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E-Vehicle Sound and Vibration Simulator

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Abstract: These days there have been rising cases in road accidents involving e- vehicles, street animals and pedestrians. This is mainly due to the fact that e-vehicles are not able to produce sounds on their own as conventional vehicles do. So we have taken this problem statement and decided to make a module that can replicate the sound and vibrations.The aim is to build a device that can be easily installed on an e-vehicle and has the ability to imitate both the sound and vibration of the conventional vehicle at different speeds. Hence resulting in safer roads. A sound and vibration of the conventional vehicle is sampled at different speeds and the sound will be sampled using a mic kept at a distance from the vehicle. The vibration can be measured using an accelerometer. Sound can be produced using a pair of Stereo speakers and the vibrations can be replicated using a motor. Implement an independent module that can be installed in an electric vehicle that will add the sound and vibration compatibility as that of the conventional vehicle. In order to trace the live path GSM/GPRS module is used.

Keywords: Sound , Vibration , Arduino Uno , GSM Module , GPS Module , SD Card, Speaker , Smartphone, mbedded C , LCD Display.HTML,CSS,PHP.

I. INTRODUCTION

An Electric vehicle during the last few decades environmental impact of the petroleum based transportation infrastructure along with peak oil has let to renewed interest in an electric vehicles. An electric vehicle run either partially or fully on electric power using energy stored in batteries while petrol and diesel vehicle use an internal combustion engine(ICE).Though the electric vehicle (EV)market in India is in a nascent stage, the government efforts to improve the infrastructure and offer incentives mean that the share of e-vehicle is estimated to grow to 12% of passenger vehicle by 2025-2026. Despite the growing expectations, the EV category has a number of obstacles that make it more difficult to compare to other fuel-powered vehicles. One of the key reasons why so many people became attracted to electric vehicles was because they offer better returns than gasoline-powered cars and are less expensive to maintain.The electric vehicles also have relatively low operating costs. There are benefits and drawbacks to electric automobiles being quieter than gasolinepowered ones. An electric motorcycle that resembles a potent gas motorcycle and is capable of producing an equally terrifying sound pattern to give the normally silent electric motor a unique USP.For purists, the motorcycle's engine's thud and deep sound are like music. When you travel down a lengthy stretch of road, a deep resonating sound can be heard, and as you apply more gas, a low-pitched sound can be heard. The distinct sound of motorcycle engines has been lost with the steady transition to electric motorcycles because the electric motors either create no audible sound at all or very little. For motorheads who live for the lovely sound of fuelpowered motors, this can be a significant turnoff. Lin Yu Cheng, an automotive designer, hopes to change this with his stunning electric motorcycle design. Concerns regarding the safety of pedestrians have been raised by quiet EVs. Children, animals, and those who are blind may have a difficult time detecting an EV because they are so silent.

Since 2019, the U.S. National Highway Traffic Safety Administration (NHTSA) has required new EVs to automatically make noise when they are traveling slower than 18.6 miles per hour “to ensure that blind, visually impaired, and other pedestrians are able to detect and recognize nearby hybrid and electric vehicles.” Beyond 18.6 mph, road noise emitted by EVs is nearly the same as that of gasoline cars.

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Electric vehicles must be fitted with an Acoustic Vehicle Alert System (AVAS) in Europe and Australia, which makes noise at speeds below 20 kilometres per hour (12 mph). Some EVs' AVAS noise is only audible from the outside, thus occupants may not even notice it

However, sighted pedestrians texting in crosswalks may fail to look up from their phones without audible car noise, endangering all pedestrians, not just the blind or visually challenged. Studies indicate a connection between pedestrian-vehicle collisions increasing as a result of people being distracted by cell phone use while crossing streets, notwithstanding the paucity of available data.

