Project Title: **Honk Free Roads**
Group No.: **DD-15**

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1. Project Objectives:

Horn blowing leads to noise pollution and creates a chaotic environment. Our project aims to:

- Develop a system which would record the number of times and rate at which a horn is pressed by the driver and transmit it to a server.
- The average number of violations in the long term would be further linked with driving capability which in turn could be used to calculate insurance premium or permit charges for the taxi or give rewards to heedful drivers.
- If the driver tries to tamper with the device we install, we will send a signal to the server saying the device has been tampered with and accordingly, strict actions can be undertaken.

2. Project Deliverables:

Our electronic design project will be able to:

- Discriminate between the horn of a car and others around it using amplitude and frequency discriminator techniques and circuits
- If identified as the horn of the car the device is installed in, it should increase the total number of horn count and transmit this to a server using a microcontroller and ESP8266
- Calculate the long term average data from the data we transmit and reward people who honk only when required which can be seen fr
- Detect if our device was tampered with and if yes, transmit this info to the server

3. Work done till Eval-1:

1. Constructed an 8th order Band pass filter by combining an 8th order low pass and high pass filter for frequencies between 400-700 Hz (car horn range) - *Dimple, Pratyush*

Circuit diagram: Refer to Figure 1

Test results: The filter lets all frequencies in the range 400-700 pass and we see a sharp decibel drop outside these cutoffs.

2. Made a mic amplifier circuit and tuned it to give desired amplitude - *Dimple*

Circuit diagram: Refer to Figure 2.
Test results: On playing a frequency on phone and keeping it near the mic, we could see sine wave of the same frequency ranging from 500-900 mV peak-peak depending on minute variation of the distance of our phone.

3. Implemented an amplitude discriminator block using a comparator and a rectifier, and set a threshold to see if the horn (sound given using a mobile phone) matches the expected amplitude - *Dimple, Nisha*

Circuit diagram: Refer to Figure 3.
Test results: Gave input from a function generator. The rectifier gives a DC output which is given to a comparator. Having a 12V supply from battery, regulated it to 5 V and using a potentiometer, set the threshold to 1V for testing. Obtained accurate results with even 100 mV peak-peak difference in input sine wave giving us a 0 V for the lower and 5 V for the higher input.

4. Combined all the above blocks together and verified that this system works. - *Dimple*

Circuit diagram: Refer to Figure 4.
Test results: We were successfully able to construct the above circuit. Had to use an amplifier after the filter because the amplitude was too low.

5. Completed the conversion of analog signal to a 0-5V signal for the microprocessor to measure the frequency for the calibration block - *Pratyush*

6. Researched on the digital potentiometer required for the frequency detection block. - *Pratyush, Nisha*

The value to be output will be decided by the frequency measured during calibration. This resistance value will be used for the determination of the central frequency used for the frequency detection filter.

7. Explored VCOs and phase detectors for constructing a PLL for the frequency discrimination block. - *Nisha*

Taking the example of the tone decoder IC LM567, we figured out part of the internal working of the IC as to how it uses phase-locked looping to detect the frequency defined by the central frequency.

8. Completed PCB design of amplitude discriminator circuit and butterworth filter - *Pratyush, Nisha*

Refer to figures 5, 6, 7

9. Started coding of TIVA microcontroller for frequency detection and calculation for initial calibration - *Nisha*

10. Voltage Regulator assignment - *Pratyush, Nisha*

4. Plans till Eval-2:

- Program the microcontroller for frequency calculation of the signal it receives for the first time and use this frequency to set the resistance value of the digital potentiometer and finish initial calibration.
- Implement the PLL with VCO and phase detector for detecting if the frequency received is our own car's.
- Combine the amplitude and frequency discriminator blocks and getting the final result. Testing this block under a variety of conditions
- Ready the PCB designs for the amplitude block, audio amplifier and filter circuits

