Project Report for MINI HANDHELD Oscilloscope

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This write-up covers the motivation, features, and working of the Mini Handheld Oscilloscope we have built as EDL Project. We have also included the references we have taken to build this.

Motivation:

We wanted to make a Mini Handheld oscilloscope. For beginners who are coming into the world of electronics, understanding and visualizing how waveforms look and how their output is changing is really important. But, the device used for this, an oscilloscope, is really costly, with its cost starting from 10,000 rupees which is too much for someone who is just starting now. So, we wanted to design an oscilloscope for beginners that helps them in understanding several waveforms, and frequencies and helps them gain experience.
The total cost of our oscilloscope is 700 rs(minimum).

Features:

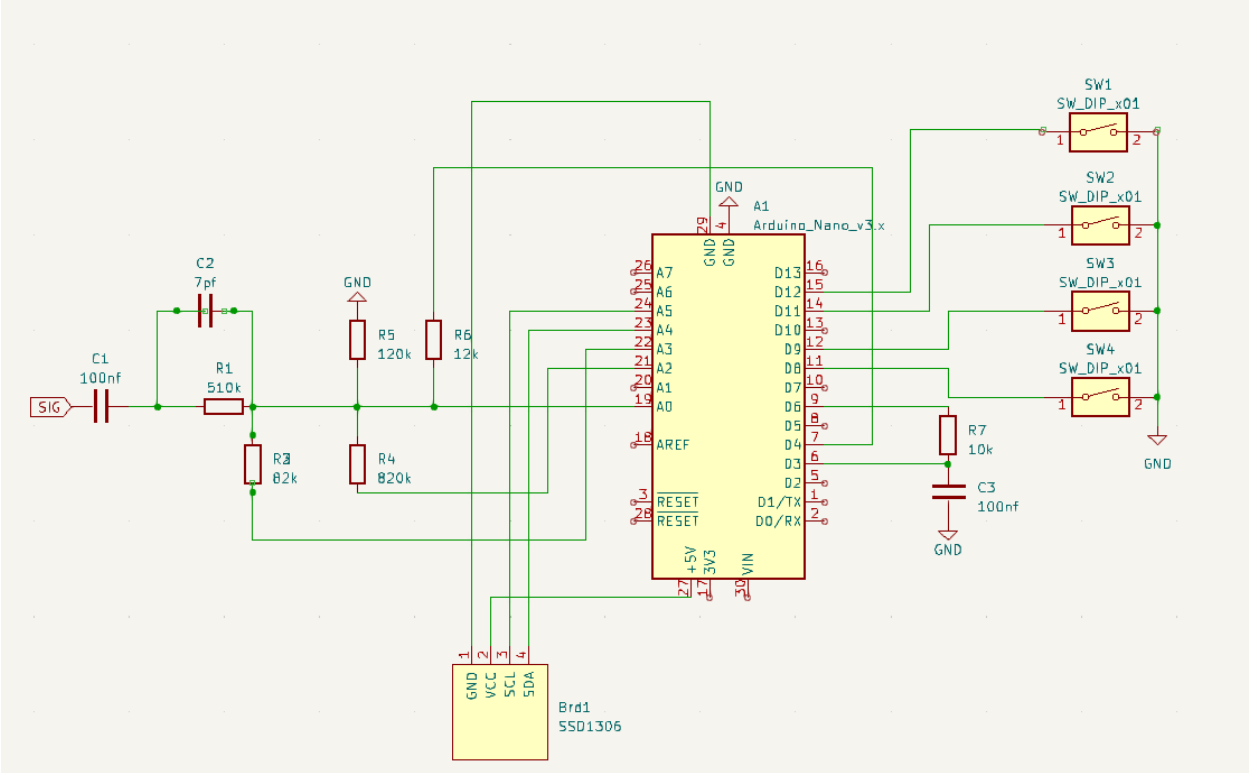
- Optimal frequency range : 10Hz to 20kHz . Single channel 20kHz Bandwidth. Maximum frequency up to 50kHz.
- Duty Cycle monitoring
- Voltage divisions up to 50V range. Time divisions up to precision of 20 μs(minimum) .
- Comes with a hold feature to pause the waveform and take the readings . Also includes buttons to select modes such as AC/DC,

cursors to select range of voltage levels and time levels,i.e, vertical and horizontal resolutions.
- RMS voltage level measurement.
- Works optimally with 5v battery @100mA current.
- Handheld and easily transportable.
- Beginner friendly and for educational purposes only.