To maintain traveller safety, both private and public transportation vehicle safety is of utmost importance. Vehicle location and tracking systems based on the Global System for Mobile Communication (GSM) and Global Positioning System (GPS) provided accurate, real-time vehicle location, mapping, and reporting that added value by raising the level of service offered.. The GPS-based car monitoring system is made to locate any vehicle precisely and notify the appropriate authority of its whereabouts via SMS. The system comes with a GPS modem that may be used to retrieve a vehicle's longitude and latitude. The GPS is used by the system to provide geographic position and timing data. The system consists of a base station that tracks data from the various cars and an onboard module that resides in the vehicle being tracked. The GPS receiver and GSM modem are both part of the onboard module. This gear was hidden from view by the way the car was fitted with it.. The monitoring device receives the location information from that system. As a result, it is constantly deployed as a clandestine unit. When a car is stolen, the tracking system's location data is used to determine the location and to provide the police with information. This offers it a competitive advantage over other technology used for the same purpose. When a user sends a request to the number at the modem, the system immediately sends a return reply to that specific mobile indicating the position of the car in terms of latitude and longitude. A programme has been created that can be used to find the car's precise location and navigate the path of a moving vehicle on a Google map. The device enables tracking of the target at any time, anywhere, and in any weather. This system may be used for many different purposes and is user-friendly, simple to implement, and accessible.

There is an embedded application in the existing design. A moving vehicle is continuously monitored, and reports on the status of the vehicle as needed. An Adriano is connected serially to a GSM modem and a GPS receiver for performing an. The vehicle's latitude and longitude are transmitted using a GSM modem from a distant location. The latitude and longitude of the vehicle's position are sent by the GPS modem as data. Although the GPS modem outputs a wide range of information, only the NMEA data from the National Marine Electronics Association is read and shown on the LCD. The same information is transmitted from the location where the vehicle's location is required to the mobile at the other end. The information a GPS receiver receives is stored in an EEPROM. It is used to find the vehicle's locations, and the GSM module sends the information to the user through SMS. Additionally, status messages or coordinates are shown on an optional 16x2 LCD. It made use of the GSM module SIM 900A and the GPS module GY- NEO6MV2.. The LCD display, GSM modem, and GPS receiver are the hardware interfaces to the microprocessor.

A MUX is utilised to connect the GSM modem and GPS receiver to the controller. When a user sends a request to the number at the modem, the system immediately sends a return reply to that specific mobile indicating the position of the car in terms of latitude and longitude. A programme has been created that allows users to find a vehicle's precise location on a Google map as well as the vehicle's real-time navigational track.

II. PROBLEM STATEMENT

Since electric vehicles have so many benefits, they are in high demand today. On the other hand, there have been an increasing number of traffic accidents involving e-vehicles, strays, and pedestrians. This is mostly because electric vehicles make far fewer noises than do conventional automobiles. We therefore decided to create a module that can reproduce the sound and vibrations based on the problem statement therefore leading to safer roads

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III. COMPONENTS

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuit

1. Arduino uno

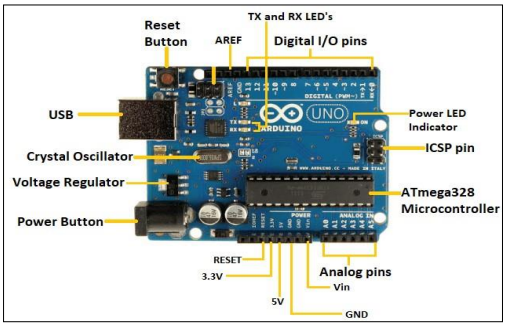

Fig 3.1

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack,and an and an ICSP (In-Circuit Serial Programming) header..

2. SIM 800 (Send Receive SMS & Call with SIM800L GSM Module & Arduino)

The SIM800L GSM/GPRS module is a miniature GSM modem that can be integrated into a large number of IoT projects. You can use this module to accomplish almost anything that a normal cell phone can do such as sending SMS messages, making phone calls, connecting to the Internet via GPRS, and much more.

At the heart of the module is a SIM800L GSM cellular chip from Simcom.

The chip's operating voltage ranges from 3.4V to 4.4V, LiPo battery supply

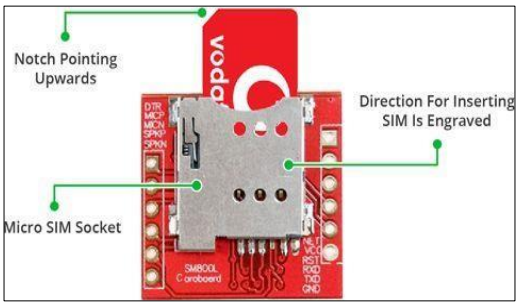

Fig 3.2 making it an ideal candidate for direct

3. MPU6050 - Triple Axis Gyro Accelerometer Module.

- Uses the popular MPU6050 IC
- MPU6050 contains a 3 axis Accelerometer and Gyroscope in a single package and simplifies design and usage.
- Input Voltage: 2.3 - 3.4V
- Selectable Solder Jumpers on CLK, FSYNC and AD0
- Tri-Axis angular rate sensor (gyro) with a sensitivity up to 131 LSBs/dps and a full-scale range of ±250, ±500, ±1000, and ±2000dps

