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Vehicle Speed Limit and Lock for Drunken Drivers

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Abstract

This research paper is giving a new approach on the section of the safety procedure of the automobile industry. By giving a technique that can be implemented to decrease the accidents happen by the drunken drivers. This technique is implemented with a smart system that monitors the driver for the presence of any alcohol level in their body by constantly checking the breath of the driver. As alcohol is very evaporative material the checking procedure is done by placing a alcohol sensor in the steering of the vehicle which will monitor the presence of alcohol molecule near the surrounding of the driver. The speed of the vehicle varies according to the content of alcohol detected. Vehicle countermeasure system constantly adjust the speed of the vehicle normal speed level of 100 km/h. 80% of speed for 0% to 20% of alcohol level, 30% to 30 % of alcohol 70% of full speed, 30% to 40% of alcohol 60% of full speed, 40% to 70% of alcohol level 50% of full speed and when alcohol level is more than 70% the vehicle slowly decrease its speed and the engine ignition off. The Global positioning system (GPS) measure the latitude and longitude values and sends the information to the responsible person along with a one-time password that switch on the ignition system again as a message using the GSM module. All the processes and function in this project are aided with the controller Raspberry Pi 2.

Acknowledgement

I am Thilakasekaram Varjith is willing to convey my thanks first for my supervisors Dr.K.W.S.N.Kumari and Mr.Ranjan Kulathunga for their great insights, perspective, guidance, creativity, support and sense of humor. My sincere thanks goes to the project coordinator for granting permission to convey my skills and findings on this topic. In the other hand it would be my pleasure to say thanks to the officers in the faculty of Science and Technology faculty of Uva Wellassa University for helping in various ways to clarify the things related to my academic works in time with excellent cooperation and guidance

My sincere gratitude goes to many individuals, friends, colleagues and my family who have not been mentioned here personally in making this educational process a success. May be I could not have made it without their supports.

Contents

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

List of Figures

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

List of Tables

Chapter 01

Introduction

1.1 Background

Accident is one of the major problem which leads to many loss of human life and a great damage to the properties and plays as one of the major reason to contribute to a major portion of the world ill health. Unfortunately the developing countries have the higher number of accidents when compared to developed countries around the world. The major reasons for accidents are high speed, not obeying rules, overtaking of vehicles in curves and restricted times, inexperienced drivers, lack of vehicle management and much more. It is estimated that more than 1.2 million lives are being taken away by road accidents each year and as many as 50 million are getting injured which fulfill 30 percentages to 70 percentages of the orthopedic cases in developing countries(Dinesh Rohan,2002). Moreover if this continues, it is predicted that the road traffic injuries are predicted to become the third major reason to the global liability of disease and injury of disease and injury of 2020.[2] (christoper et al, 1996)

Especially the developing countries tolerates high amount of burden when compared to developed countries by 85 percentage of annual deaths and 90 percentage of the disability-adjusted life years lost because of road traffic injury (WHO,2002). The most important point in this is 73 percentage of deaths are males in the age of between 15 and 44 years old. This problem also creates a huge economic suffering due to the loss of family breadwinners.

The road traffic accidents and injuries are very predictable and preventable, but for this an accurate data are important to understand the possible ways in which the road safety interventions and technology can be successfully transferred from developed countries which they have been proved effective. The knowledge of the costs of the road traffic accidents among the law makers and the general public is becoming less concerned because of the busy and fast moving life. An amalgamation of wide-ranging road safety programs and technology adaptations into national planning is very important in the developing countries.

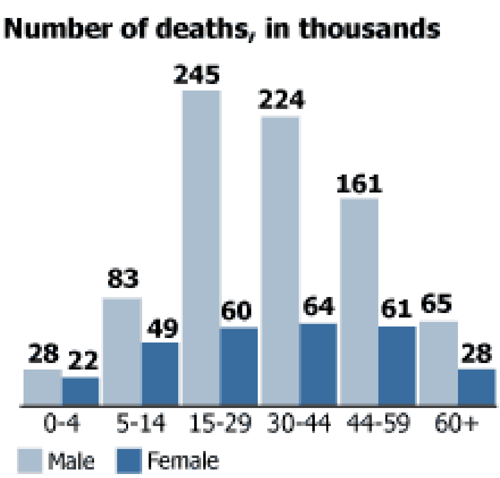

Figure 1 : Road Traffic Deaths Worldwide by Sex and Age Group, 2002

In general, pedestrians, cyclists, and moped and motorcycle riders are the most vulnerable road users as well as the heaviest users of roads in poor countries. Most people who use public transportation, bicycles, or mopeds and motorcycles or who habitually walk are poor, illuminating the higher risk borne by those from less privilege. In Asia, for instance, motorized two- and three-wheelers (such as motorized rickshaws) will make up the anticipated growth in numbers of motor vehicles.

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

In developing countries, exposure to potential road traffic injury has increased largely because of rapid motorization, coupled with poor road conditions, rapid population growth, lack of safety features in cars, crowded roads, poor road maintenance, and lack of police enforcement. For example, in Vietnam, the number of motorcycles grew by 29 percent in 2001, with an associated increase of 37 percent in the number of road traffic deaths.

1.2 Motivation

In the past decades when comparing the road traffic accidents that had happened in Sri Lanka shows us that even though the citizens of Sri Lanka are well educated, obeying the rules and regulations of the road laws in Sri Lanka has become very less. Only in the year of 2015 the number of deaths by accident is more than 2700.

Overview	Total
Deaths	2801
Fatal accidents	2590
Minor accidents	13095
Critical accidents	7719
Damages only	13514

Table 1 : Road accidents the way taking place analysis 2015

It is well known that Sri Lankan government is maintaining a high level of duty tax for importing of new vehicles into the country. But year by year the number of vehicle imported into the country is increasing considerably, the sad part in this about thirty five percentage of the vehicles that are imported tend to be used vehicles for many years. Not only this the as the duty tax is very high the cars with high security costs high so the peoples go for the cheaper one, which unlikely increase the probability of getting injured when an accidents occur.

Even in my life I have experienced an injury in an accident which could have been avoided if I have used a new vehicle with the latest technology. It is sad that the government is considering the tax income more than the safety of the citizens

Vehicle accidents	Fatal vehicle accidents			Total vehicle accidents			
Year	2012	2013	2014	2012	2013	2014	2015
Motor cycles	715	723	845	9877	9430	8962	10147
Lorry	320	400	329	4797	4500	4324	4429
Dual purpose vehicles	305	265	259	7184	6413	5198	4858
Private bus	257	217	180	3357	3001	2936	2877
Three wheelers	252	228	274	7434	6282	6401	6871

Table 2 : Number of accidents according to vehicle type

Not only lives but the table 3 and table 4 Shows that how much wealth is being get lost because of the accidents. The government collects money for the accidents from the insurance company and only a mere amount of people tend to claim their rightful compensation from government and a big amount is left alone to the government. So this project can also reduce this by reducing the amount of accidents happens around the island.

