ENHANCED VEHICLE SECURITY SYSTEM USING IOT

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Abstract-These days vehicle robbery cases are higher than any other time. On an average in America there is a vehicle robbery in every 40.9 seconds in recent times. As per the Insurance Information Institute (III) almost 8 lakh vehicles were stolen every year. The first consideration is safety and this paper addresses all this with the tracking of vehicle, offering different features like – Anti-theft system, face recognition, live vehicle tracking, alerts on towing of the vehicle and sharing the current location of the vehicle. System is equipped with technology that enables to send information only to the selected users if there is some sort emergency situation occurs. The other concern about the vehicle is the performance parameters which can be labeled as status of the vehicle's functions like – digital fuel monitoring and rash driving warnings. For this, sensors used are Level sensor, IR sensor, PIR sensor and Shock Sensor. Other equipment used are OLED display, Buzzer alarm, Arduino Uno, GSM, GPRS Module, Raspberry Pi and Camera. All the information is sent on the user's mobile application using Wi-Fi Module.

Keywords: Global Positioning System (GPS), Global System for Mobiles (GSM).

1. INTRODUCTION

As per the survey put through by some of the famous carmakers in the world, they found that the major concerns in almost every customer is about the Safety, Security, and Performance of the vehicle. According to them the top most concern is about the safety and security and the Car add Ons addresses these problems with features like tracking of the vehicle and also offering features like - Anti-theft system, tracking of the vehicle, alerts on towing of the vehicle and sharing the location of the vehicle. This system is equipped to send information to the concerned ones if there is some emergency situation occurs. The other concern is about the performance parameter of the vehicle which can be addressed by live status of the vehicle functions that provides information like digital fuel monitoring, alerts on over speeding and more.

So many security and tracking systems are there to help with huge number of vehicles and also resolving other purposes too. But there are definitely some security gaps with these systems which is needed to be resolved to ensure greater security.

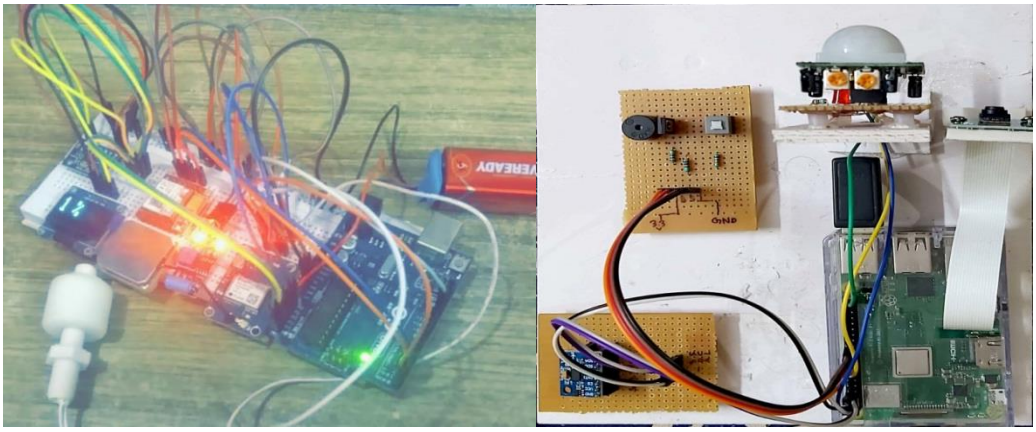

Fig. 1.1 Hardware Implementation

2. NOTATION AND ASSUMPTIONS

GPS is for Global Positioning System
GSM is for Global System for mobile
SMS is for Short Service Message
PIR: Passive Infrared Sensor
It is assumed that the tools used works alike for small datasets to large datasets.

3. VEHICLE TRACKING SYSTEM

Global Positioning System is basically a way to track or to figure out where a thing is. A GPS tracking system work as device where it either can be in the fixed state or in a portable unit, also can be used on a mobile phone, fixed or

placed in a vehicle etc. GPS provides information of the exact location or the coordinates. It can be used to track the movements of any vehicle or person. So, for example, nowadays there is tracking done for the package by various shopping sites, they monitor the progress for the parcel, and by parents to have some idea of the location of their child, or even to monitor high-valued assets in transit. It sends the data as $GPGGA string which contains the coordinates, time, height, altitude and other useful information.