Components:

- Arduino nano / Arduino Uno .
- 0.96 inches OLED display with SH110x or SSD130x libraries.
- Breadboard and PCB
- Connecting Wires.
- Resistors : 100k, 10k , 510k, 820k, 12k, 82k.
- Capacitors: 100nF, 7pF, 1µF.
- Push Buttons x4.

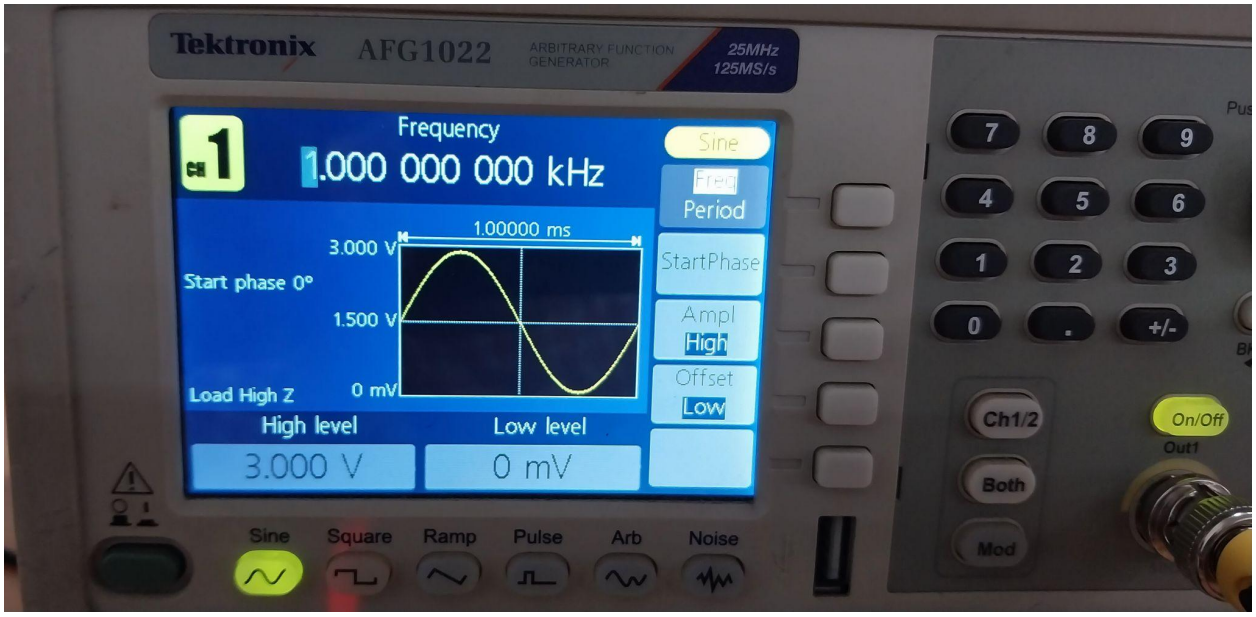
Circuit Diagram:



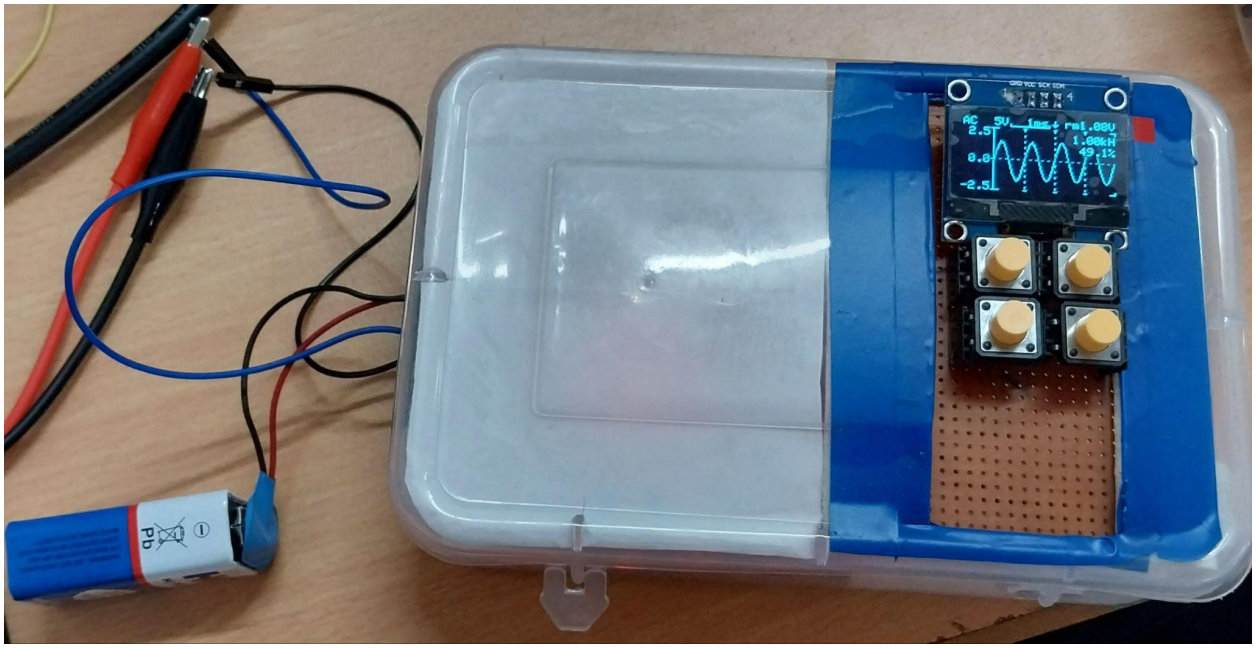
(circuit made using KiCad 7.0)

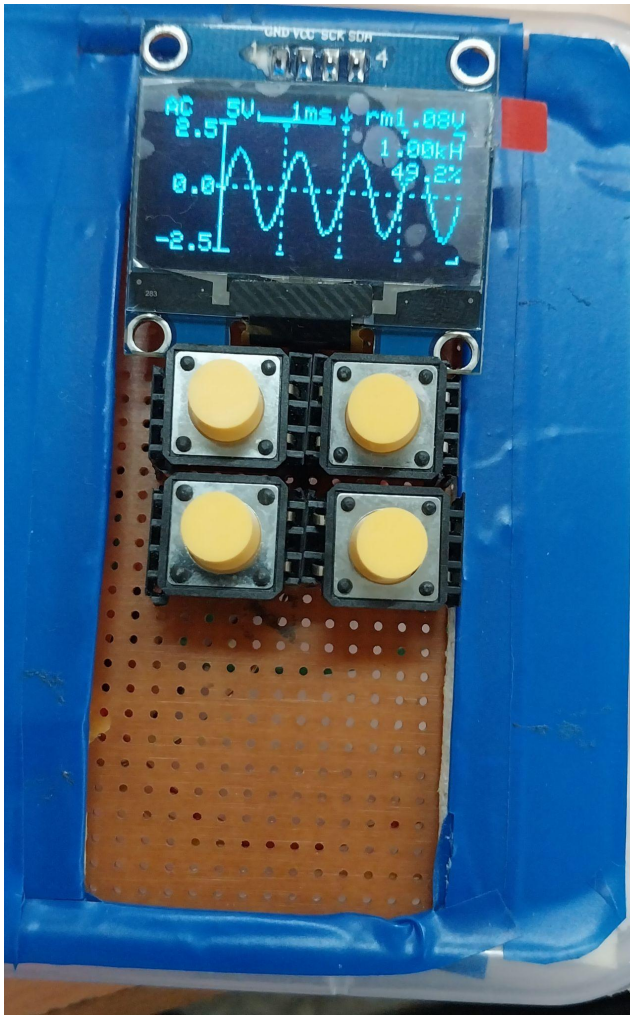
Working :

