



# Rash Driving Analysis for Safety Enforcement

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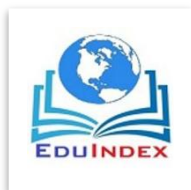
*Abstract*—The usage of vehicles is increasing daily in everyone's lives. Most of the people break the rules of traffic and indulge in rash driving. Rash driving is extremely dangerous for all people involved: the driver, passengers, pedestrians, and other vehicles on the road. Nearly 90% of deaths on the road happen due to rash driving. If there are a greater number of vehicles moving on a road, then there is a higher possibility of an accident. Rash driving is a problem that goes undetected in the status quo due to the lack of any devices or technologies to detect it at every instance. It is extremely tough to detect it manually, and this poses a big safety threat. In this paper, we propose a detection system that can analyze gyrometer and accelerometer readings to conclusively decide whether a driver is operating their vehicle in an unsafe manner or not, viz a sudden braking, sudden acceleration or crossing the speed limit. We make use of Raspberry Pi 3 Model B+ and similar IoT (Internet of Things) technologies to implement this system. Our final aim is to reduce incidents of rash driving to make a safer environment on roads and to reduce the number of accidents taking place.

*Index Terms*—Internet of things, micro-processor, accelerometer, rash driving analysis, safety enforcement.

## I. INTRODUCTION

Rash or reckless driving is a serious traffic violation where a driver does not abide by safety regulations set by road authorities and endangers not only the driver, but other civilians too. The consequences of this ranges from minor accidents to even casualties of the driver and other members of the road who may not even be at fault,

The problem with rash driving is that it is hard to detect and conventional solutions rely on a lot of manual detection being done, which puts the state under pressure to provide the necessary manpower and infrastructure to be able to do so. Even if the required manpower and road personnel deployed to keep things in order are provided, reckless driving is still hard to catch without the use of proper technology. The reason for this is that reckless driving can manifest in multiple, divergent ways.



Common ways people commit traffic violations through rash driving include:

- 1) Tailgating, which means driving unsafely close to a vehicle in front of them
- 2) Failure to comply with traffic lights or stop signs. 3) Driving over the speed limit
- 4) Sudden braking or constant braking
- 5) Not using turn indicators while changing lanes or at a turning
- 6) Being under the influence of drugs or alcohol while driving
- 7) The usage of phones, fidgeting with on-board display systems, eating while driving etc. can lead to driving distractedly
- 8) Not using headlights at night or in the rain.
- 9) Making illegal turns or lane changes, or driving into no entry zones.

This may not always lead to an accident or harm to others, but they are all traffic offenses and can lead to a driver being penalized by the road authorities. The punishment ranges from just fines, community service, suspension of driving license to even imprisonment in severe cases.

This study has two objectives, one, which is to analyse sudden brakes/acceleration and second, is to alert on crossing the speed limit and both of them symbolize rash driving [1] [2]. For detecting sudden acceleration and brakes and to detect over speeding, a MPU6050 3 axis accelerometer was used [3]. It is a difficult task to multitask the processes (to sense the speed limit and the sudden acceleration/brakes) and to synchronise them together.

The project is developed to analyze various aspects of a vehicle's motion to determine whether rash driving has occurred or not. To do so, our project requires gyro meter and accelerometer readings that will be processed by a Raspberry Pi 3 Model B+ and a python code will compute the changes in these values [5] [6]. Using these values, changes in acceleration and speed can be determined to fulfill three primary goals:

- 1) To check whether the vehicle is travelling within the speed limit
- 2) To check for sudden acceleration

- 3) To check for sudden braking

Since the project is on a smaller scale, our implementation is limited to smaller changes in values of speed. The aim of our project is to determine cases of rash driving and hence punish perpetrators appropriately, creating a safer environment for all stakeholders: drivers, their passengers and other members on a road [6] [7].

## II. PROBLEM STATEMENT

Real-time rash and reckless driving behaviour detection is a cornerstone to improving overall road safety.

To notify driver's of any violations they might be committing, or to alert them of their improper driving habits, we need to consider a real-time monitoring solution, which detects abnormal driving behaviours and helps prevent any accidents before they can occur.

National Crime Research Bureau (NCRB) statistics have shown that over 90 percent of all road related casualties in 2017 in India were due to rash or negligent driving with the latest, revealing that 0.15 million deaths in 0.135 million road accidents were due to reckless driving [2] [4]. Conventional solutions to this problem, such as police monitoring and speed cameras are a costly solution [5].

## III. NEED FOR THE SYSTEM

Rash and reckless driving is the leading cause of hazardous road accidents and usually goes unnoticed by the agencies of law since it is so hard to provide the kind of manpower that is required to maintain discipline.

Rash driving usually follows a similar pattern across drivers and our aim is to identify this by the use of sensors present in the car and alert the user as well as related authorities ( RTO, Police, local road authorities) before it leads to an accident [1].