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$GPGGA,104534.000,7791.0381,N,06727.4434,E,1,08,0.9,510.4,M,43.9,M,,*47
$GPGGA,HHMMSS.SSS,latitude,N,longitude,E,FQ,NOS,HDP,altitude,M,height,M,,checksum data
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Fig. 3.1 GPS Parameters

Fig. 3.2 GPS Tracking

4. DIGITAL FUEL MONITORING

Digital Fuel Monitoring monitors the level of the fuel remaining in the vehicle tank and dispay the percentage of fuel remaining in the tank. For this Level Sensor is mounted in the fuel tank of the vehicle which contains a magnetic float that moves up and down with the fuel level. The sensor will provide the digital readings of fuel level in real time. The sensor output value ranges from 0 to 1023 which on applying mapping show the results between 0 to 100 in the form of percentage. This Level Sensor is controlled by the microcontroller, i.e., Arduino Uno and display the result on the OLED display.

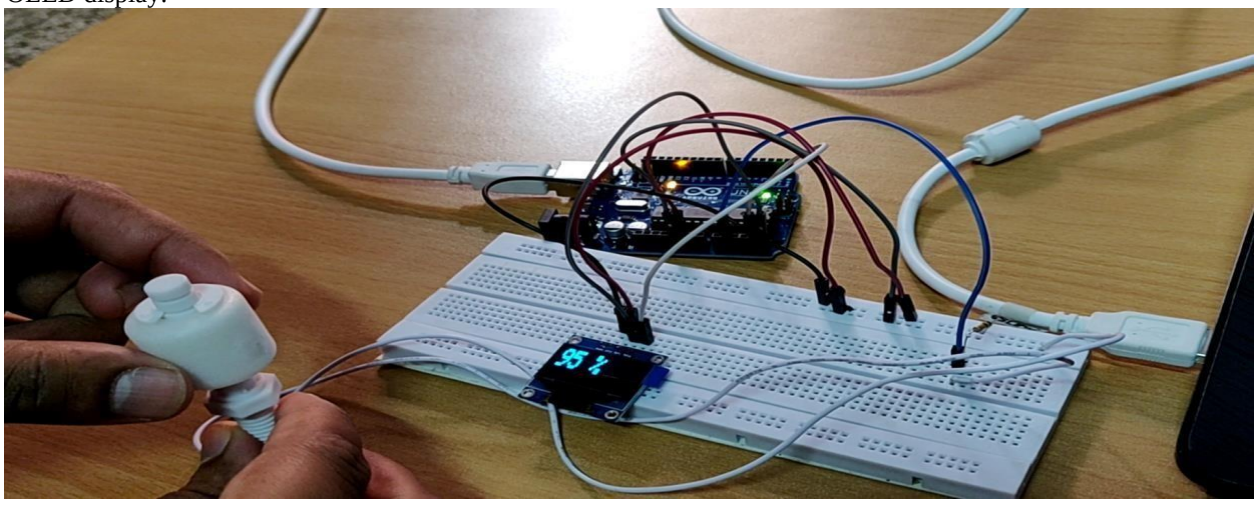

Fig. 4.1 Digital Fuel Monitoring

5. EMERGENCY ALERT SYSTEM

ADXL345 is a Three-axis accelerometer which is used to measure static force,s one of the most common static force is the gravitational force. Accelerometer also measures the dynamic forces that are the movements, or vibrations etc. The unit is meter per second squared (m/s^2). But , it notifies in the unit of gravity(g) . One “g” is the value of the earth gravitational force which equals to 9.8 meters per second squared.

If a accelerometer is placed in a flat position which is facing upwards the Z-axis in opposition to that of the gravitational force , in this state the Z-axis output of sensor will be around 1g. Also the other axis that is X and Y outputs will not have any effect on them due to gravitational force being perpendicular to X and Y hence there outputs will be zero .

ADXL345 Data Sheet

SPECIFICATIONS

T_A = 25°C, V_S = 2.5 V, $V_{DD\ I/O}$ = 1.8 V, acceleration = 0 *g*, C_S = 10 µF tantalum, $C_{I/O}$ = 0.1 µF, output data rate (ODR) = 800 Hz, unless otherwise noted. All minimum and maximum specifications are guaranteed. Typical specifications are not guaranteed.

Table 1.