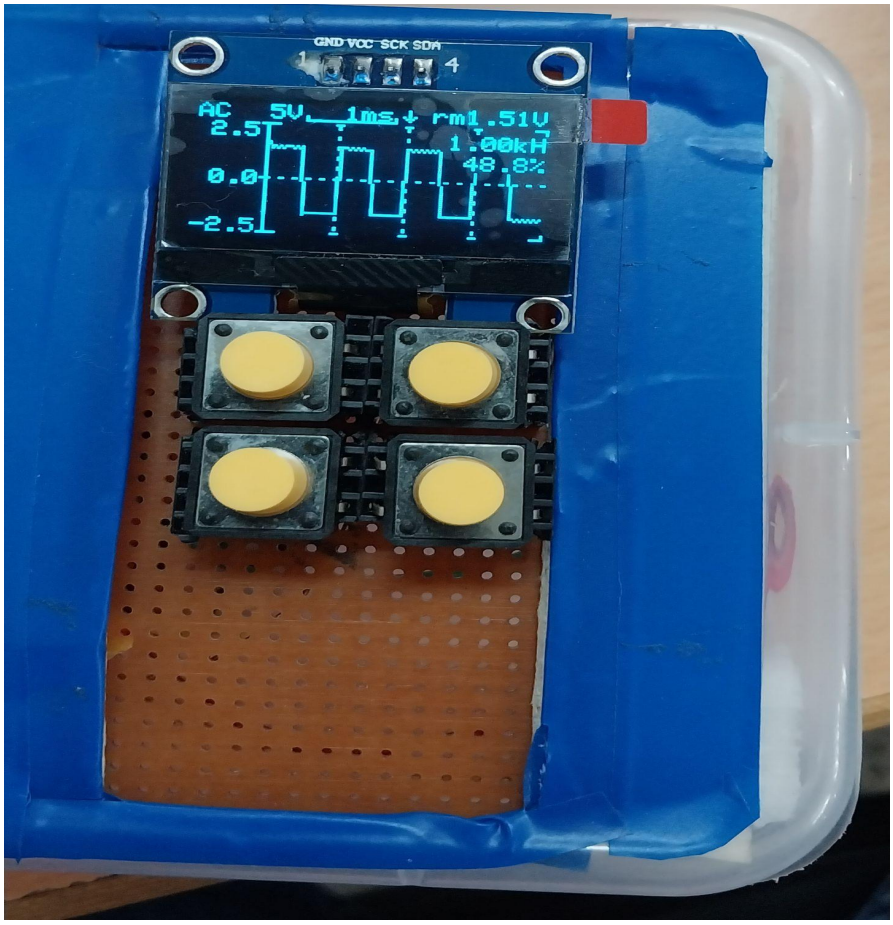
For signal input shown Below:



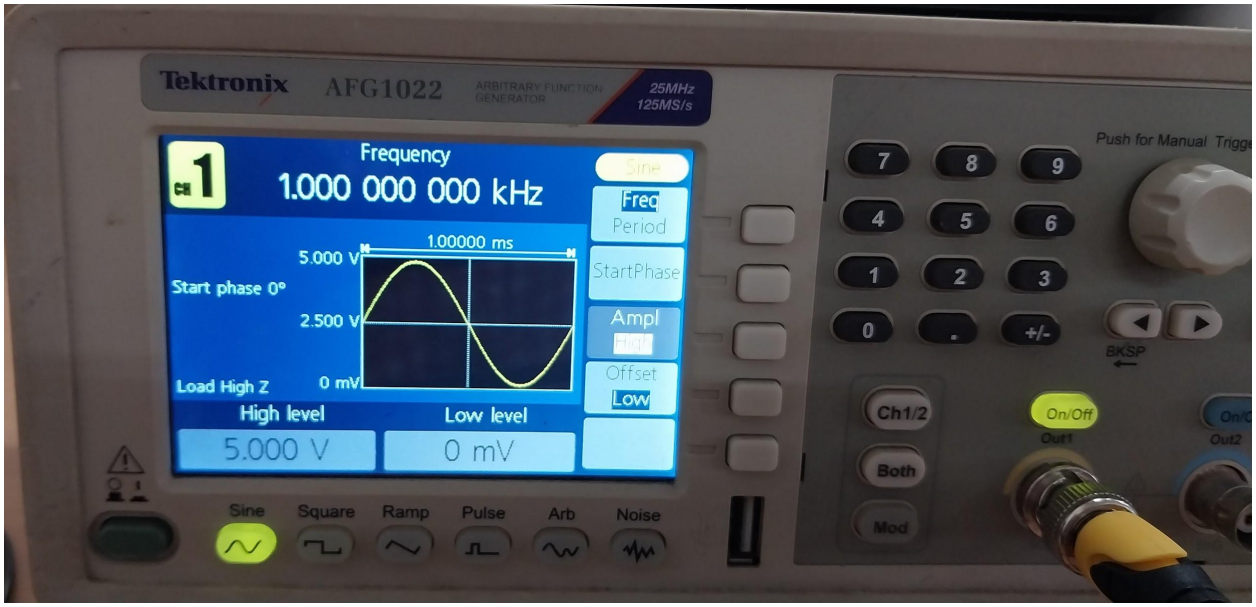
The pictures shows the outputs for several signals.