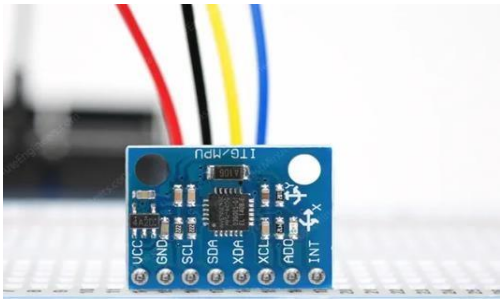

Fig 3.3

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- Tri-Axis accelerometer with a programmable full scale range of ±2g, ±4g,±8g and ±16g
- Digital-output temperature sensor

4. Speaker

- Power Handling - Peak W 285
- Power Handling - Continuous W95
- Impedance Ω - 4
- Frequency response Hz 45 ÷ 22k
- Sensitivity dB SPL 92
- Woofer size mm (in.) 165 (6.5)
- Woofer Voice Coil Ø m (in. 25 (1)
- Tweeter voice coil Ø mm (in.)20 (0.8)
- Woofer magnet High density flux ferrite
- Tweeter magnet Neodymium Woofer cone Pressed-paper cone

Fig 3.4

5. Vibrator Motor (DC motor 1000rpm)

Microcontrollers are used with virtually every vibration motor application. Whilst some industrial applications may want vibration motors to run continuously (where we would recommend a brushless vibration motor).

Fig 3.5

6. SD card (Interfacing Micro SD Card Module with Arduino*)*

- Support 5V/3.3V input. This module can handle 2GB SD cards.
- Size: 4.7 x 3.1 cm. LED indicator. SD Card Holder.
- Onboard 3.3V regulator (AMS1117-3.3) for +5v to 3.3V generation. 3.3V is also available as output.

Fig 3.6

7. NEO-6M GPS Module (Interface u-blox NEO-6M GPS Module with Arduino)

It has the ability to sense locations with the NEO-6M GPS module that can track up to 22 satellites over 50 channels and achieve the industry's highest level of tracking sensitivity i.e. -161 dB, while consuming only 45 mA current.

Unlike other GPS modules, it can perform 5 location updates in a second with 2.5m horizontal position accuracy. The U-blox 6 positioning engine also has a Time-To-First-Fix (TTFF) of less than 1 second.

Fig 3.7

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The required data pins of the NEO-6M GPS chip are broken out to a 0.1″ pitch headers. It contains the pins needed for communication with the microcontroller over the UART. The module supports baud rates from 4800bps to 230400bps with a default baud of 9600.

8. DF Player MP3 module

The DF Player Mini MP3 Player For Arduino is a small and low price MP3 module with an simplified output directly to the speaker. The module can be used as a standalone module with attached battery, speaker and push buttons or used in combination with an **Arduino UNO** or any other with RX/TX capabilities.

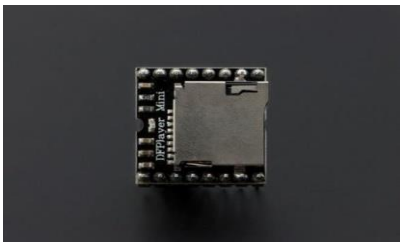

Fig 3.8

IV. BLOCK DIAGRAM

The project has two parts –

1. Data logging part - Where the sound and vibration of the conventional vehicle is sampled at different speeds. The sound will be sampled using a mic kept at a distance from the vehicle. The vibration can be measured using an accelerometer.

2. Module Development - The sound can be produced using a pair of Stereo speakers and the vibrations can be replicated using a motor. The sound and vibrations would be different at different speeds.