Parameter	Test Conditions	Min	Typ[1]	Max	Unit
SENSOR INPUT	Each axis				
Measurement Range	User selectable		±2, ±4, ±8, ±16		*g*
Nonlinearity	Percentage of full scale		±0.5		%
Inter-Axis Alignment Error			±0.1		Degrees
Cross-Axis Sensitivity[2]			±1		%
OUTPUT RESOLUTION	Each axis				
All *g* Ranges	10-bit resolution		10		Bits
±2 *g* Range	Full resolution		10		Bits
±4 *g* Range	Full resolution		11		Bits
±8 *g* Range	Full resolution		12		Bits
±16 *g* Range	Full resolution		13		Bits
SENSITIVITY	Each axis				
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	All *g*-ranges, full resolution	230	256	282	LSB/*g*
	±2 *g*, 10-bit resolution	230	256	282	LSB/*g*
	±4 *g*, 10-bit resolution	115	128	141	LSB/*g*
	±8 *g*, 10-bit resolution	57	64	71	LSB/*g*
	±16 *g*, 10-bit resolution	29	32	35	LSB/*g*
Sensitivity Deviation from Ideal	All *g*-ranges		±1.0		%
Scale Factor at X_{OUT}, Y_{OUT}, Z_{OUT}	All *g*-ranges, full resolution	3.5	3.9	4.3	mg/LSB
	±2 *g*, 10-bit resolution	3.5	3.9	4.3	mg/LSB
	±4 *g*, 10-bit resolution	7.1	7.8	8.7	mg/LSB
	±8 *g*, 10-bit resolution	14.1	15.6	17.5	mg/LSB
	±16 *g*, 10-bit resolution	28.6	31.2	34.5	mg/LSB
Sensitivity Change Due to Temperature			±0.01		%/°C

Fig. 5.1 ADXL345 Data Sheet

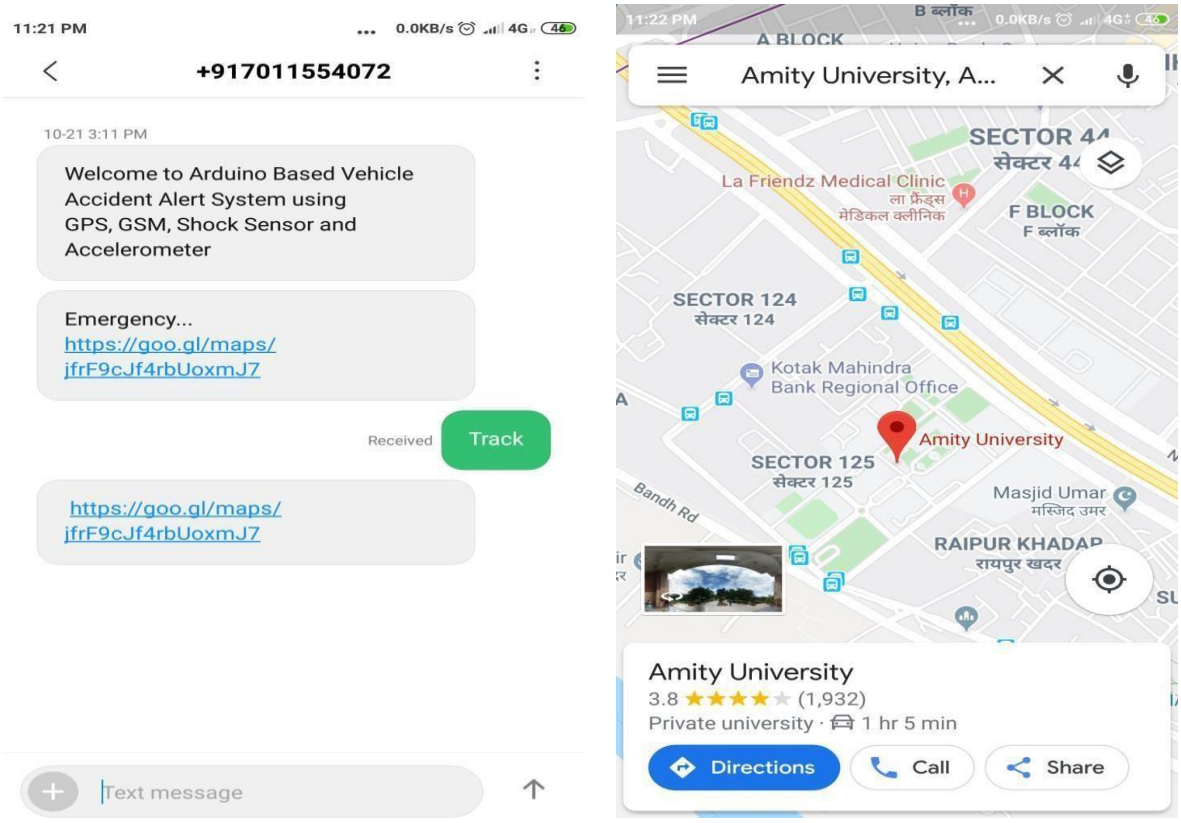

Fig. 5.2 Emergency Alert and GPS Tracking message and Location on Google Maps

6. THEFT ALERT SYSTEM

- Major fear in owners about their vehicle security.
- Brings out latest technologies together to make the vehicles secured.
- Enables the user to have the track of their vehicle when not around.