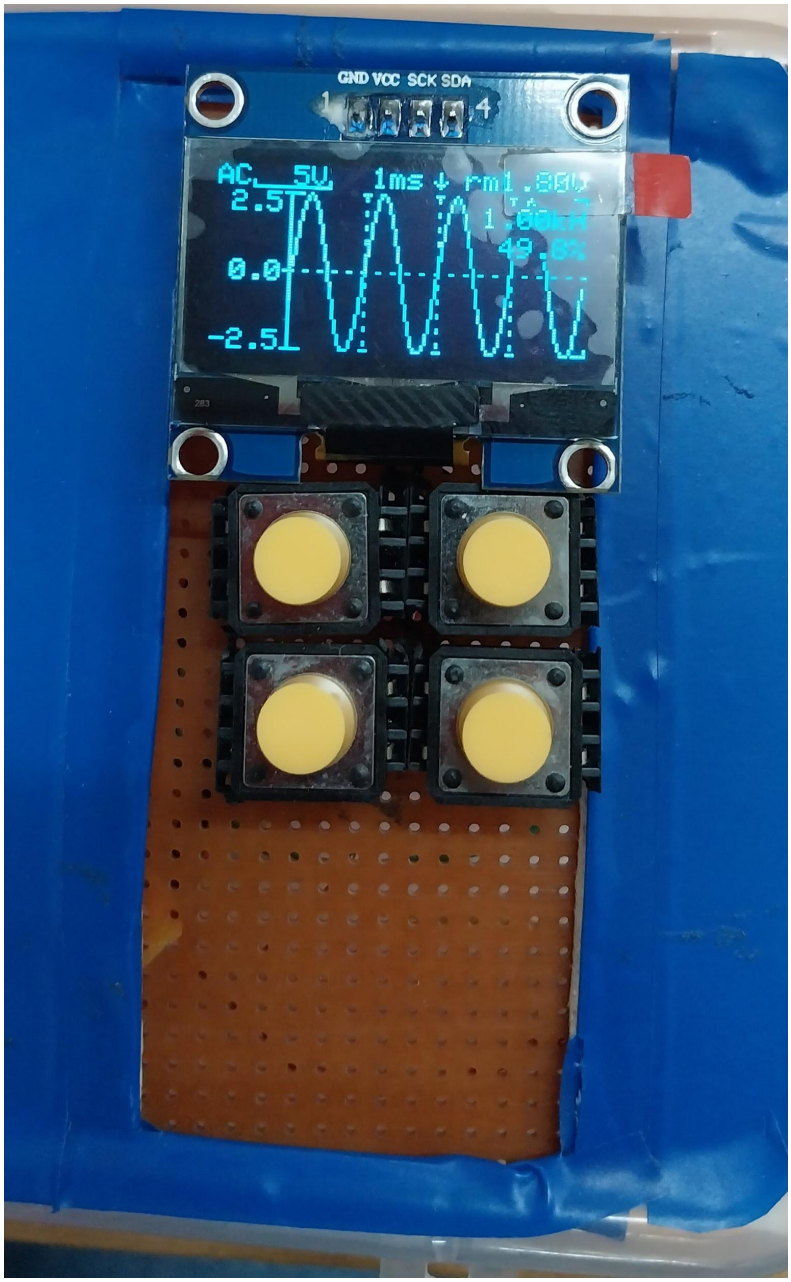

GND VCC SCK SDA
AC 5V 1ms rm1.08V
2.5
0.0
-2.5
1.00kH
49.2%



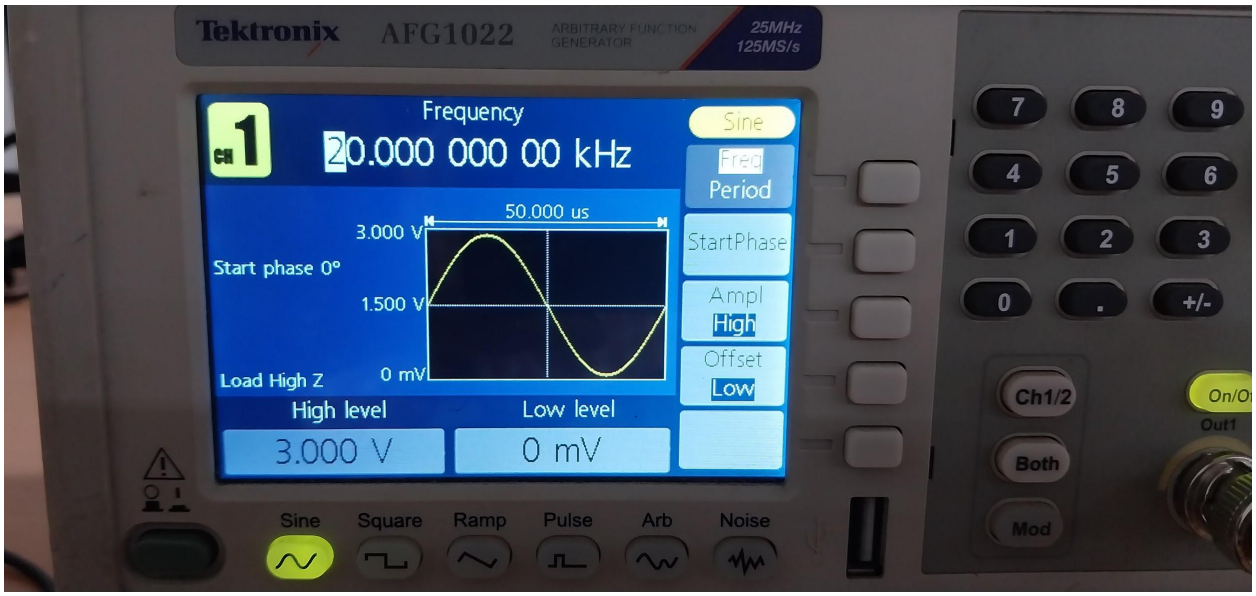
For input signal given below :