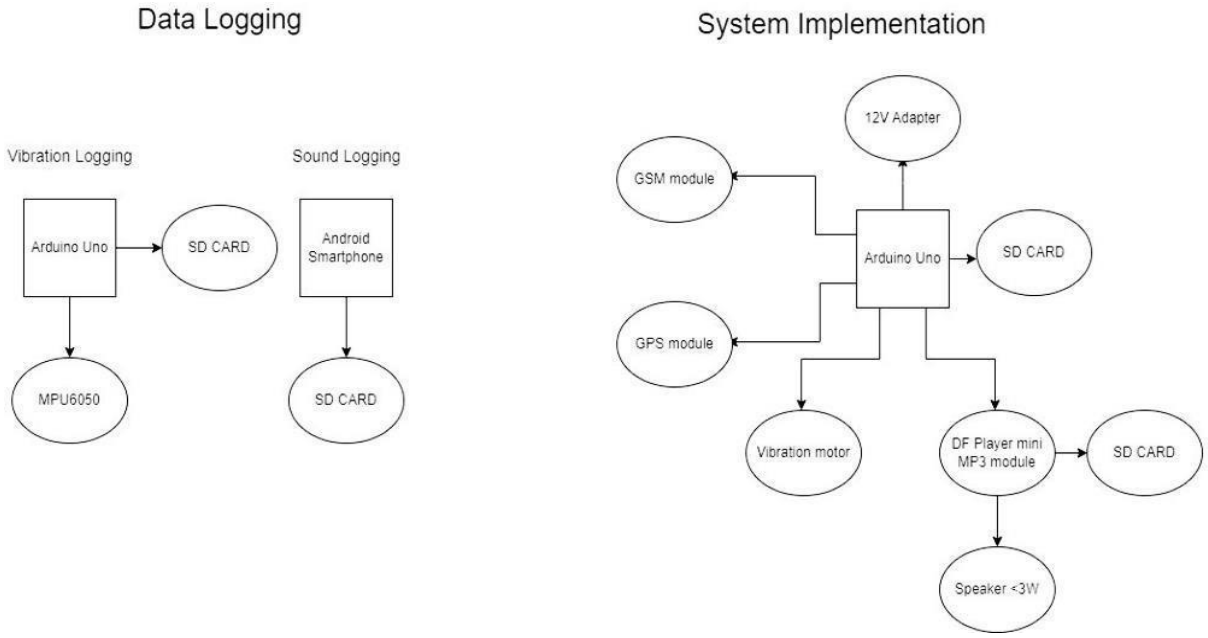

Fig .4.1 Module 1&2

V. COLLECTING THE DATA AT DIFFERENT SPEED

A sound and vibration of the conventional vehicle is sampled at different speeds. That is 10 mph, 20mph, 30mph and 60mph, the sound will be sampled using a mic kept at a distance from the vehicle. The vibration can be measured using an accelerometer. The gyroscope measures rotational velocity or rate of change of the angular position over time, along