6.1 Vibration Sensor

Vibration sensor is dynamic sensor can measure vibration from any angle. This sensor used in vibration and impact of shock. Vibration sensor are based on Micro-Electro-Mechanical Sensors (MMEs) .Sensor working is based on the displacement of small mass etched into the silicon surface of the IC, and suspended by small beams. The displacement of the mass can be measured using capacitive sensing. Vibration sensor has three straight pins interface, VCC,GND and Digital Output. Apart from pins there are four major parts of vibration sensor i.e. vibration sensor element, sensitivity adjust, power indicator and signal indicator.

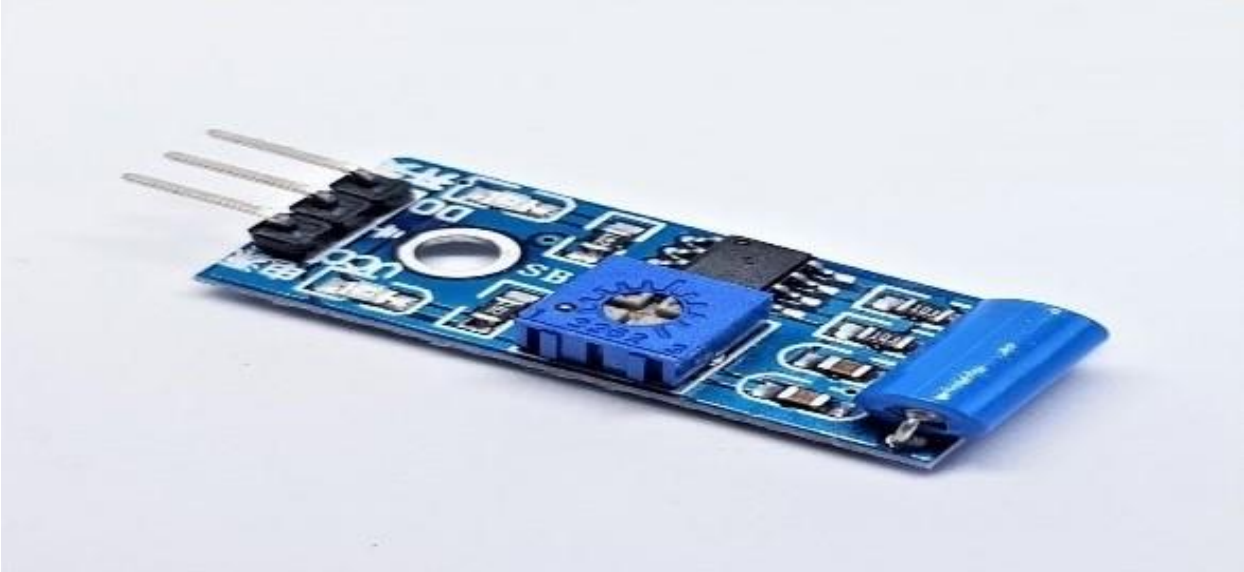

Fig. 6.1 Vibration Sensor

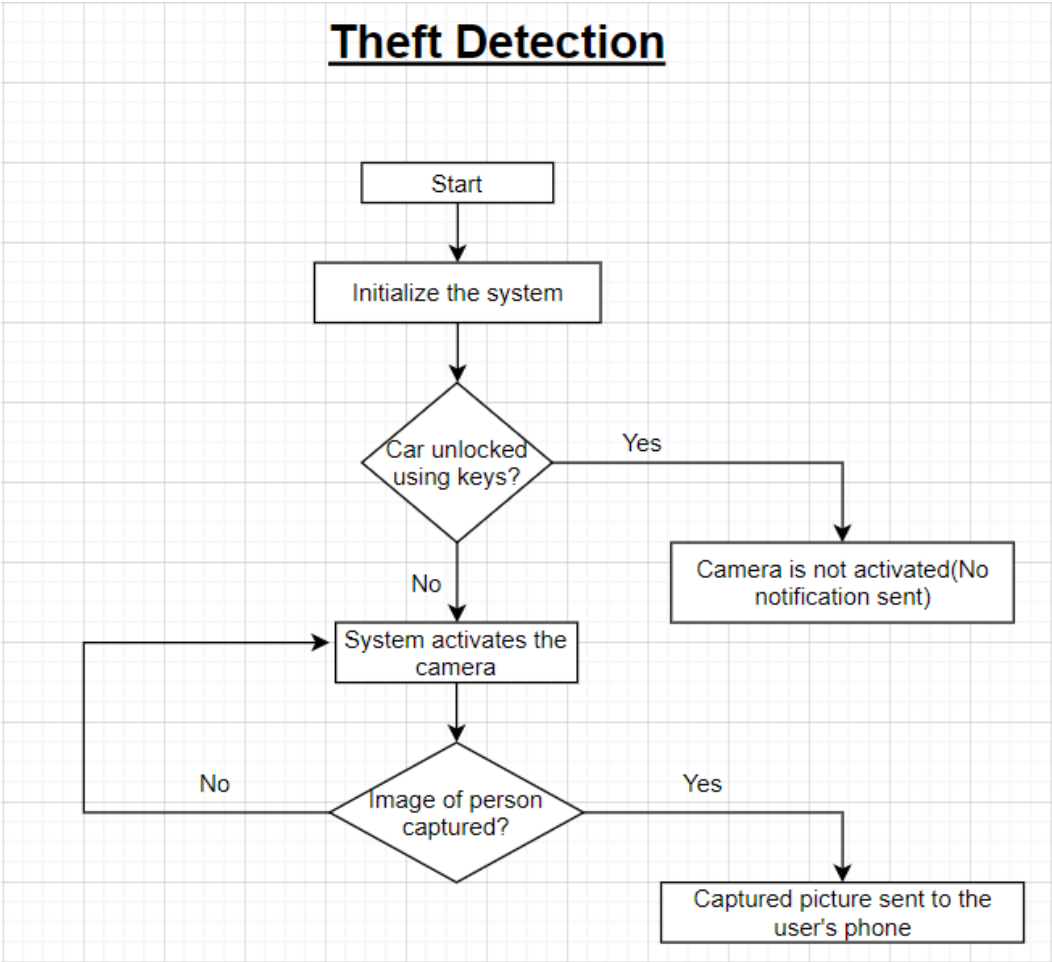