Year	2011	2012	2013	2014	2015
From third party insurance(in million)	20.8	24.4	25.8	27.7	33.49

Table 3 : Revenue given by insurance company for 3rd party to government

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

Year	2011	2012	2013	2014	2015
Compensation paid to death(in million)	1.3	0.9	0.8	1.05	4.0
Compensation paid to critical injuries (in million)	0.4	0.3	0.6	0.6	2.4

Table 4 : Expenditure of the accidents

1.3 Goals

The main purpose of this project is to decrease the number of human losses by road traffic accidents and also this project will decrease the loss of properties of induvial and the government by avoiding accidents. As the main feature of this project is not letting the drivers to overcome the speed limits it will decrease the possibility of accidents by a huge percentage and fatal accidents can be reduced as the major reasons for the fatal accident is driving the vehicles very fast.

More over as it is mentioned above the maximum deaths are between the age of 15 to 44 and especially men. The major reason is the curiosity of driving the vehicle fast and this project is aimed to reduce it. The accidents will be reduced and this will help in the GDP growth of our country because a considerable number of workers and tax payers are saved. Not only this by doing this project it is aimed to stop the use of vehicles by drunken drivers which in return reduces the number of accidents and as time passes all Sri Lankan citizens will maintain a discipline of avoiding driving when drunken, and persons in the field of driving will not get used to drinks as it will be a major problem to their jobs which will be a good behavior for their working carrier.

Providing visible, crashworthy, and smart vehicles. Designing motorized vehicles that are more crashworthy is an important intervention in those developing countries where automobile safety regulations are more lax than in developed countries. One study showed that in developing countries, buses and trucks are involved in a much greater proportion of crashes, yet lack relevant safety standards.

Improving vehicular visibility is also important. In Thailand, hospital records showed that 75 percent to 80 percent of road traffic injuries were among users of motorized two-wheeled vehicles, which are not easily visible to larger vehicle operators. Improving the visibility of drivers in other instances (such as at night or during fog) can reduce injuries. Daytime running lights and high-mounted stop lamps have improved crashes in these cases, as have reflectors and colorful clothing.

New technologies have created other avenues for road safety. These developments include intelligent speed adaptation, in which the vehicle determines the speed limit for the road; alcohol-ignition interlock systems that detect alcohol on the breath of drivers, preventing them from starting their engines; or electronic driver improvement monitors that connect individual driver profile assessments and an individual vehicle operator's actual driving performance.

Setting road and safety rules, securing compliance, and improving transport policy. Setting and enforcing speed and blood alcohol concentration limits have proven to be perhaps the most successful interventions contributing to the decrease in injury in developed countries. Speed limiting devices on vehicles, limits on engine power, and non-vehicular traffic-calming measures hold the greatest promise in developing countries, according to Dinesh Mohan, professor of biomechanics and transportation safety coordinator with the Transportation Research and Injury Prevention Program at the Institute of Technology in New Dehli, India.

Enforcing blood alcohol limits is another opportunity to improve road safety. While it is commonly understood in developed countries that impaired driving is an important contributor to road traffic fatalities and injuries, little is known in these countries about the nature and scope of the problem. One survey of studies found that, in developing countries, blood alcohol was present in 33 percent to 69 percent of fatally injured drivers

Because blood alcohol tolerances vary across countries, comparison studies are difficult, and to date, no study has provided the evidence to benchmark the tolerance level at which reductions in accidents can occur in developing countries. David Bishai, an injury prevention expert and associate professor at Johns Hopkins University's Department of Population and Family Health Sciences, suggests that taxing gasoline and alcohol could lower traffic deaths by causing less driving and less drunk driving in developing countries. But he warns that other measures must be taken and must fit the needs of the local environment.

Finally, although mandatory seat-belt-use laws have reduced traffic injuries in developed countries by 40 percent to 50 percent, such laws must be tailored to the local situation: In developing countries, car occupants constitute less than 10 percent to 20 percent of traffic fatalities. These countries also need to improve helmet safety and use among two- and three-wheel vehicle operators as well as to enforce the appropriate number of passengers for these vehicles.

1.4 Achievement in brief

A prototype is made that can resembles the project because it is a heavy project and easy for the demonstration. According to the project titled a well efficient system has been created which can consequently monitor the alcohol level of the driver. As defined the raspberry pi was used for the processing part. And all the components were fixed in a chassis that can resemble an automobile system. The camera in front is detecting the road sign pictures. Here the openCV technique has been used to detect the road signs. Moreover according to the intensity of the alcohol level of the driver the speed limited is well maintained.

On the other hand the system that detects the road signs also working good. When that system is on, the speed of the vehicle varies according to the road sign until it detects the next road sign. So it can be concluded that the system is good to be implemented in the vehicles of our country and also to all the vehicles in other countries with some small alterations that are needed to obey that country rules and regulations.

Chapter 02

Problem statement

2.1 Preliminaries

This project is aimed to reduce the number of accidents happening because of the drunken drivers and avoiding over speeds when driving.

2.2 Problem identification

Day to day in our life we will be able to see accidents happening in front of our eyes. Even though the government rules and regulations are becoming stronger the percentage of the accidents didn't fall out dramatically. So it can be said that obeying the rules is becoming less and less in our community. However the government tries to give an awareness about

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Volume 04 Issue 01
January 2017

the accidents and the drawbacks of them through campaigns, Medias and advertising there is no much benefit. I would say more than ninety percentage of Sri Lankan citizens are well aware of the drawbacks of accidents but even though there is enough knowledge everyone dares to break the rules and regulations to compete this busy life. So my idea is to insert the techniques in a way that cannot be over ruled by normal citizens in the safety regulations which will be a better idea rather than giving self-awareness about the problem.

2.3 Problem solution objectives

The main objective of this project is to control the use of vehicles by drunken drivers and to avoid drunken drivers running the car in a high speed. And even to the drunken drivers also for normal drivers to avoid driving the car more than speed limits allocated by the government of Sri Lanka. By decreasing the accidents it is aimed to decrease the loss of property and the cost of reassembling vehicles as in our country buying a vehicle needs a considerable amount of money. From this project it is aimed to decrease the number of deaths and number of patients attending the orthopedic section of our country hospitals. More than this the project will decrease the families from getting into unbearable economic crisis as this project will mostly secure men who are the economic pillars of families.

