

# ML Driven Adaptive Hardware

## Team 9

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# About the project

Our project is based on making a circuit(VCO) that would enable us to decrease the chances of failure of electrical appliances due to any fluctuation in the input voltage because of which the output frequency changes.

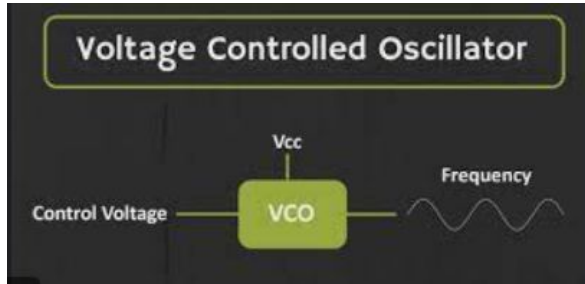
To make it a reality ML has been used which would tell us for how much fluctuation of the input voltage by what value resistors needs to be changed so to bring back the original frequency.



# Voltage Controlled Oscillator (VCO)

Voltage controlled oscillator (VCO), from the name itself it is clear that the output instantaneous frequency of the oscillator is controlled by the input voltage.

It is a kind of oscillator which can produce output signal frequency over a large range (few Hertz-hundreds of Giga Hertz) depending on the input DC voltage given to it.



# About Microcap



Microcap is a software allowing us to simulate our circuit and allowing us to see how various components are changing with respect to change in other physical quantities like input voltage or temperature.

We can make the changes in the circuit according to our needs and get all the required data that we want.