Fig. 6.2 Flow Chart of Theft Detection

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6.2 Theft Alert on User's Mail

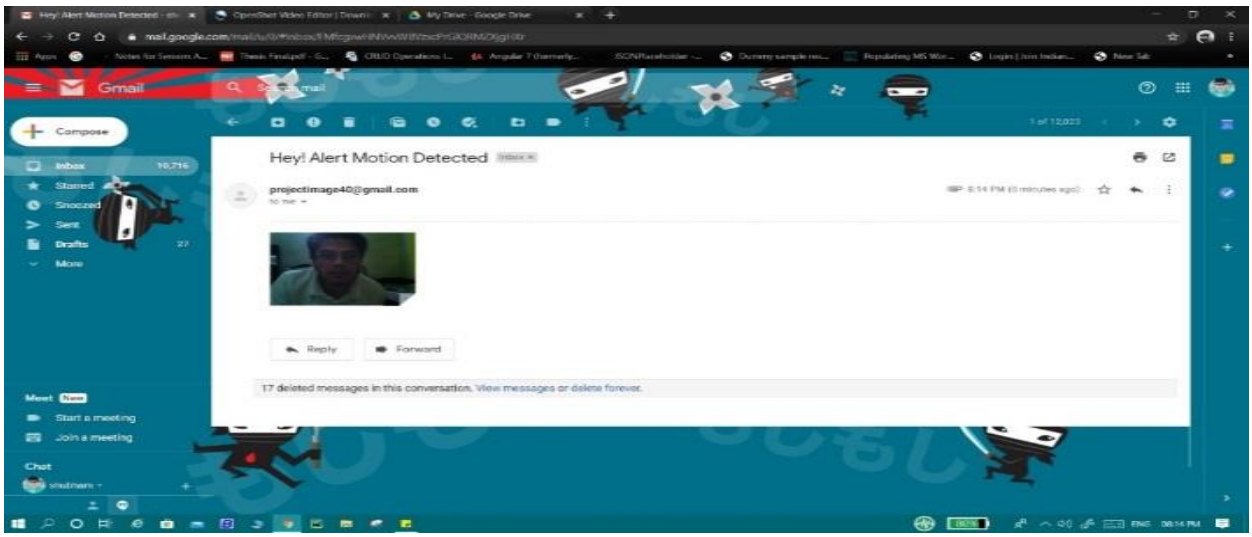

Fig. 6.3 Theft Alert

7. FACE RECOGNITION

Face recognition and detection system is an addition to the anti theft system which alert the user when it senses a new face on the driving seat of the vehicle. It make use of Raspberry pi and camera to alert the user. It works on the LBP algorithm. Firstly it trains the model with the dataset provided by the user. After that it matches the face with the given dataset with the confidence level. If the confidence level in the image is above than 70% than it halt its execution else if confidence level is less than 70% it will alert the user.