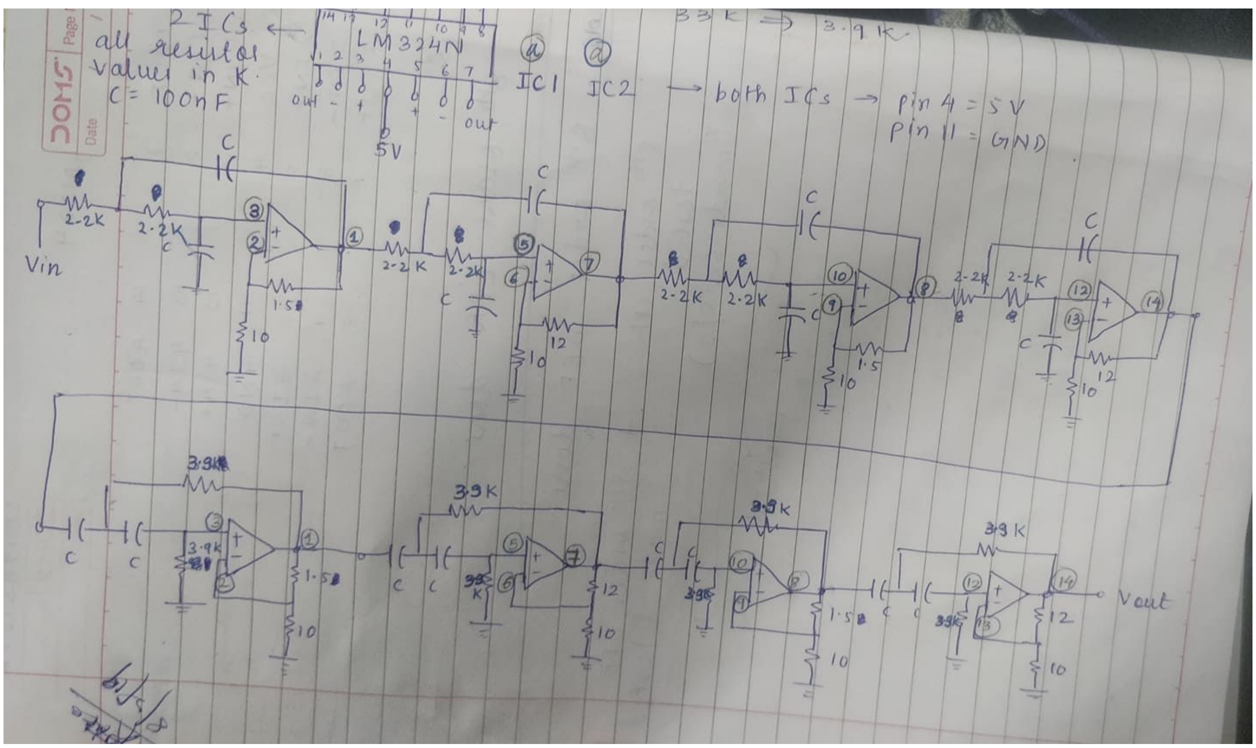


Figure 1

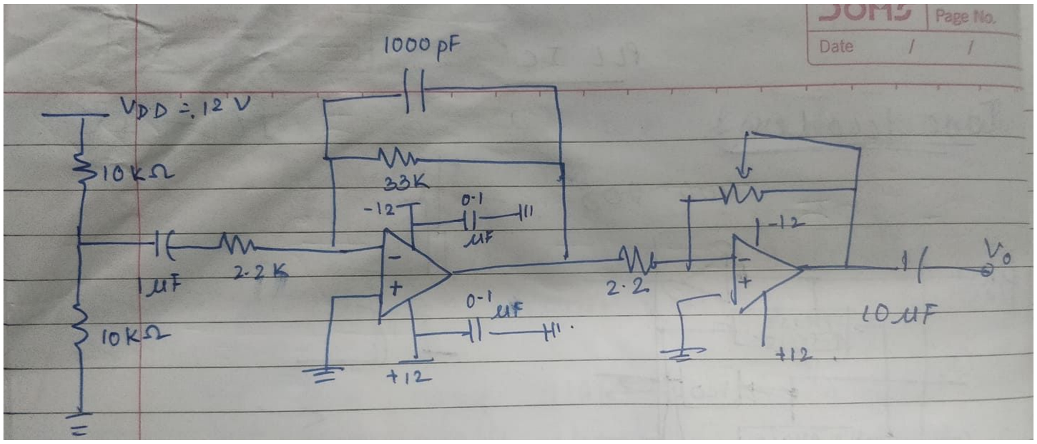


Figure 2

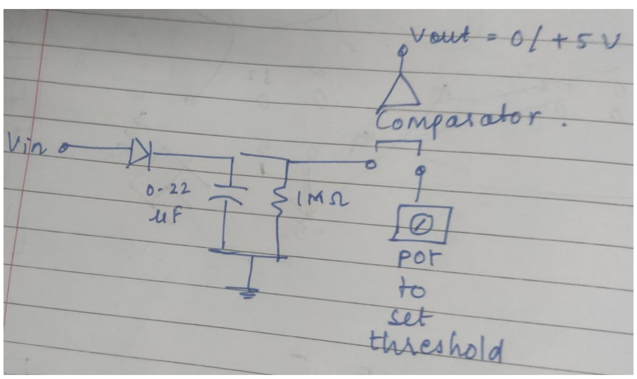


Figure 3

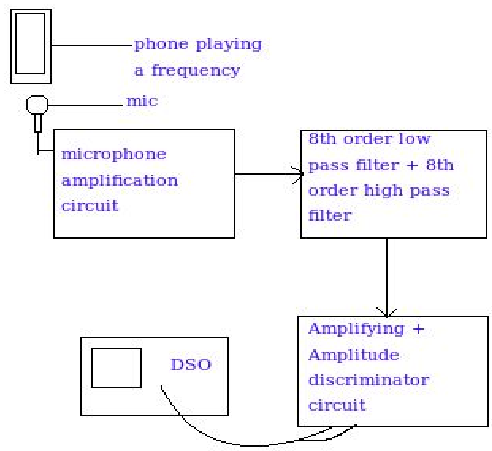


Figure 4