International Journal of Research
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e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

Chapter 03

System modelling

3.1 Methods and techniques

For this project the 1st thing that is needed is to detect the presence of the driver in order to do that there are many techniques that can be used. An optical sensor can be used, or an IR sensor can be used or a pressure sensor can be used and so many other possibilities are present to detect the presence of the driver. As the presence of the driver is detected, next the amount of alcohol present in the driver's body must be calculated. For that we can use the driver breath or the driver sweat or both. The breath will contain alcohol molecule which

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

is detected by the sensor. Or we can use a touch sensor which can be placed all over the steering handle that will get the sweat of the driver and will measure the amount of alcohol present in the blood. There are many sensors available in the market to detect the alcohol level like PAS 32U, gas sensor MQ3 and MQ303A.

After the amount of the alcohol is detected then a processor is needed to process the input and to give the output. There are many microprocessors in the market that can be used for this project like raspberry-pi, banana-pi, Arduino, omega board and PLC. The main output is the controlling the rpm of the vehicle, a predefined values are uploaded into the processor and according to the value given, the processor controls the rpm of the vehicle. And if the alcohol level value of the driver exceeds the predefined value then the vehicle ignition will be turned off and locked, using the global positioning system technique the position of the vehicle is detected and using the GSM technique a message can be sent to someone who will be responsible to the driver or vehicle which is an option for easily finding the vehicle. More than this to avoid the driver again turn on the ignition again we are using a one-time password technique which can be used to turn on the ignition once turned off.

International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

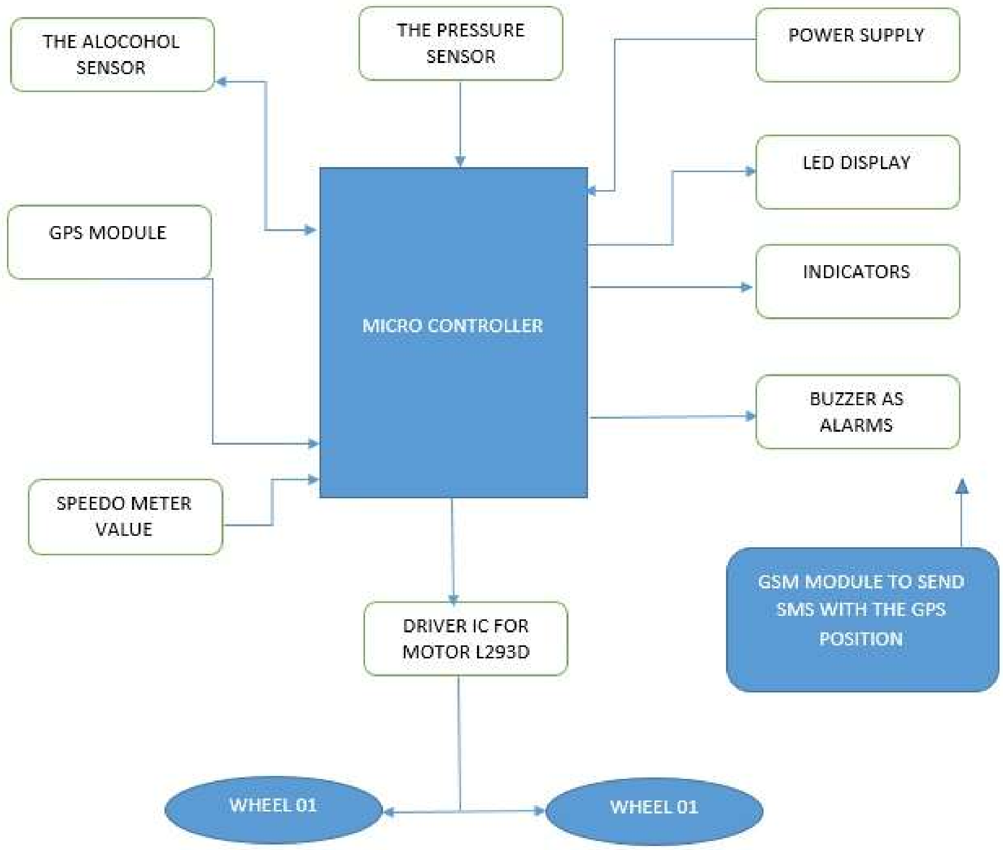

Figure 2 : Block Diagram of the alcohol system

For the speed limiting using the sign boards option. The basic technique is to detect the sign board. There are many techniques available at present to detect an object in a video. A camera is used to capture the environment of the road infront of the vehicle and from the captured video if any signs are detected then the rpm of the vehicle is decreased according to the decteted sign value. An extra option is given toswtich on and off this feature even if this feature is switched off by the driver when the vehicle exceeds the speed limit a warning signal is given to the driver like " you are exceeding the allocated road speed limit. Please slow down"