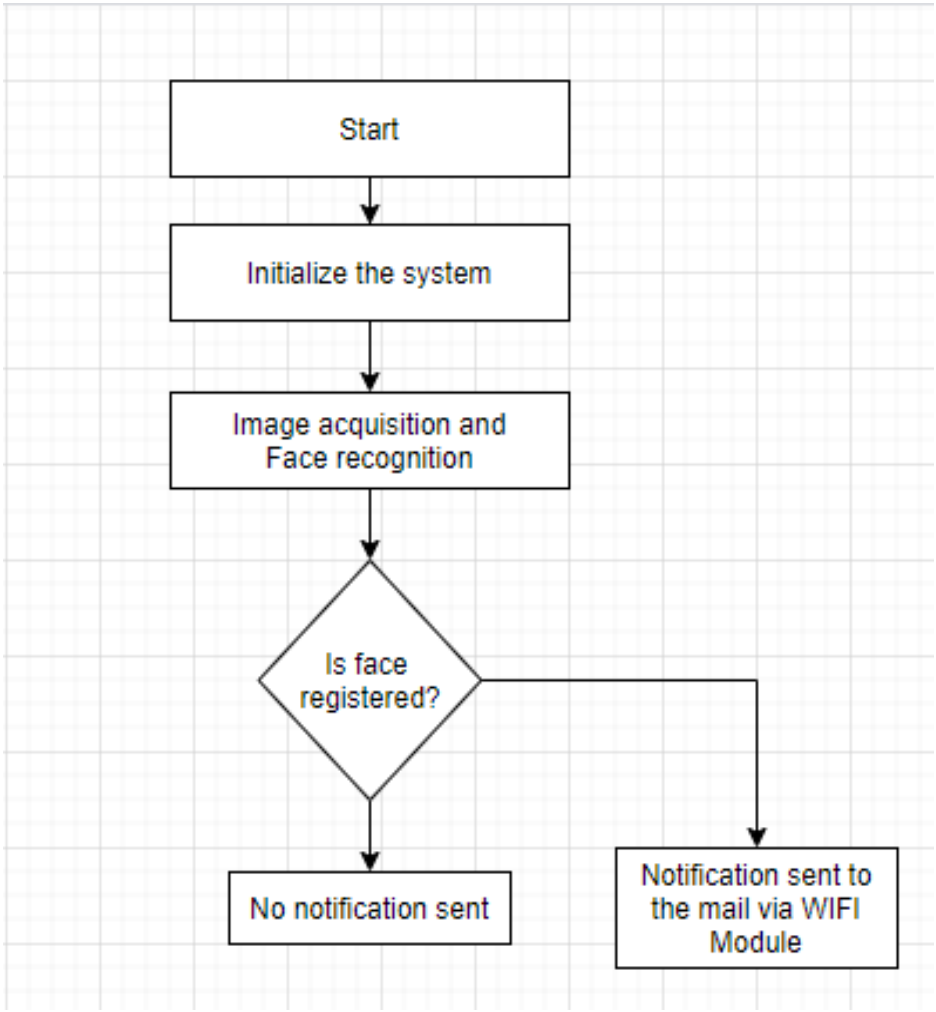

Fig. 7.1 Flow Chart of Face Recognition

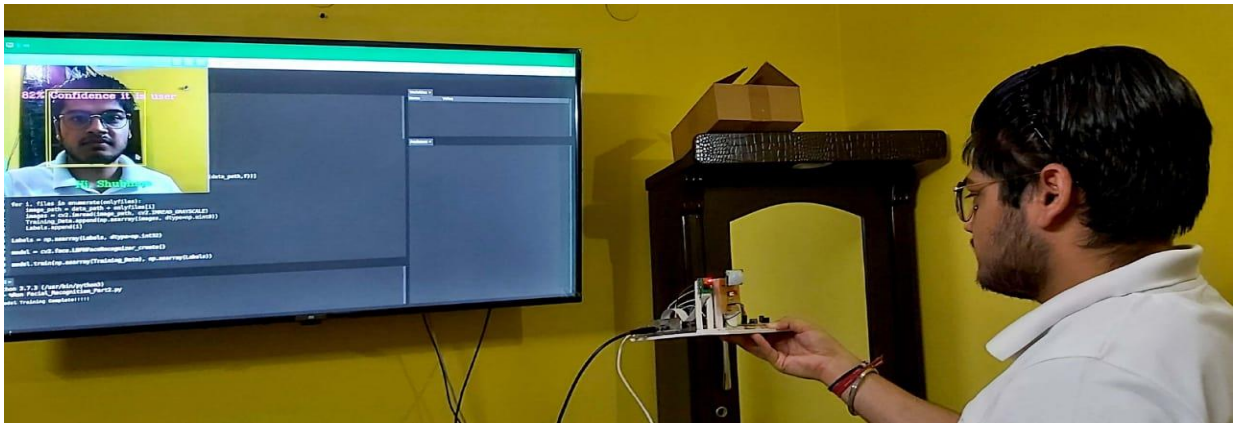

Fig. 7.2 System Recognizes the Person Already Stored in the Database

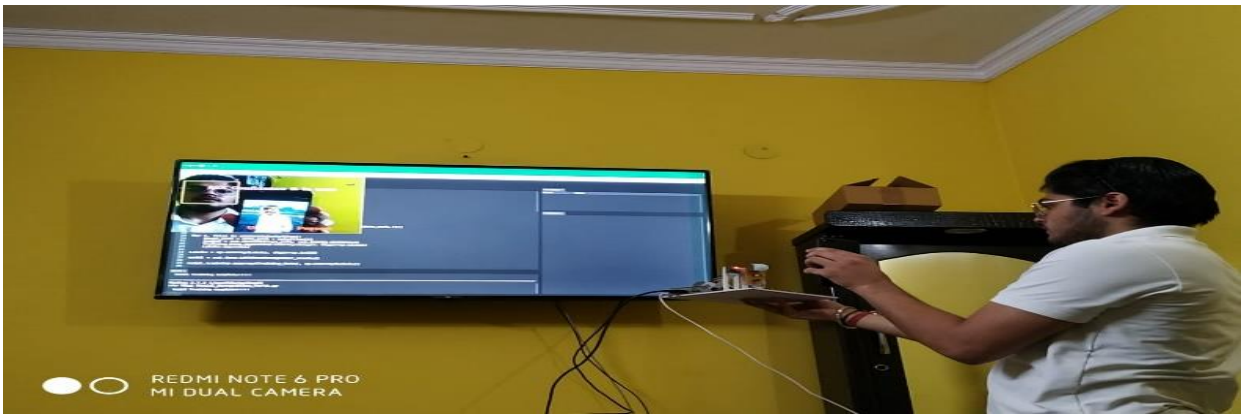

Fig. 7.3 Person is not Registered, hence not Recognised

8. TOW ALERT

Sometimes in emergency vehicle parked in no parking area. Less availability of parking around malls, offices, schools etc. If vehicle is towed , then owner is aware about towing.
Sensor used in tow alert system is tilt sensor. Tilt sensor, there is free mass rolling ball and there is conductive bottom plate and free mass rolling ball that makes circuit open and close. When tilt sensor tilt free mass rolling ball moves towards conductive plate and makes circuit close and system provides tow alert.