## IV. OBJECTIVE

The system will read gyro meter and accelerometer data to analyze the changes in speed and check for sudden breaking. It will also check for whether the driver is over speeding by accessing the geo-positional data of the vehicle to check for speed limit in particular area.

```

pi@raspberrypi: ~/Desktop
File Edit Tabs Help
accel_xout: 588, scaled: 0.031805659375)
accel_xout: 248, scaled: 0.01513671875)
accel_xout: -206, scaled: -0.01226703125)
accel_xout: 256, scaled: 0.015625)
accel_xout: 16, scaled: 0.0009765625)
accel_xout: -272, scaled: -0.0166015625)
accel_xout: -388, scaled: -0.018798828125)
accel_xout: -684, scaled: -0.036865234375)
accel_xout: -816, scaled: -0.0498646875)
accel_xout: -872, scaled: -0.05322265625)
accel_xout: -252, scaled: -0.015380859375)
accel_xout: -380, scaled: -0.021193359375)
accel_xout: -348, scaled: -0.021240234375)
accel_xout: -236, scaled: -0.014464296875)
accel_xout: -4, scaled: -0.000244140625)
accel_xout: 72, scaled: 0.00439453125)
accel_xout: -204, scaled: -0.012451171875)
accel_xout: -196, scaled: -0.011962890625)
accel_xout: 284, scaled: 0.01733084375)
accel_xout: 188, scaled: 0.006591796875)
accel_xout: 296, scaled: 0.01806640625)
Z
[1]+ Stopped sudo python mpu6050.py
pi@raspberrypi:~/Desktop $
    
```

The radius of turn will be checked, since larger the turn, riskier it would be and can possibly endanger the safety of the driver and those around them.

This data will be compiled to form a point based system for each driver, where points are deducted for rash and negligent driving with penalties after every interval of point deduction [1] [2].

### V. SYSTEM DESIGN

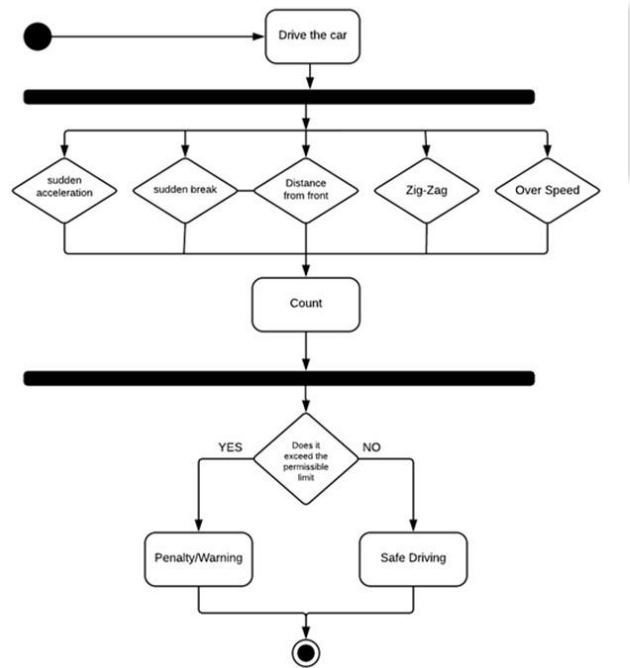
#### A. MPU6050 - 3 Axis Accelerometer and Gyrometer

The MPU6050 accelerometer can detect motion along all 3 axis. This gives the rate of change of displacement along the three dimensions which helps us determine whether a driver has changed their speed suddenly. This can be in the form of sudden braking or sudden speeding. This accelerometer rallies data to the Raspberry Pi 3 Model B+ in real time. The gyrometer detects changes in rotational motion in real time.

Fig. 1. Activity Diagram of RASE

#### B. Raspberry Pi 3 Model B+

The Raspberry Pi is a small single-board computer which is used in a lot of Internet of Things (IoT) applications, The Raspberry Pi 3 Model B+ gets data in real time from the MPU6050 - 3 Axis Accelerometer and Gyrometer where the connectivity and communication of the hardware and software is established using smbus, i2cdetect, MPU6050 (3 axis accelerometer) modules in python 3.



```

WZ 168.42.49 (raspberrypi) - VNC Viewer
pi@raspberrypi: ~/Desktop
File Edit Tabs Help
GNU nano 2.7.4 File: mpu6050.py
import smbus
import math
import time
import csv

# Power management registers
power_mgmt_1 = 0x6b
power_mgmt_2 = 0x6c

def read_byte(adr):
    return bus.read_byte_data(address, adr)

def read_word(adr):
    high = bus.read_byte_data(address, adr)
    low = bus.read_byte_data(address, adr+1)
    val = (high << 8) + low
    return val

def read_word_2c(adr):
    val = read_word(adr)
    if (val >= 0xd000):
        return -(0x535 - val) + 1
    else:
        return val

def dist(a,b):
    return math.sqrt((a*a)+(b*b))

def get_y_rotation(x,y,z):
    radians = math.atan2(x, dist(y,z))
    return -math.degrees(radians)

def get_x_rotation(x,y,z):
    radians = math.atan2(y, dist(x,z))
    return math.degrees(radians)
    
```

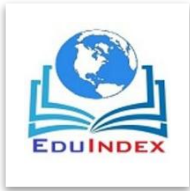
Fig. 2. Python code to establish a connection between the hardware and the software

Fig. 3. Once the connectivity and communication of the hardware and software is established, the MPU6050 starts sensing the acceleration

#### C. R Studio Console

RStudio is a development tool for R, a programming language for statistical computing and graphics. The accelerometer data from the Raspberry Pi 3 Model B+ is processed in R to check for the conditions set with regards to traffic violations.