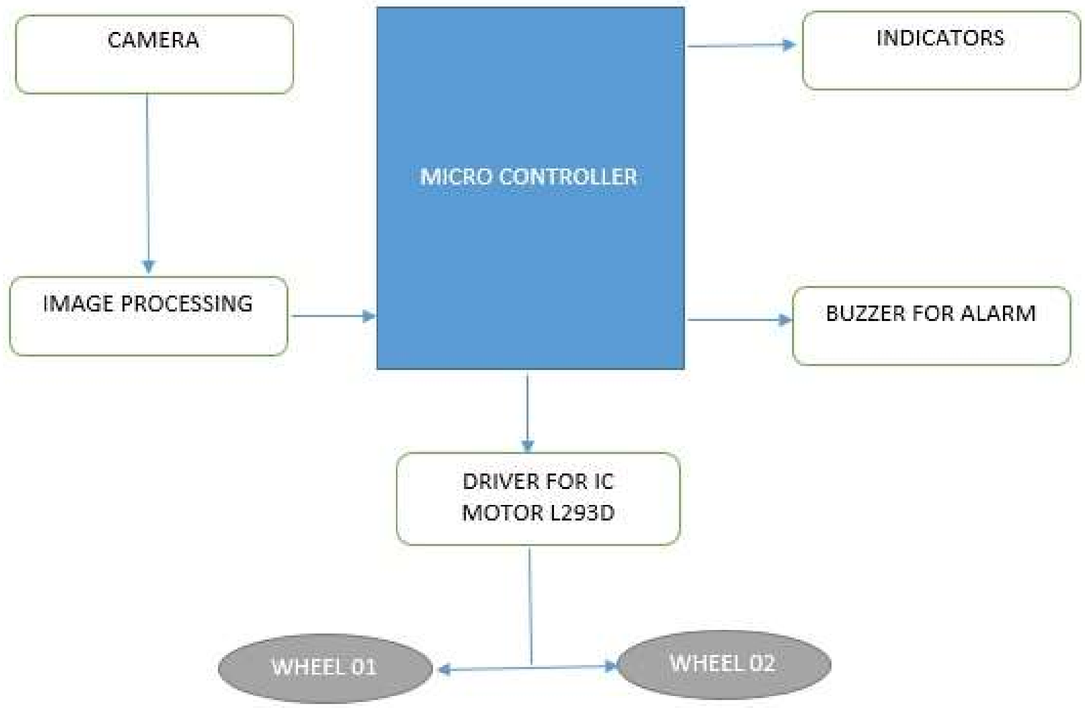

Figure 3 : Block Diagram of the sign board detection system

3.2 Methodology

3.2.1 Processing phase

The microcontroller acts as a processing unit and executes all the functions in the prototype. For executing the instructions microcontroller is programmed in 'C' language with the help of Kiel software and for the image processing the openCV is installed. Raspberry Pi 3rd generation is used based on 16-bit/32-bit ARM7TDMI-S CPU with real time emulation and embedded trace support, that combine the microcontroller with embedded high speed flash memory ranging from 32kB to 512kB is used in the system.

The microcontroller development board is activated with power supply of 5V by using power regulator. By activating the serial ports in the microcontroller, communication path is established by using UART1 and MAX 232. The analog to digital convertor pins is used to receive the data from the alcohol sensor in the analog form and to convert the received data to digital form and transfer the data to microcontroller. By using the Pulse Width Modulation (PWM) pin the speed of the motor is controlled automatically by the microcontroller.

3.2.2 Data acquisition phase

In this prototype data acquisition is sensing of amount alcohol taken by the protagonist. This process is done with the help of alcohol sensor PAS 32 U and the raspberry pi camera for the detection of the sign boards. Due to the low voltage variations and instability of voltage; microcontroller is not able to drive the sensor directly so, by using LM358 op-amp driving circuit the connection path is established between microcontroller and sensor. The sensor used in the project is shown in the Fig. 4.

Figure 4 : The alcohol sensor

According to the amount of alcohol sensed, variation in voltages is produced by the sensor. The alcohol sensed is inversely proportional to the voltage produced by the sensor. The data from the sensor used in this prototype is sent to the microcontroller by activating P0.30 pin of the microcontroller. Speed of the motor is proportional to the voltage generated by the sensor.

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

3.2.3 Communication Phase

In this prototype communication phase is used for sending SMS alert to law and enforcement authorities in the extreme situations along with the positioning values of the vehicle and uploads the riding conditions to the web server when any sign of the alcohol is detected. The communication phase consists of GSM SIM 900 module and GPS module.

Both the modules are connected to relay through UART1 of the microcontroller board. The relay is an electronic circuit which acts like switch to trip the connection between GPS and GSM module. The data sent from the communication path is in serial, to the UART1. The data is sent to the microcontroller through MAX232 from UART1. In this prototype for uploading the data to web server the GPRS phase of GSM modem is used. The GPS modem locates the position of the vehicle. The GSM modem responds to the microcontroller with the AT (Attention) commands.

The overall built proposed system consisting of LCD display, PAS 32 U sensor, LPC2148 microcontroller board, GPS and GSM modules are shown in the Fig. 5.

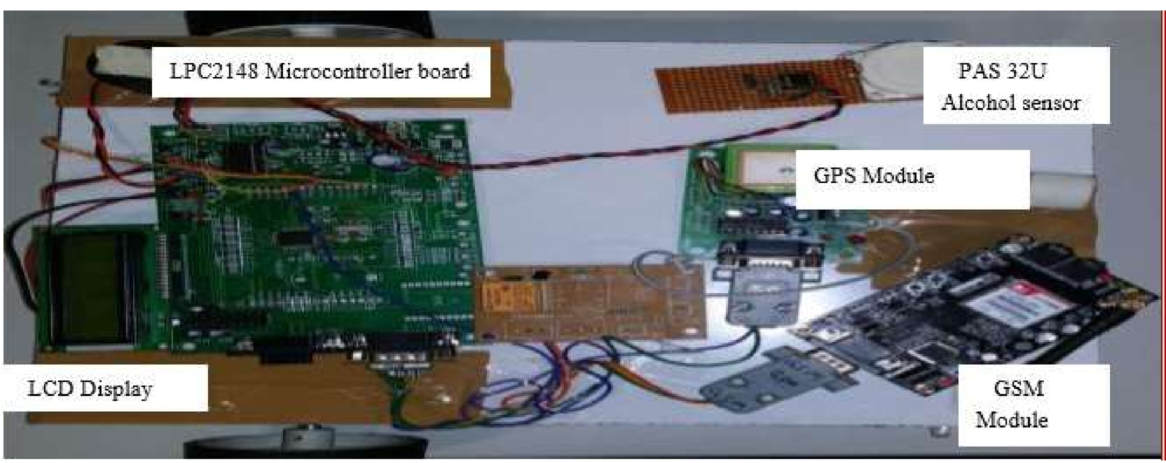

Figure 5 : The proposed system

Chapter 04

Theoretical development

4.1 Analysis

The working of the system starts with sensing of the content of alcohol detected by the sensor. When no content of alcohol is detected the prototype is made to run normally (100kmph). The speed varies according to the content of alcohol detected by the sensor. The flow chart of the proposed system is shown in the Fig 6 and Fig 7.

The algorithm for microcontroller program is shown in the Fig 6. The program starts with initialization of all components, after receiving the activation (AT) command from GSM module and starts acquiring the data from the alcohol sensor. If no sign of alcohol detected in the breath of the protagonist, the program runs in the same loop. If system detects any sign of alcohol beyond the threshold, then the detection process is divided into three different sections. If 10% of alcohol detected from the driver then speed of the vehicle is cut down to 80 kmph automatically. For 20% to 30% of alcohol content the speed of the vehicle is made to maintain at 60 kmph. When the alcohol content of more than 30% detected in the breath of the driver, a caution message is displayed on the LCD screen. If the driver ignores and does not stops the vehicle in the stipulated time, system stops the vehicle automatically and sends a SMS alert to law and enforcement authority with GPS locations and One Time Password (OTP). Whenever a sign of alcohol detected from the driver in the back end system starts uploading the data to web server continuously in particular intervals of time. The vehicle can only be restarted by entering the correct password.