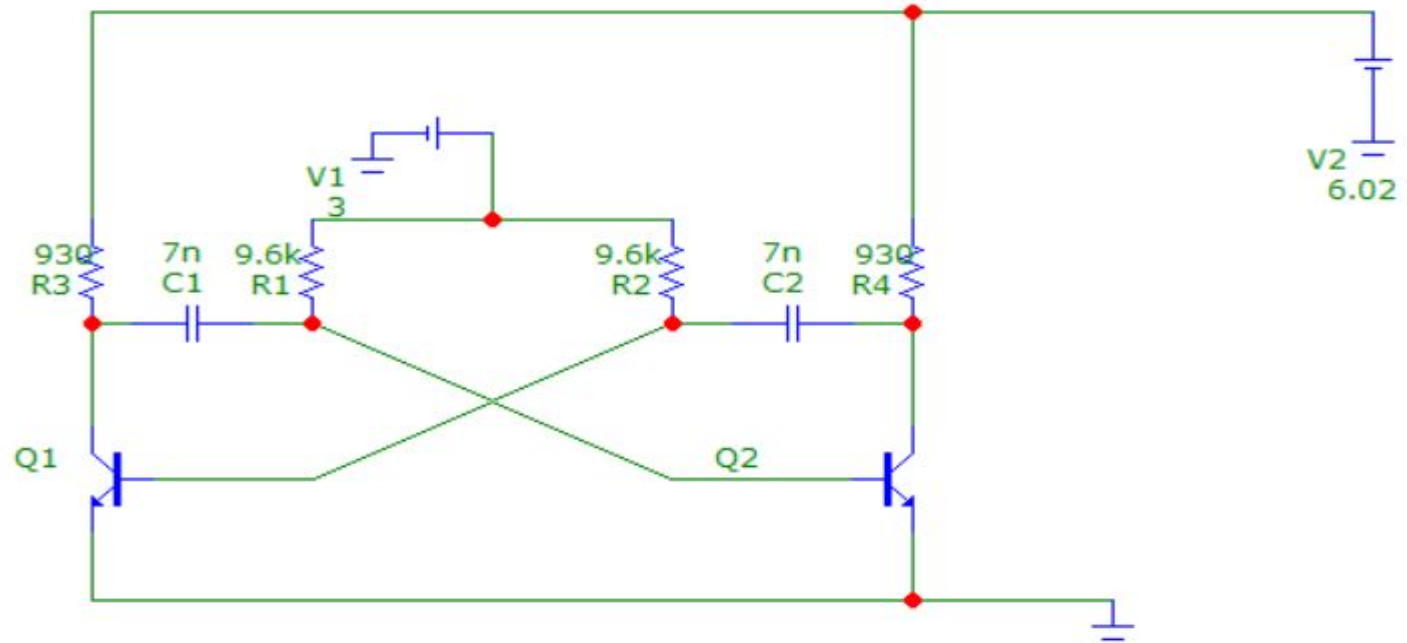


# Hardware/ Components used

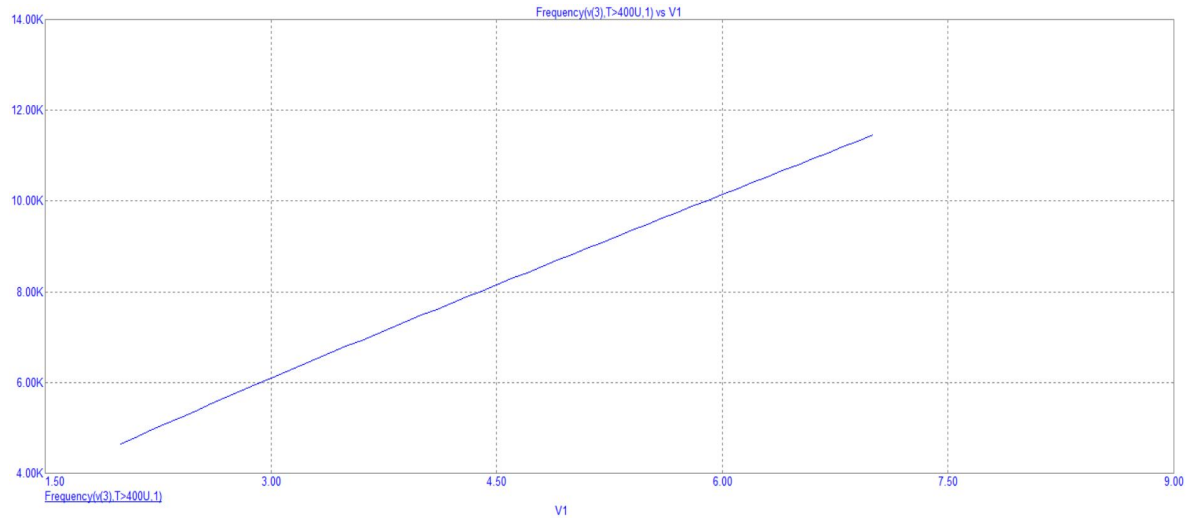
- Capacitor (7nF)
- Transistor (Model = BC547B)
- Resistor (9.6k $\Omega$  and 930 $\Omega$ )
- Oscilloscope
- Breadboard
- Jumper Wires