#### D. Virtual Network Computing - SSH connectivity / puTTY



PuTTY is a terminal emulator that is open-source, it has a serial console and capable of network file transfer application. We make use of it for SSH connectivity and it's required to establish a safe link with the Raspberry Pi 3 Model B+ using remote connectivity.

E. Message Queuing Telemetry Transport (MQTT) - Node

The MQTT protocol is a publish and subscribe system where one can push and receive messages as a client. It is implemented in Node.js and it is used to establish a simple and light message delivery system with the Raspberry Pi Model 3+. It is incredibly lightweight in nature.

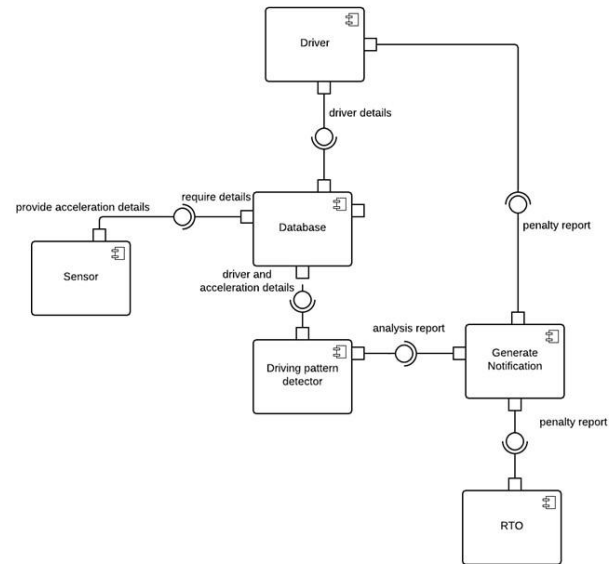
VI. METHODOLOGY

The following steps are followed by the RASE system for a hassle-free working.

Prototype Implementation

- 1) Implementing the micro system in the Raspberry Pi 3 where the connectivity and communication of the hardware and software is established using smbus, i2cddetect, MPU6050 (3 axis accelerometer) modules in python 3
- 2) Once the connectivity and communication of the hardware and software is established, the MPU6050 starts sensing the acceleration of the parasite with respect to the set sensitivity (+2g)
- 3) The device and setup is placed on a dummy model vehicle that is remote controlled and the model vehicle is made to accelerate and decelerate multiple times, with different rates of change of speed each time.
- 4) Based on the sensed values by the accelerometer, the values are statically put into the csv file and sent to the

Fig. 4. System Architecture of RASE



- 5) The system then sends out an alert saying rash driving has been detected.

VII. RESULT

The final result obtained is an alert of rash driving, which is then forwarded to higher authorities aforementioned in this paper. The higher authorities can then take a call on how to penalize the offender depending on the frequency and degree of offenses.

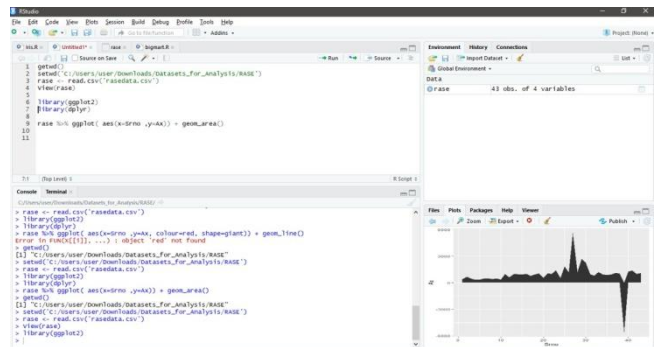
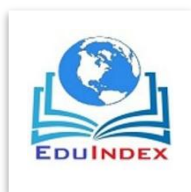


Fig. 5. Output on R Studio

VIII. FUTURE SCOPE

The system can be expanded to consider many more parameters to assess rash driving, such as rapid change of tyre angle, lane switching, setting of speed limits based on geo-location APIs among others. Communication can be established amongst different devices in different vehicles to understand the context of the rash driving better. For example, a car can have rapid deceleration in the event of the vehicle ahead of it stopping suddenly without any indication. The system can be expanded to be integrated into the existing system used by the road authorities to directly alert



them in cases of negligent rash driving. The ultimate aim is the conception of a smart, independent system to monitor road traffic and enforce traffic regulations with minimum resources and cost to state.

International Conference on Innovations in Green Energy and Healthcare Technologies (IGEHT), Coimbatore, 2017, pp. 1-6.

### IX. CONCLUSION

The Rash Driving Analysis for Safety Enforcement ( RASE ) system aims to automate a problem that requires intense physical labour and infrastructure to be solved conventionally. By making use of technology domains such as IoT, overall road safety can be improved in an efficient, cost-effective and sustainable manner.

### X. ACKNOWLEDGEMENT

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