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the X, Y and Z axis. The outputs of the gyroscope are in degrees per second, so in order to get the angular position we just need to integrate the angular velocity.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	**Stable						Start				10km				20km				30km		
2	X	-0.1		-0.31		10.34	X	-0.13	-0.32	10.39	X	-1.03	0.57	9.92	X	-0.95	-1.71	9.64	X	-3.6	-1.91
3	-0.11	-0.02		-0.3		10.38	-0.1	-0.12	-0.28	10.32	-1.83	-1.14	-0.47	10.52	-3	2.04	0.92	6.78	2.38	-3.65	-2.1
4	Y	-0.1		-0.31		10.47	Y	-0.09	-0.29	10.33	Y	1.51	-0.42	10.77	Y	3.38	1.95	9.3	Y	-1.77	-1.85
5	-0.32	-0.12		-0.33		10.37	-0.32	-0.11	-0.4	10.39	0.35	-0.63	-0.07	9.93	1.56	-1.12	-0.55	11.68	3.17	1.61	1.49
6	Z	-0.1		-0.34		10.36	Z	-0.1	-0.25	10.31	Z	1.04	-0.51	9.57	Z	-3.65	-1.4	12.86	Z	2.9	2.21
7	10.35	-0.06		-0.28		10.27	10.35	-0.07	-0.47	10.33	10.01	-0.88	0.53	10.31	11.6	-3	-2.28	10.76	7.72	2.51	1.8
8		-0.06		-0.3		10.4		-0.08	-0.53	10.26		-0.75	-1.64	10.36		-1.92	-1.43	10.18		-1.29	-1.13
9		-0.13		-0.26		10.28		-0.05	-0.38	10.31		2.5	-0.96	10.67		1.8	1.61	9.92		-2.82	-2.12
10		-0.1		-0.37		10.4		-0.12	-0.51	10.27		-1.83	1.19	9.81		3.16	0.62	9.02		-3.32	-2.43
11		-0.1		-0.3		10.34		-0.11	-0.32	10.35		-0.36	-1.98	10.24		3.32	1.25	8.94		0.94	1.29
12		-0.09		-0.33		10.32		-0.12	-0.35	10.35		1.3	-0.79	10.81		1.34	0.99	9.68		2.7	1.34
13		-0.07		-0.29		10.3		-0.04	-0.41	10.34		-0.38	1.05	10.18		-1.59	-1.24	9.99		3.5	1.17
14		-0.09		-0.31		10.38		-0.01	-0.24	10.46		1.03	-1.09	9.94		-3.04	-1.73	10.95		3.9	1.36
15		-0.09		-0.32		10.34		-0.07	-0.17	10.38		-1.48	0.95	10.86		-4.09	-1.66	11.68		3.51	0.89
16		-0.11		-0.31		10.42		-0.06	-0.24	10.51		-0.76	-2	10.67		-1.06	1.68	12.02		-1.94	-1.44
17		-0.11		-0.33		10.41		-0.1	-0.33	10.45		3.01	0.47	10.33		2.38	0.55	10.54		-3.28	-1.5
18		-0.06		-0.31		10.33		-0.08	-0.44	10.37		-1.53	0.83	9.94		2.96	0.4	9.38		-3.5	-1.99
19		-0.05		-0.31		10.37		-0.09	-0.28	10.35		-1.28	-0.52	10.47		3.82	0.38	9.15		-3.75	-1.9
20		-0.1		-0.29		10.38		-0.09	-0.38	10.43		-0.09	-0.25	11.26		3.93	0.93	8.52		-3.62	-1.53
21		-0.05		-0.27		10.38		-0.1	-0.34	10.35		-1.15	-0.98	9.89		3.5	1.27	9.69		-3.52	-1.91
22		-0.14		-0.32		10.38		-0.11	-0.28	10.39		2.56	-1.16	10.3		-0.11	-1.42	9.45		-3.56	-2.38
23		-0.09		-0.32		10.37		-0.1	-0.39	10.35		-1.77	1.42	9.63		-2.8	-1.12	11.01		-2.67	-1.11
24		-0.15		-0.31		10.33		-0.08	-0.31	10.34		-0.35	-2.01	10.14		-3.33	-1.65	11.65		-1.86	-1.35
25		-0.08		-0.28		10.37		-0.14	-0.36	10.31		0.98	-0.49	10.67		-4.39	-1.56	11.52		-0.48	-1.61
26		-0.06		-0.27		10.41		-0.11	-0.32	10.32		-0.51	0.62	10.54		-1.89	0.95	9.97		0.58	-0.16