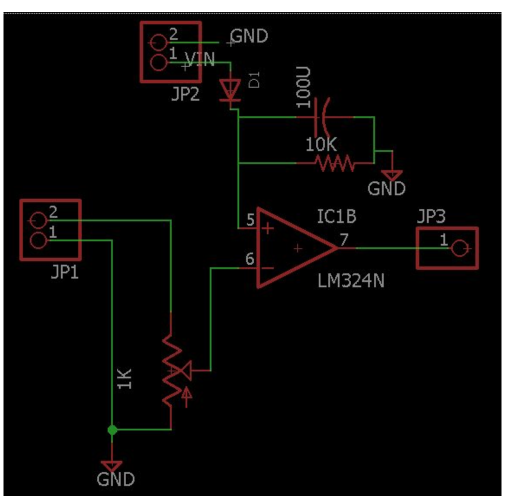


Figure 5

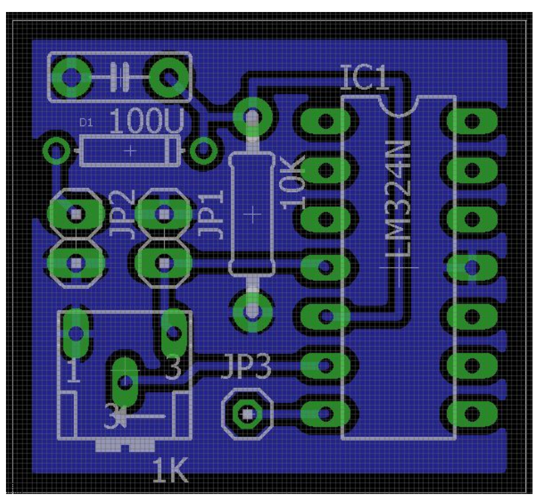
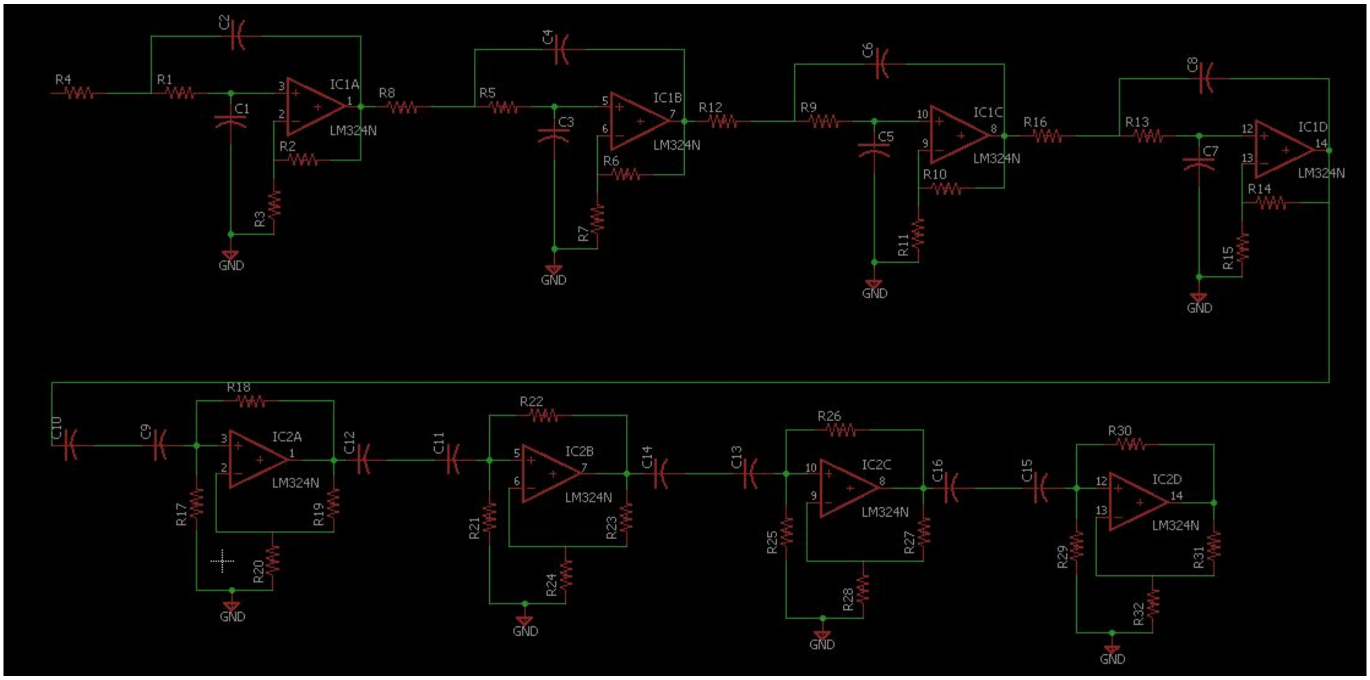


Figure 6



C2
R4
R1
C1
IC1A
LM324N
R2
R3
GND
R8
C4
R5
C3
IC1B
LM324N
R6
R7
GND
R12
C6
R9
C5
IC1C
LM324N
R10
R11
GND
R16
C8
R13
C7
IC1D
LM324N
R14
R15
GND
C10
C9
R18
IC2A
LM324N
R17
R19
R20
GND
C12
C11
R22
IC2B
LM324N
R21
R23
R24
GND
C14
C13
R26
IC2C
LM324N
R25
R27
R28
GND
C16
C15
R30
IC2D
LM324N
R29
R31
R32
GND

Figure 7