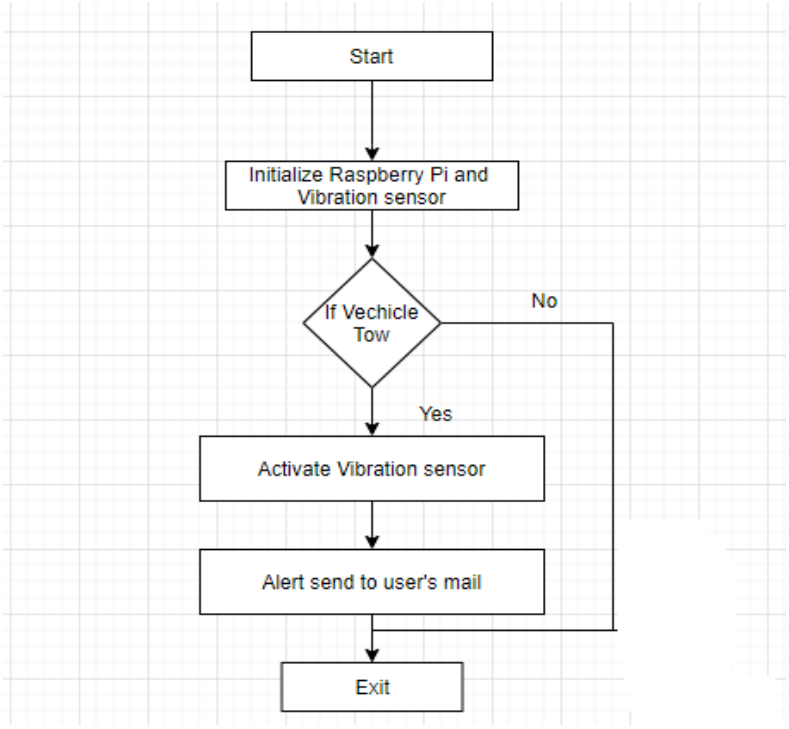

Fig. 8.1 Flow Chart of Tow Alert System

8.1 Tow Alert send to user's Mail

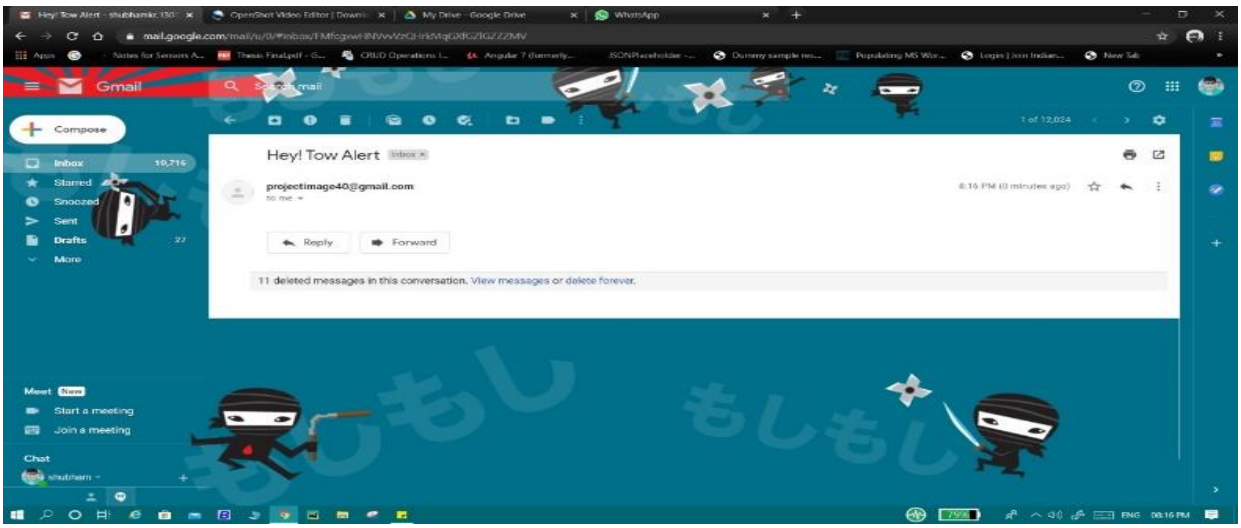

Fig. 8.2 Tow Alert

CONCLUSION

Car Add-Ons is a promoted safety and fiited car system, and our system proposed for seamless connected car experience to car owners and enable customers to manage services such as fuel alert, vehicle tracking alert, emergency alerts, theft alert, tow alert, face recognition, and many more functions on their smartphones and our system create an enjoyable car ownership . It is a step towards growth of an ambient eco-system "Connected Cars". Through it has some vanishing point, our team severely believes that the execution of this system will certainly benefit the car users.

REFERENCES

[1] Montaser N. Ramadan, Mohammad A. Al-Khedher, Senior Member, IACSIT and Sharaf A. Al-Kheder, "Intelligent Anti – theft and tracking system for automobiles" , International journal of Machine Learning and computing, Vol. 2, No. 1, February 2012.

[2] Hnin Pwint Han, Hla Myo Tun, "Advanced Car Security System using GSM", International journal of scientific and research publications, Vol. 4, Issue 5, May 2014.

[3] Suzuki Connect – Advanced Telematic Solutions, "https://www.nexaexperience.com/suzuki-connect.html" launched in july 2018.

[4] A. T. Hapsari, E.Y. Syamsudin, and I. Pramana, "Design of Vehicle Position Tracking System Using Short Message Services and Its Implementation on FPGA", in Proc. Conference on Asia South Pacific Design Automation, Shanghai, China, 2005.

[5] E. M. Tamil, D. B. Saleh, and M. Y. I. Idris, "A Mobile Vehicle Tracking System with GPS/GSM Technology", in Proc. 5th Student Conference on Research and Development (SCORED), Permala Bangi, Malaysia, 2007, pp. 398-402.

[6] I. Lita, I. B. Cioc and D. A. Visan, "A New Approach of Automobile Localization System Using GPS and GSM/GPRS Transmission," in Proc. Int. Spring Seminar on Electronics Technology, 2006, pp. 115- 119.

[7] T. K. Kishore, T. S. Vardhan, and N. L. Narayana, "Vehicle Tracking Using a Reliable Embedded Data Acquisition Sysytem With GPS and GSM", Int. Journal of Computer Science and Network Security, vol. 10, no. 2, pp. 286-291, 2010.

[8] V. Kulkarni, and L. N. K. Rao, "Embedded Car Security System on Face Detection". in Proc. 2nd National Conference on Information and Communication Technology, New York,2011, no. 40.