VI. CIRCUIT DIAGRAM

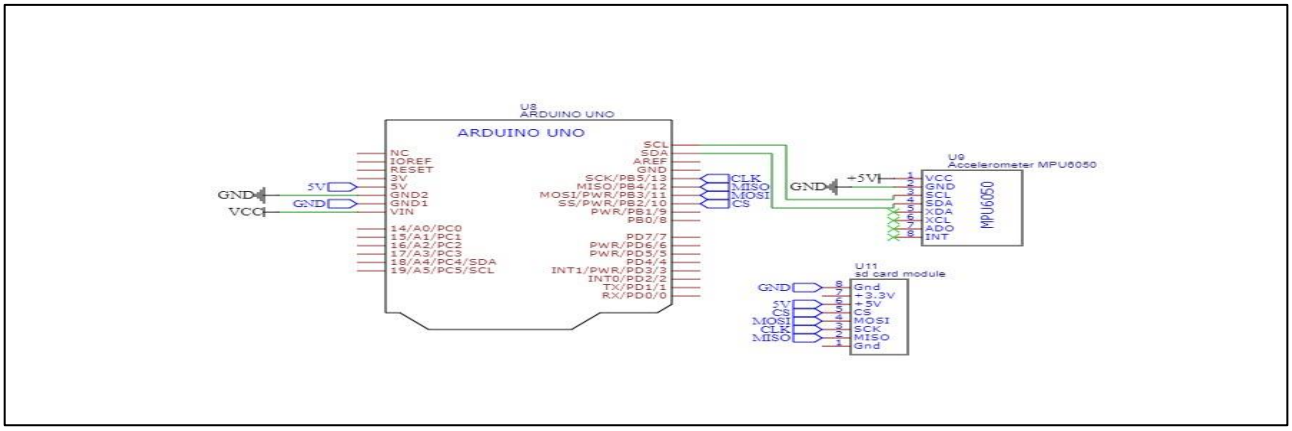

Fig 6.1 Module 1

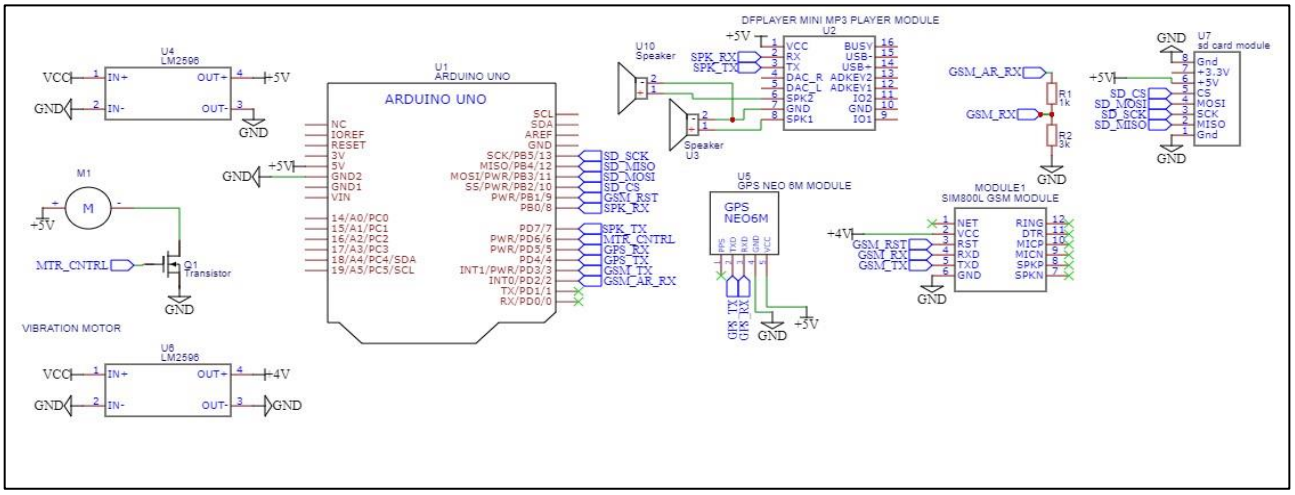

Fig 6.1 Module

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VII. FLOWCHART

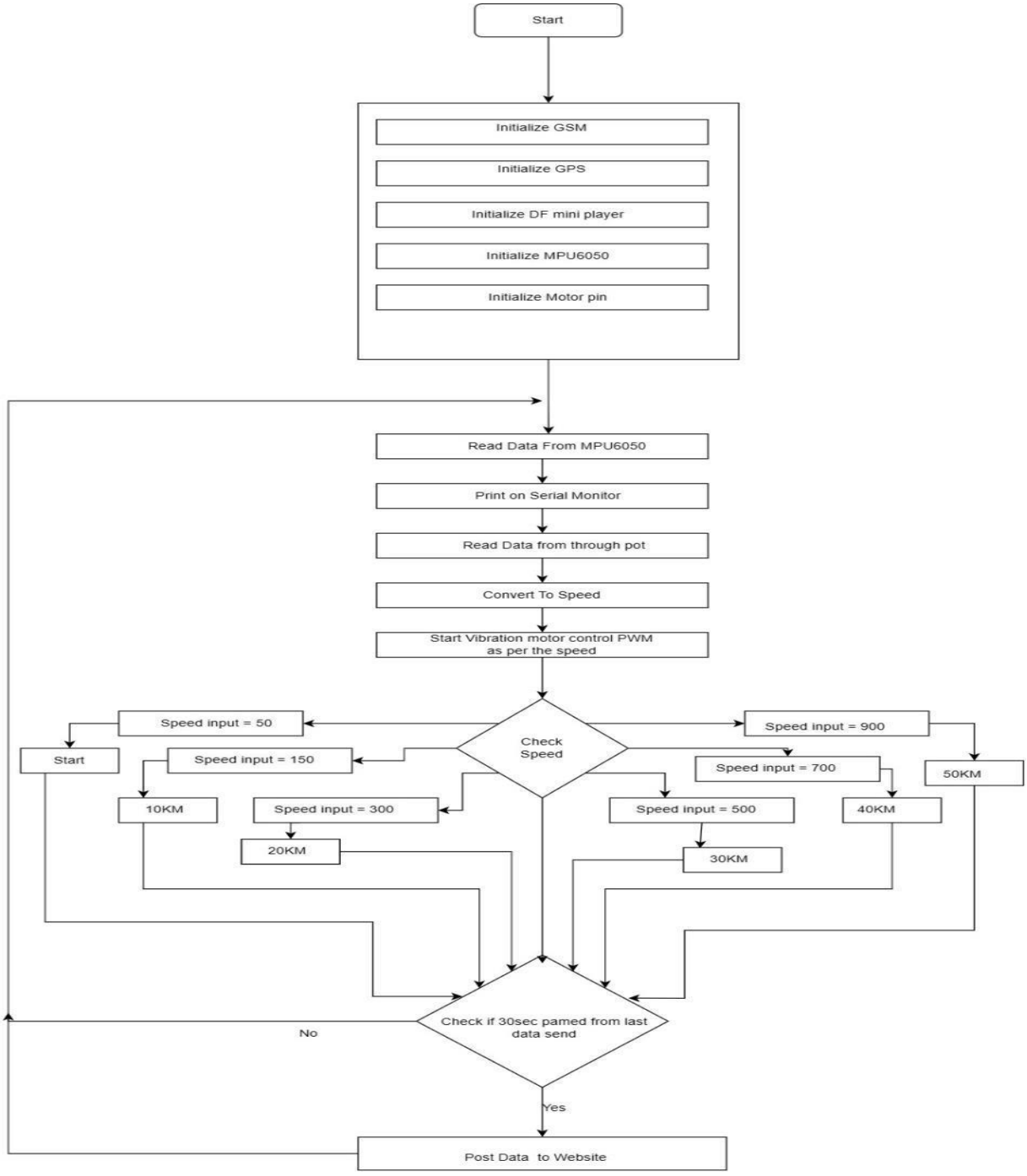

Fig 7.1 Flowchart

VIII. EXPECTED OUTCOMES

The device help to prevent road accident and keep alerting pedestrians and street animal by producing sound and vibration. This hardware is fitted on to the vehicle in such a manner that it was not visible to anyone. The safety of private and public vehicles is a major concern to ensure safety while travelling. Global System for Mobile Communication (GSM) and Global Positioning System (GPS) based vehicle location and tracking system provided effective, real time vehicle location, mapping and reporting this information value on website and add by improving this level of service provided.

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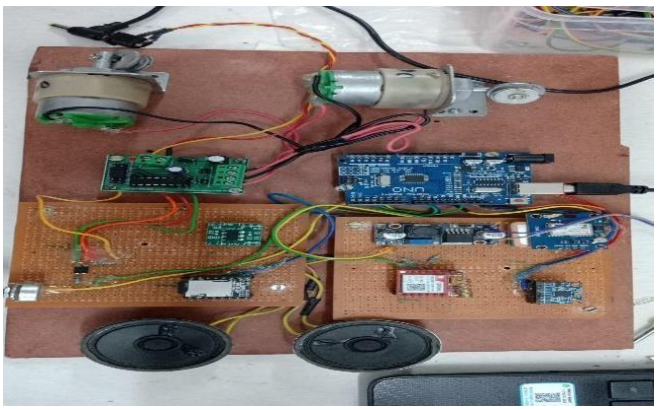

IX. CONCLUSION

a separate module that can be installed in an electric automobile to improve the vehicle's sound and vibration compatibility, improving road safety. The findings demonstrate that the speed of the test automobiles and the location of the vibration monitoring instrument have an effect on the statistics of pavement vibration. Accurate vibration data collection depends on a variety of other factors, including the number of monitoring repetitions. Both test vehicles' smartphone applications' data on pavement vibration accuracy are Acceptable. Additionally, there is a correlation between per values and the pavement vibration monitoring method using smartphone applications, showing that this method is reliable and appropriate for ongoing road pavement monitoring activities... It also provides a precise indication of the pavement's performance and quality Furthermore, this study work attempts to present several pavement monitoring approaches that may be employed by researchers and transportation organizations with acceptable levels of accuracy.

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