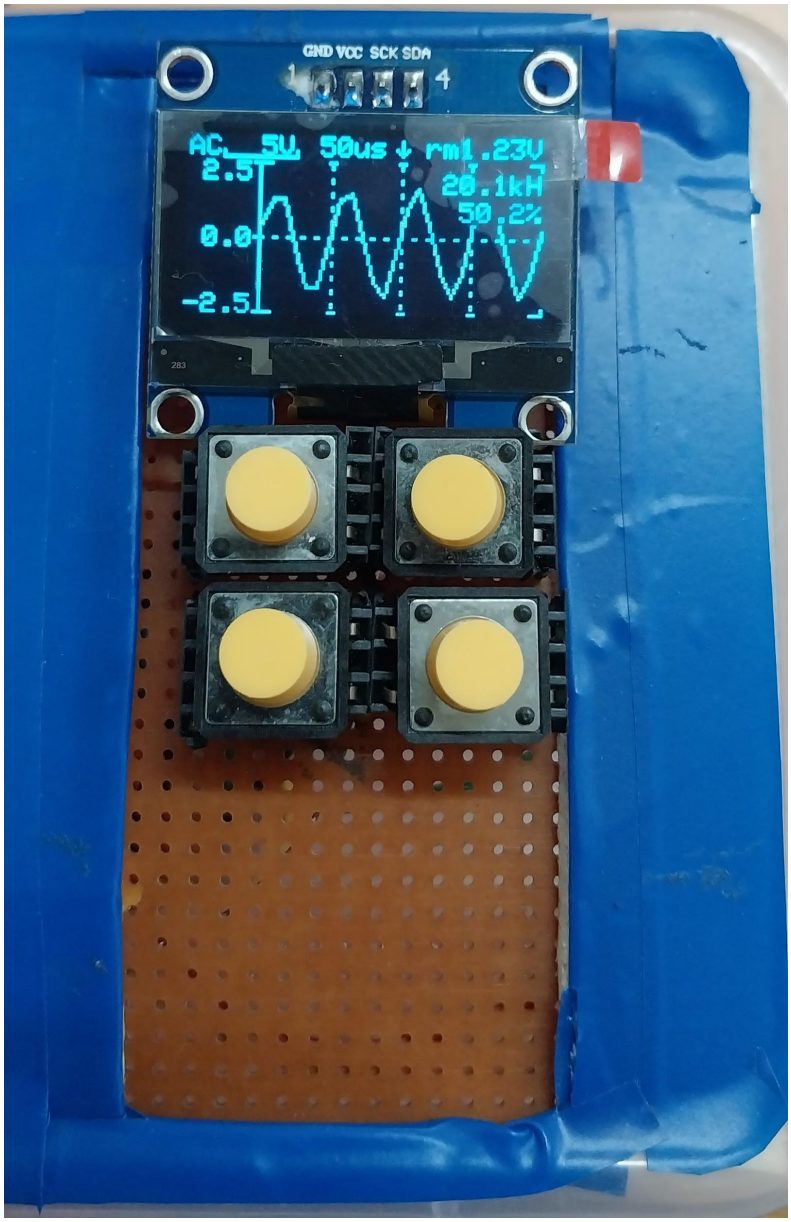
The waveform is shown As :



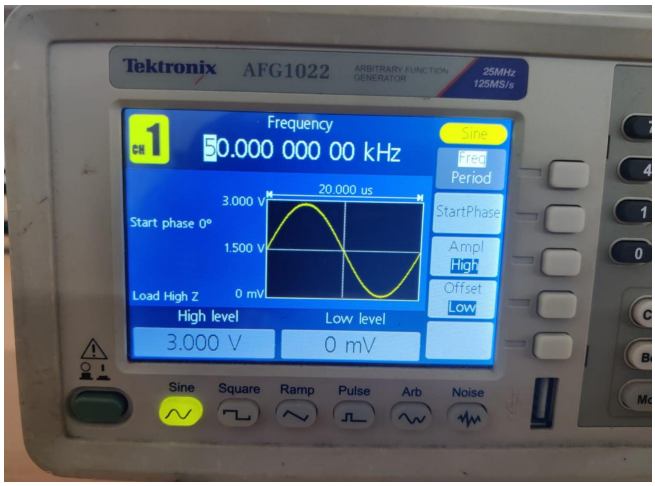
For frequency of 20kHz(bandwidth value) :