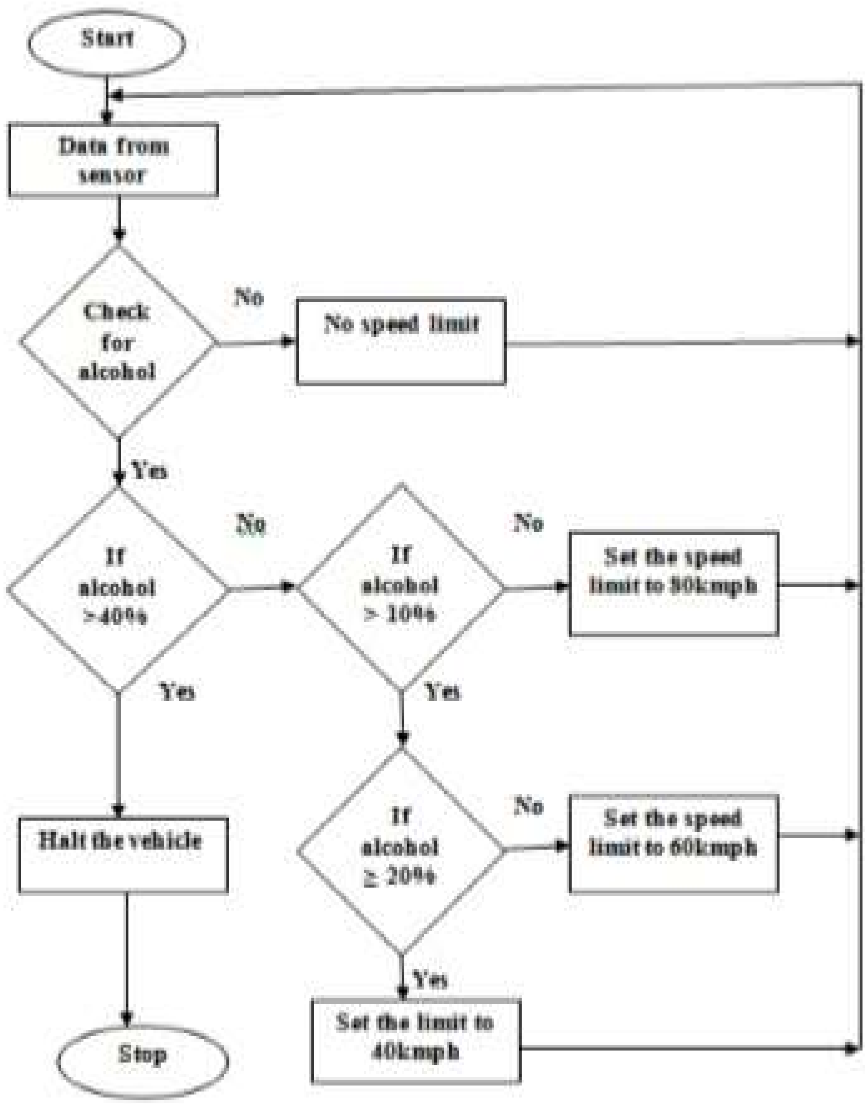

Figure 6 : Algorithm for alcohol sensor system

The algorithm in Fig 7, is designed for the tracing of the sign boards. This is really a high level of advanced task to do as detecting a sign board when the vehicles move in a speed

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

of 100 kmph is not that much easy and for that we have used the openCV programming technology and a high précised image capturing camera

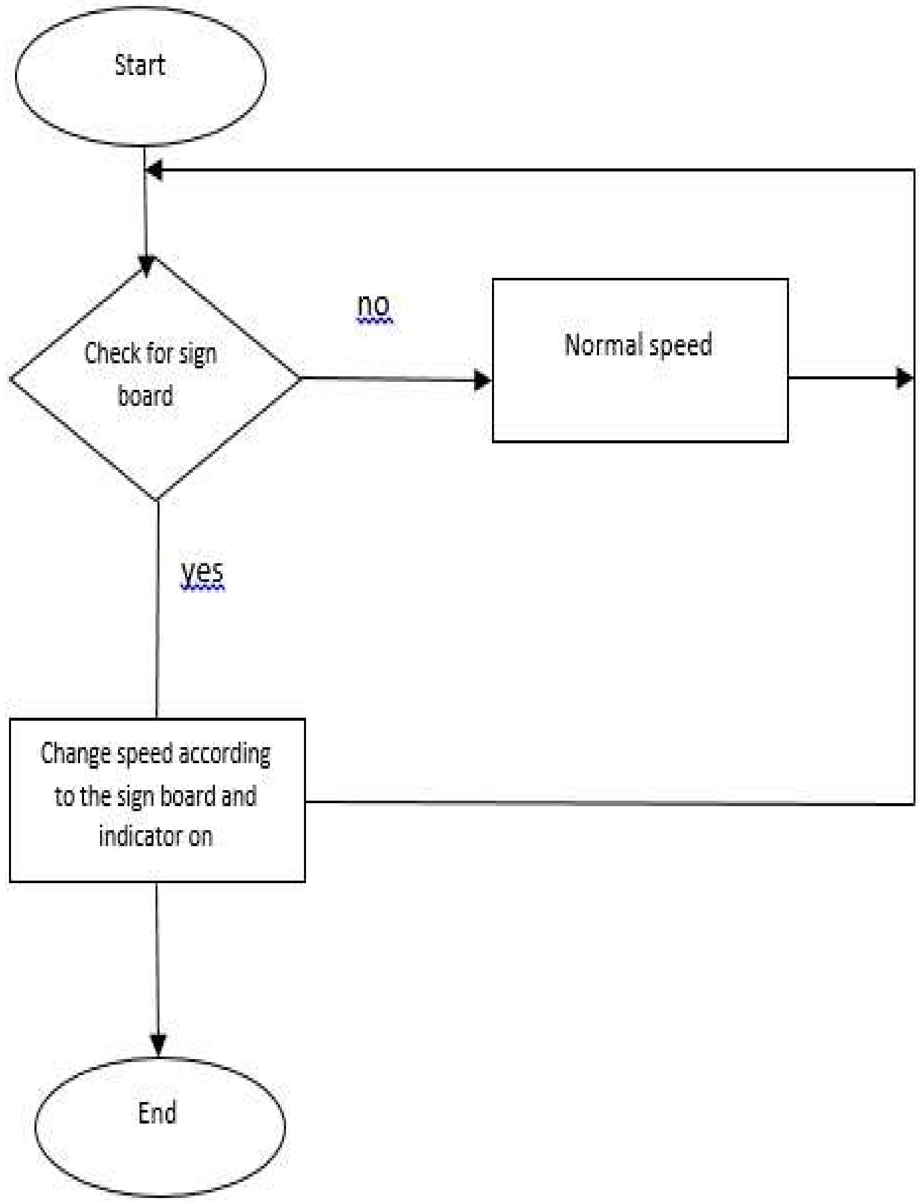

Figure 7 : Algorithm for detection of sign boards

Chapter 05

Application of the proposed system

This system is mainly designed to be used in four wheel vehicles that comes with the new latest digitally controlled vehicles, unfortunately old manual vehicles cannot be controlled by this system. The system is fully controlled by the micro controller and there are many other electronic circuits that is needed to operate the system. A motor driver is used to control the wheels speed, a GSM module is used to send SMS, a GPS module is used to detect the signal, a camera is used to detect the sign board and an alcohol sensor is used to detect the amount of alcohol present in the driver body. These all are works in the DC voltage and the current will be gained from the car battery.

