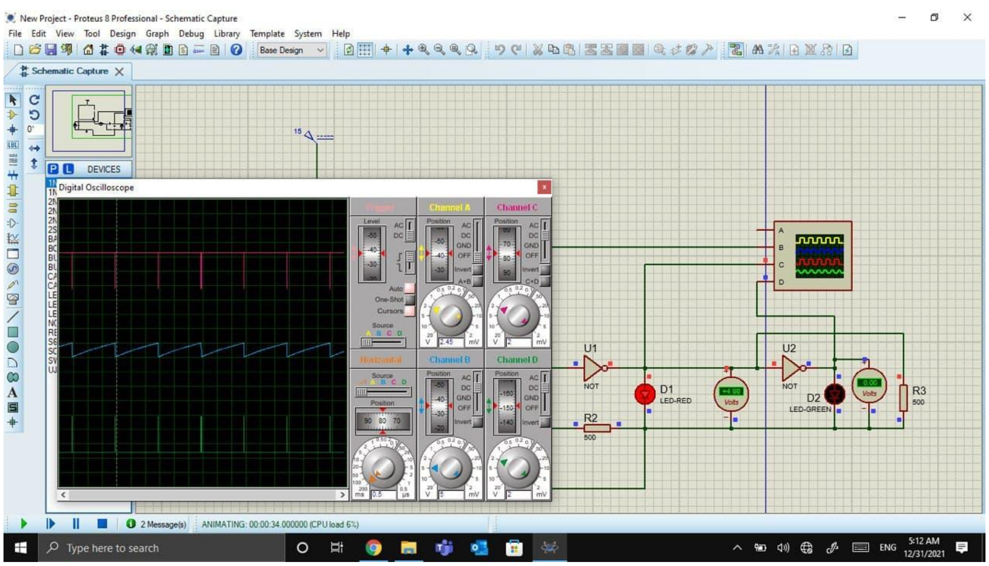
Charge time $t_1=R_1C \ln((V-V_v)/ (V- V_p))$ =4.4582 sec

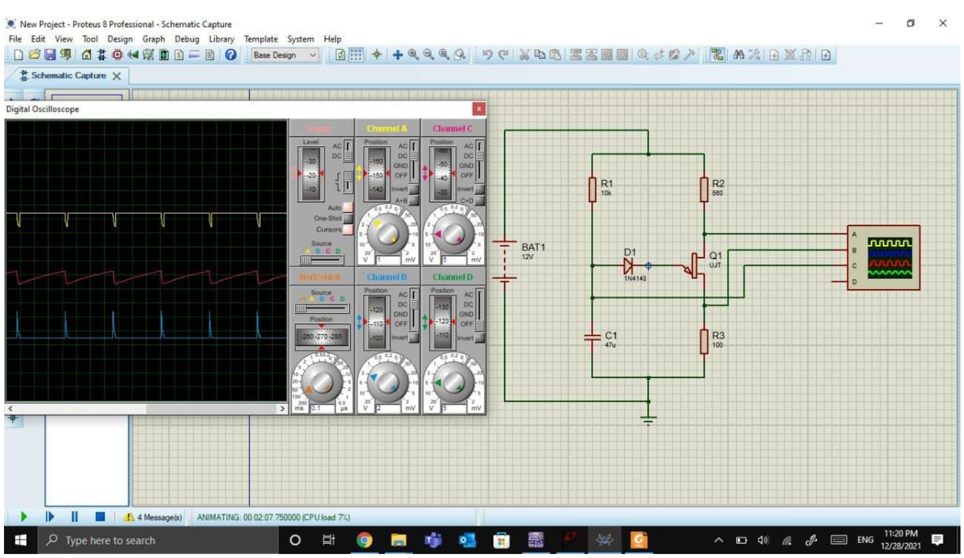
Approximately $T \approx t_1$ $f_{osc}= 1/T = 0.2243$ Hz