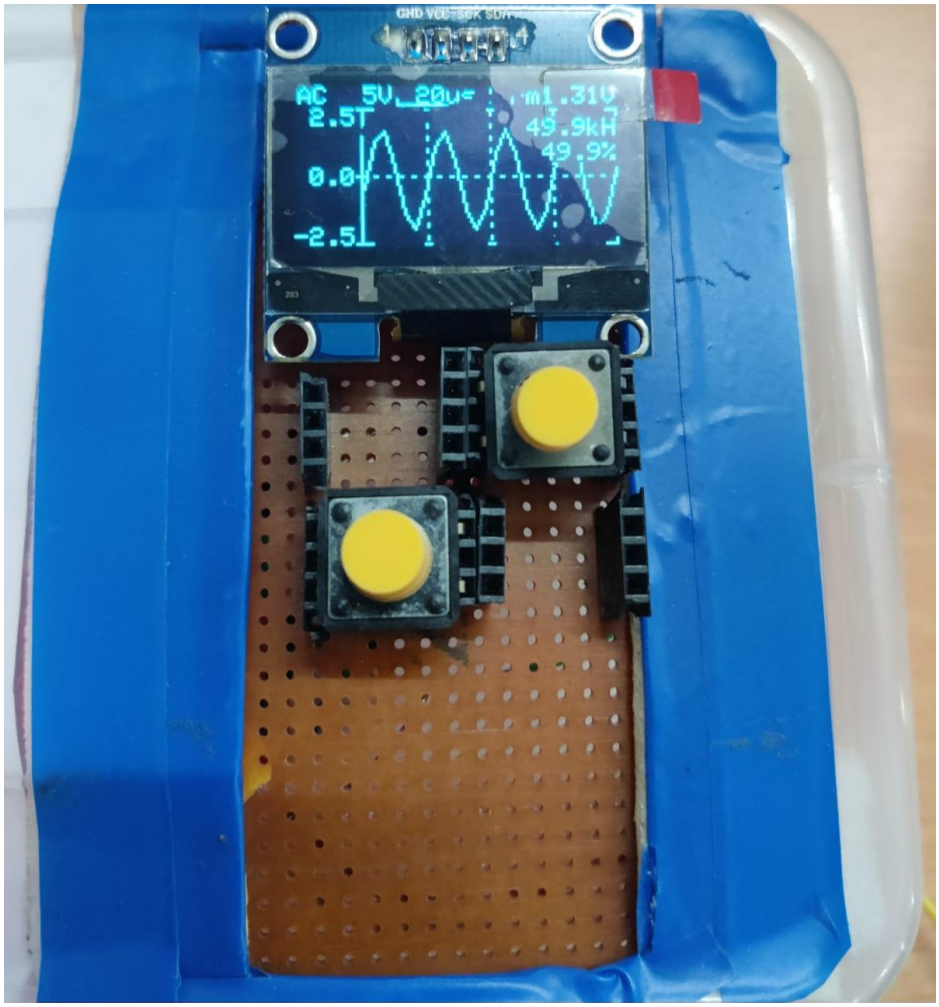
The output is shown as :


GND VCC SCK SDA
1
4
AC 5V 50us rms1.23V
2.5
0.0
-2.5
20.1kH
50.2%

For maximum frequency of 50kHz input given:



The output comes as :



References :

https://www.youtube.com/watch?v=2sGuLeqap3Q

https://www.youtube.com/watch?v=LpbKPiw65_Q

https://www.instructables.com/Oscilloscope-Arduino-Processing/