This system is actually made with the concept of implementing it into new vehicles as an additional feature that can be selected by the customer when buying a new car or it can be a permanent feature of the vehicle according to the car manufacturing company it can be concluded. The system is good for the specific designs of the car because as there are many designs not a common type can be used in all the vehicles, so the system need some changes according to the design of the vehicle for the better performance

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

This system can be only implemented in Sri Lanka because the road signs feature is only designed for the signs available in Sri Lanka. So if this system need to be implemented in other countries then the sign board feature have to be altered according to the signs in that particular country.

Chapter 06

Results and Analysis

Whenever a sign of alcohol detected by the system data regarding to the amount of alcohol detected, speed, longitude and latitude values are measured by the system. The content of the alcohol consumed by the driver is indicated in the LCD present in the prototype. The picture of the LCD indicating the information is shown in the Fig 8 and 9. The information regarding the location of the drunken driver is sent to the authorities automatically by a message. The message received in the mobile is shown in the Fig 10.

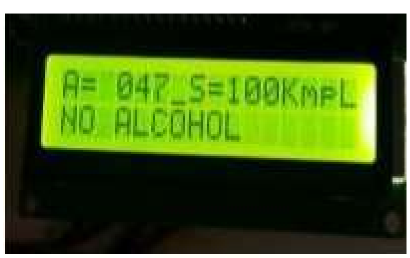

Figure 8 : The result when alcohol is not detected

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

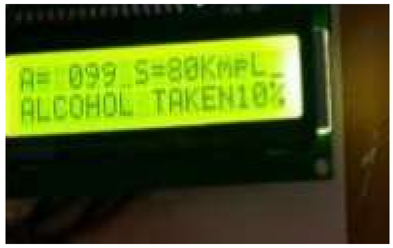

Figure 9 : The result when an alcohol level of 10 percentage detected

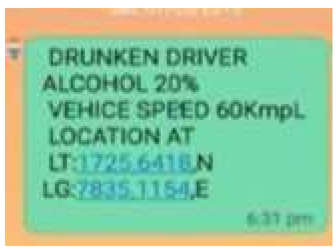

Figure 10 : The SMS send to the responsible person

This paper has resulted designing, analyzing and building a prototype of the smart drink and drunken driver detection and safety system for vehicles. The sensor used for detecting alcohol for breath of the human is PAS 32U. The smart alcohol detection and safety system for vehicles prototype has been built and test runs have been carried out for the analysis of the system and the evaluations for the prototype have been carried out with its sensor, controllers and the communication modules compared and evaluated.

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

Chapter 07

Conclusion and future works

The system is built in a prototype the system has given results which has unveiled it can be used in real vehicles systems. By using this the number of accidents happens in a day can be reduced considerably. Not only preventing the accidents in terms of drivers if anyone has a drinking habit this system will eventually reduce that habit as whenever the driver is drunken it will control the vehicle so if the driver wants to drive then he need to let go the drinking habit.

There must be some small changes when it comes to a real vehicle because of the size of the vehicles and the engine rpm the systems need some changes according to the type of vehicle. And when executing the system in a real vehicles there may be some problems can occur. We are using a high level alcohol sensor which can detect even a small amount of alcohol present near it, so there may be some situations like the driver has used a perfume, body spray or the use of vehicle fragrant, these items too consist of alcohol but not much amount of alcohol which can outrun the condition.

Unfortunately as there are is only one vehicle Production Company in Sri Lanka, and other vehicles are imported to our country so implementing this system in Sri Lankan vehicles will be a big challenge. Therefore a rule have to be made that new vehicles comes into Sri Lanka must hold this system and not every vehicle manufacturing company is going to accept this rule or it will take time for them to check, trail, run and implement this system into their vehicles

So it can be concluded that even though this system is ok, it will take many more years to implement this system in real time. Until then only the government and the citizens have to think about the loss and must obey the rules and regulations in order to reduce the accidents.

7.2 Future works

For this system as the future work we can implement this system in addition with the internet of thing (IoT), by using the IoT all the details can be uploaded into a central database. We can use these data to inspect the behavior of the driver and even can be used as evidence when an accident occur to see which side have the fault.

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3. One DALY is roughly equivalent to one healthy year of life lost. For more on the traffic-injury burden, see World Health Organization (WHO) and World Bank, "World Report on Road Traffic Injury Prevention," accessed online at www.who.int, on august, 2016
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Appendix

```
#include "opencv2/text.hpp"
#include "opencv2/core/utility.hpp"
#include "opencv2/highgui.hpp"
#include "opencv2/imgproc.hpp"
#include "opencv2/features2d.hpp"
#include <iostream>
#include <thread>
#include <unistd.h>
#include <fcntl.h>
#include <termios.h>
#include <cstring>
#include <string.h>
#include <vector>
#include <iomanip>
#include <sys/ioctl.h>
#include <sys/stat.h>
#include <stdio.h>
#include <errno.h>
```