f_{osc} is very low frequency signal duo to large R_1 and relatively large C

Simulation results:-





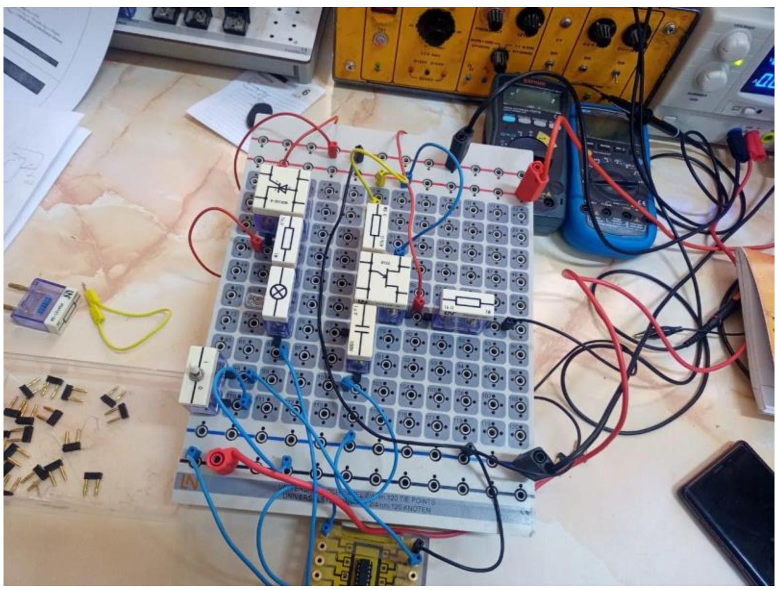


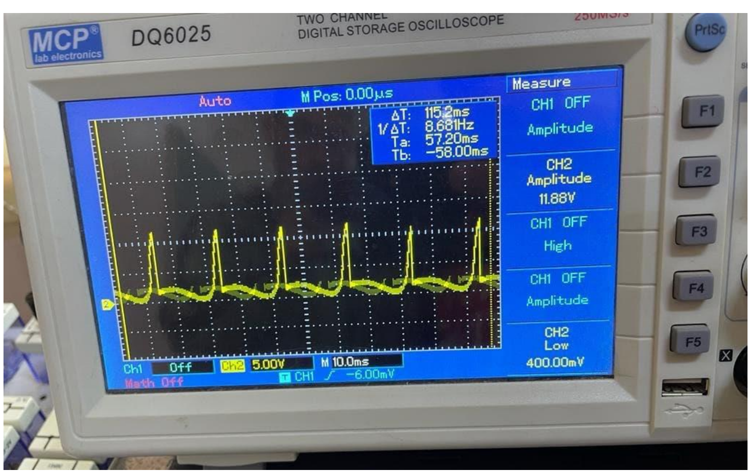
Circuit implementation and mesurment:-

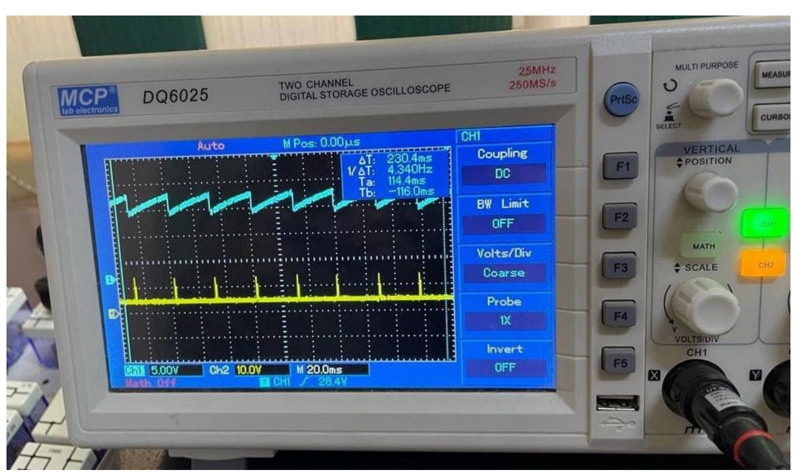
-There is a little difference between circuit implementation and the simulation due to the unavailability of certain components and the UJT model we used in simulation

-We also used two different methods to spot the pulses

-In the lab we used it to fire SCR which would activate a buzzer if a certain contact wasn't found (The circuit could be used as a safety check circuit for cars)







On the simulation program we used two LEDs With two not gates which makes one LED on when a pulse exists and another LED on when the capacitor is a charging

Conclusion:-

-Relaxation oscillators could be used in a wide range of applications due to the programmable time period

-It’s important as it turns DC voltage into a nearly 1 or zero signal which can be used in clocks, memory and other digital obligations

-The capacitor charge time is larger than their discharge time which means that we can approximately calculate frequency and time period if we calculate capacitor charge time

References:-

(Simulation)

1) Proteus electronics simulator

(Prototype)

1) use department lap and its components

(datasheet)

website: https://www.alldatasheet.com/

(YouTube)

1) https://youtu.be/WDeU50KQkRI

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1) Prof. Dr. Mohamed Abdel-Gawad, Lab Experiments in Basic Electronics (2), Assiut University-Faculty of Engineering-Electrical Engineering Department

2) Robert L. Boylestad, Electronic Devices and Circuit Theory, Eleventh Edition, ch17: pnpn and Other Devices