# Circuit Diagram

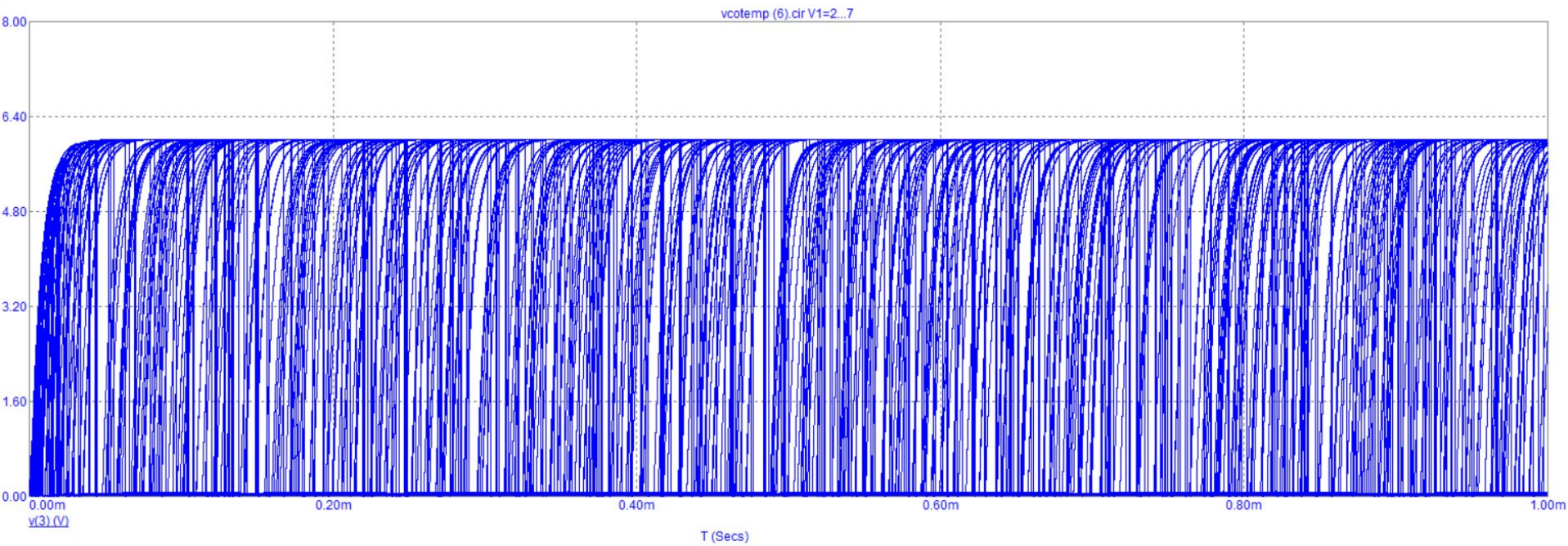


# Graphs/ Data

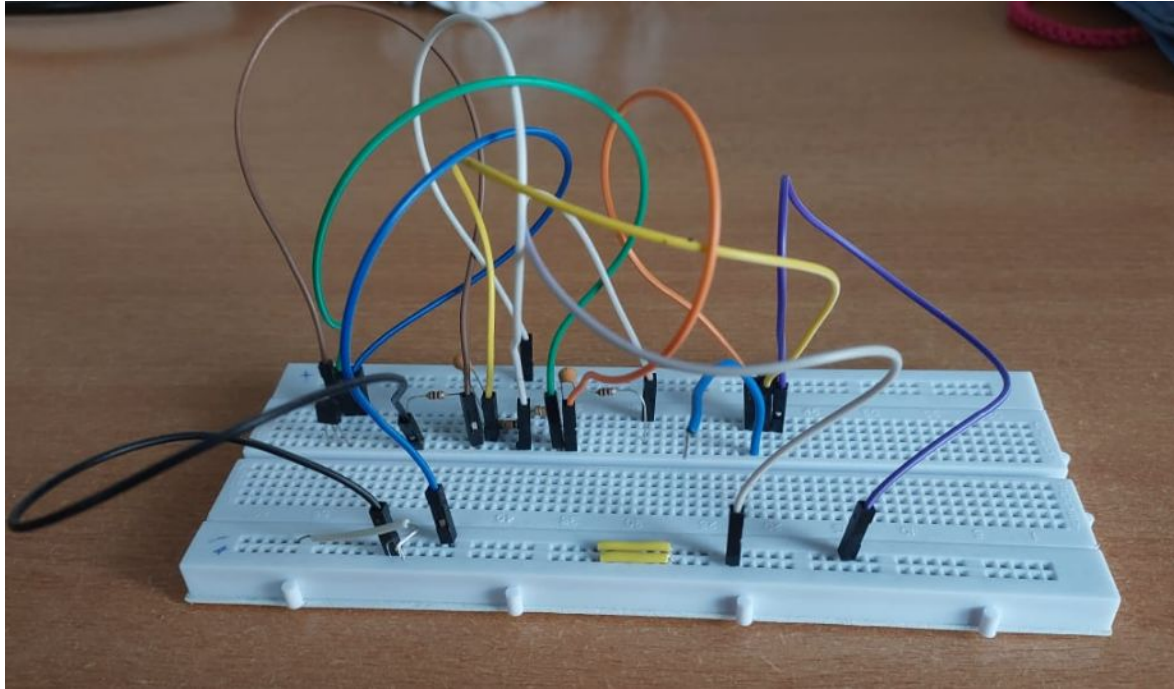


**Frequency vs Voltage relationship**



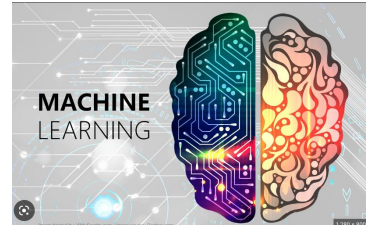


**Voltage vs time relationship**



**This is our circuit**

# How ML is implemented?



In machine learning we have created a program that will take voltage and temperature as input and will predict frequency with the maximum possibility.

For this program we have used linear regression technique. The accuracy of our model is above 95%.



## ML (contd.)

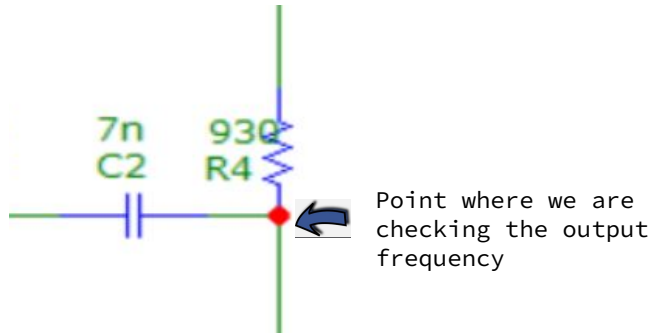
The model will take two input files one for its training and one for evaluation purpose.

Through machine learning we can get the frequency of the circuit in advance at a given voltage and temperature which will help us do the necessary changes in the circuit to get the same frequency in the circuit.



# Working

What we have done is we have created the circuit using the components specified and is connected to the oscilloscope to check the output frequency.



By varying the value of  $V_2$  we are checking the value of output frequency through oscilloscope, this can also be predicted by our ML code with 95% accuracy.

According to the change in voltage the ML is giving us the approximate value of resistor that should be replaced so that we can get back our original frequency.

This can thus help us to save our appliances from external factors



# Scope in the future

This circuit can be created commercially and get be implemented at homes. We can change the resistor to a rheostat which can be automated i.e. changing its value according to the ML's output.

Information regarding any appliances in danger i.e. if huge fluctuation in voltage are taking place can be sent to the user to notify him that there might be some internal issue so that some action can be taken.



# Contact

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