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

```
#include <stdlib.h>
#include <wiringPi.h>


using namespace std;
using namespace cv;
using namespace cv::text;

//OCR recognition is done in parallel for different detections
template <class T>
class Parallel_OCR: public cv::ParallelLoopBody
{
private:
   vector<Mat> &detections;
   vector<string> &outputs;
   vector< vector<Rect> > &boxes;
   vector< vector<string> > &words;
   vector< vector<float> > &confidences;
   vector< Ptr<T> > &ocrs;

public:
   Parallel_OCR(vector<Mat> &_detections, vector<string> &_outputs, vector<
vector<Rect> > &_boxes,
   vector< vector<string> > &_words, vector< vector<float> > &_confidences,
   vector< Ptr<T> > &_ocrs)
   : detections(_detections), outputs(_outputs), boxes(_boxes), words(_words),
   confidences(_confidences), ocrs(_ocrs)
   {}

virtual void operator()( const cv::Range &r ) const
{
   for (int c=r.start; c < r.end; c++)
   {
      ocrs[c%ocrs.size()]->run(detections[c], outputs[c], &boxes[c], &words[c],
&confidences[c], OCR_LEVEL_WORD);
   }
}
Parallel_OCR & operator=(const Parallel_OCR &a);
};
```

```
//Discard wrongly recognised strings
bool   isRepetitive(const string& s);
//Draw ER's in an image via floodFill
void   er_draw(vector<Mat> &channels, vector<vector<ERStat> > &regions,
vector<Vec2i> group, Mat& segmentation);
//Checking string for numeric value
bool isNumeric(const string& s);
//Thread to Read buttons
void Thread_to_Read_Buttons();
//Stop motors Gradually
void StopMotors();
//Set speed.
void SetSpeed(const int& sp);
//Function read GPS
void thread_read_GPS();

//data stream to read Arduino Board
int uart0_filestream = -1;
int uart1_filestream = -1;
int uart2_filestream = -1;
char *rx_buffer1 = (char *)malloc(256);
int rx_length1;

//speed
int speed=0;
int Maxspeed = 0;

//High Alcohol
bool HighAlcohol = false;

//GPS Variables
float Lat,Lon;
bool GPSValid = false;


//Main Program
int main(int argc, char* argv[])
{
cout << "  Usage:  " << argv[0] << " [camera_index]" << endl << endl;
cout << "  Press 'ESC' to exit." << endl << endl;

setprecision(10);
namedWindow("Frame",CV_WINDOW_AUTOSIZE);
```

```
moveWindow("Frame",0,30);
namedWindow("Image_grey", CV_WINDOW_AUTOSIZE );
moveWindow("Image_grey",650,30);

//Variables
//bool downsize = false;
//int  REGION_TYPE = 1;
//int  GROUPING_ALGORITHM = 1;
//int  RECOGNITION = 0;
//char *region_types_str[2] = {const_cast<char *>("ERStats"), const_cast<char
*>("MSER")};
//char *grouping_algorithms_str[2] = {const_cast<char *>("exhaustive_search"),
const_cast<char *>("multioriented")};
//char *recognitions_str[2] = {const_cast<char *>("Tesseract"), const_cast<char
*>("NM_chain_features + KNN")};

Mat frame,grey,orig_grey,out_img;
vector<Mat> channels;
vector<vector<ERStat> > regions(2); //two channels

//Initialize OCR engine (we initialize 10 instances in order to work several
recognitions in parallel)
cout << "Initializing OCR engines ..." << endl;
int num_ocrs = 4;
vector< Ptr<OCRTesseract> > ocrs;
for (int o=0; o<num_ocrs; o++)
{
ocrs.push_back(OCRTesseract::create());
}

cout << " Done!" << endl;

//Setup wiring pi and interrupts

wiringPiSetup();
pinMode(0, INPUT);
pullUpDnControl(0,PUD_UP);
pinMode(6, OUTPUT);


//Open Serial Port from Arduino Board
uart1_filestream = open("/dev/ttyACM0", O_RDWR | O_NOCTTY);
```

```
if (uart1_filestream == -1)
{
printf("Error - Unable to open UART <> Arduino.  Ensure it is not in use by
another application¥n");
}
else
{
printf("Opened Arduino Serial port sucessfully - %d¥n",uart1_filestream);
}

        struct termios options1;
        tcgetattr(uart1_filestream, &options1);
        options1.c_cflag = B9600 | CS8 | CLOCAL | CREAD;          //<Set baud
rate
        options1.c_iflag = IGNPAR;
        options1.c_oflag = 0;
        options1.c_lflag = 0;
        tcflush(uart1_filestream, TCIFLUSH);
        tcsetattr(uart1_filestream, TCSANOW, &options1);


uart2_filestream = open("/dev/ttyUSB0", O_WRONLY | O_NOCTTY);

if (uart2_filestream == -1)
{

cout << "Error - Unable to open UART.  Ensure it is not in use by another
application" << endl;
}
else
{
cout << "Opened Serial port sucessfully" << uart2_filestream << endl;
}

        struct termios options;
        tcgetattr(uart2_filestream, &options);
        options.c_cflag = B9600 | CS8 | CLOCAL | CREAD;           //<Set baud
rate
        options.c_iflag = IGNPAR;
        options.c_oflag = 0;
        options.c_lflag = 0;
        tcflush(uart2_filestream, TCIFLUSH);
        tcsetattr(uart2_filestream, TCSANOW, &options);
```

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

```
//Setting up Thread

thread t1(Thread_to_Read_Buttons);
thread t2(thread_read_GPS);

usleep(1000000);



int cam_idx = 0;
if (argc > 1)
cam_idx = atoi(argv[1]);

VideoCapture cap(cam_idx);
//Setting capture frame rate
cap.set(5,2);

if(!cap.isOpened())
{
cout << "ERROR: Cannot open default camera (0)." << endl;
return -1;
}

while (cap.read(frame))
{

        //Flipping camera frame

        flip(frame, frame, -1);

        /*Circle Detection*/
        vector<Vec3f> circles;
        cvtColor(frame,orig_grey,COLOR_RGB2GRAY);
        HoughCircles(orig_grey,circles,CV_HOUGH_GRADIENT,1,200,200,50,10,400);


        //If Process is Enabled using Switch
        if(digitalRead(0) == 0 && !HighAlcohol)
        {
        //Only 1st Circle is considerring
        cout << "Image Processing ON" << endl;
```

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

```
digitalWrite(6,HIGH);
if(circles.size() > 0)
{
int x;
int y;
x= cvRound(circles[0][0]);
y = cvRound(circles[0][1]);
Point center(x, y);
int radius = cvRound(circles[0][2]);
// draw the circle center
circle( orig_grey, center, 3, Scalar(0,255,0), -1, 8, 0 );
// draw the circle outline
circle( orig_grey, center, radius, Scalar(0,0,255), 3, 8, 0 );


//Taking sub image of Circle
int start_x = (x - radius);
int start_y = (y-radius);
int end_x = (x + radius);
int end_y = (y+radius);
Mat Img = Mat::zeros((end_y-start_y),(end_x-start_x), frame.type());

for(int i=start_y; i<(end_y); i++){
       for(int j=start_x; j<(end_x); j++){
              Img.at<Vec3b>(i-start_y,j-start_x) = frame.at<Vec3b>(i,j);
       }
}

//Convert sub image to grey
cvtColor(Img,grey,COLOR_RGB2GRAY);


// Extract channels to be processed individually
channels.clear();
channels.push_back(grey);
channels.push_back(255-grey);


regions[0].clear();
regions[1].clear();


//Extract MSER
```

```
	vector<vector<Point> > contours;
	vector<Rect> bboxes;
	Ptr<MSER> mser =
MSER::create(21,(int)(0.00002*grey.cols*grey.rows),(int)(0.05*grey.cols*grey.ro
ws),1,0.7);
	mser->detectRegions(grey, contours, bboxes);

	//Convert the output of MSER to suitable input for the
grouping/recognition algorithms
	if (contours.size() > 0)
	MSERsToERStats(grey, contours, regions);


	vector< vector<Vec2i> > nm_region_groups;
	vector<Rect> nm_boxes;

	erGrouping(Img, channels, regions, nm_region_groups, nm_boxes,
ERGROUPING_ORIENTATION_ANY,"./trained_classifier_erGrouping.xml", 0.5);



	/*Text Recognition (OCR)*/


	Img.copyTo(out_img);
	//vector<string> words_detection;




	vector<Mat> detections;

	for (int i=0; i<(int)nm_boxes.size(); i++)
	{
	Mat group_img = Mat::zeros(Img.rows+2, Img.cols+2, CV_8UC1);
	er_draw(channels, regions, nm_region_groups[i], group_img);
	group_img(nm_boxes[i]).copyTo(group_img);
	copyMakeBorder(group_img,group_img,15,15,15,15,BORDER_CONSTANT,Scalar(0)
);
	detections.push_back(group_img);
	}

	vector<string> outputs((int)detections.size());
```

```
        vector< vector<Rect> > boxes((int)detections.size());
        vector< vector<string> > words((int)detections.size());
        vector< vector<float> > confidences((int)detections.size());

        for (int i=0; i<(int)detections.size(); i=i+(int)num_ocrs)
        {
        Range r;
        if (i+(int)num_ocrs <= (int)detections.size())
                r = Range(i,i+(int)num_ocrs);
        else
                r = Range(i,(int)detections.size());

        parallel_for_(r, Parallel_OCR<OCRTesseract>(detections, outputs, boxes,
words, confidences, ocrs));

        }


        for (int i=0; i<(int)detections.size(); i++)
        {
        outputs[i].erase(remove(outputs[i].begin(), outputs[i].end(), '¥n'),
outputs[i].end());

                //if (outputs[i].size() < 3)
                int uart0_filestream = -1;//continue;

                for (int j=0; j<(int)boxes[i].size(); j++)
                {

                //words_detection.push_back(words[i][j]);

                        if (isNumeric(words[i][j]))
                        {
                                cout << "OCR Detected word = " << words[i][j] << "
confidence = " << confidences[i][j] << endl;
                                Maxspeed = stoi(words[i][j]);
                                if(speed > Maxspeed)
                                {
                                speed = Maxspeed;
                                }


                        }
```

p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 04 Issue 01
January 2017

```
        }

}
} //End of recognizing detected 1st circle
} //End of Enablling Process, if
else
{
cout << "Image Processing OFF" << endl;
digitalWrite(6,LOW);
}//End of Enablling Process,else

//Prining Speed value
cout << "Maximum speed = " << Maxspeed << endl;
cout << "Current speed = " << speed << endl;

//Sending Speed value to Arduino Board to set speed.

SetSpeed(speed);

//Reading Alcohom meter

char ASend[] = "A¥n";
write(uart1_filestream, ASend, strlen(ASend));


int pos1 = 0;
while(pos1<255){
rx_length1 = read(uart1_filestream,rx_buffer1+pos1,1);
if(rx_buffer1[pos1] == '¥n') break;
pos1++;
}
rx_buffer1[pos1] = 0;
cout << rx_buffer1 << endl;
int AlcoholConcent = stoi(rx_buffer1);

if((AlcoholConcent > 400) && !HighAlcohol){


char msg1[] = "AT+CMGS=¥"0777873939¥"¥x0D¥x0A";
write(uart2_filestream, msg1, strlen(msg1));

char msg2[160];
```

```
	int SMS = sprintf(msg2,"Drankan Driver At (%f,%f) Speeding at %u
kmph",Lat,Lon,speed);
	write(uart2_filestream, msg2, strlen(msg2));

	char msg3[] = "¥x1A";
	write(uart2_filestream, msg3, strlen(msg3));

	//Stoping vehicle
	StopMotors();
	HighAlcohol = true;

	}

	imshow("Frame", frame);
	imshow("Image_grey", orig_grey);

	//Close command "Esc" key
	int key = waitKey(30);
	if (key == 27) //wait for key
	{
		cout << "esc key pressed" << endl;
		//Stoping Moters before Exit
		char endspeed[] = "S0¥n";
		write(uart1_filestream, endspeed, strlen(endspeed));
		break;
	}
	else
	{
		switch (key)
		{
		default:
		break;
		}
	}

} //End of While loop



return 0;
} // End of Main
```

```
bool isRepetitive(const string& s)
{
int count  = 0;
int count2 = 0;
int count3 = 0;
int first=(int)s[0];
int last=(int)s[(int)s.size()-1];
for (int i=0; i<(int)s.size(); i++)
{
if ((s[i] == 'i') ||
(s[i] == 'l') ||
(s[i] == 'I'))
count++;
if((int)s[i]==first)
count2++;
if((int)s[i]==last)
count3++;
}
if ((count > ((int)s.size()+1)/2) || (count2 == (int)s.size()) || (count3 >
((int)s.size()*2)/3))
{
return true;
}


return false;
}


void er_draw(vector<Mat> &channels, vector<vector<ERStat> > &regions,
vector<Vec2i> group, Mat& segmentation)
{
for (int r=0; r<(int)group.size(); r++)
{
ERStat er = regions[group[r][0]][group[r][1]];
if (er.parent != NULL) // deprecate the root region
{
int newMaskVal = 255;
int flags = 4 + (newMaskVal << 8) + FLOODFILL_FIXED_RANGE +
FLOODFILL_MASK_ONLY;
floodFill(channels[group[r][0]],segmentation,Point(er.pixel%channels[group[r][0
]].cols,er.pixel/channels[group[r][0]].cols),
Scalar(255),0,Scalar(er.level),Scalar(0),flags);
```

```
}
}
}

bool isNumeric(const string& s)
{
for(int i = 0; i < s.size();i++)
{
if (!isdigit(s[i]))
{ return false; }
}
return true;
}

void Thread_to_Read_Buttons(){

	pinMode(4, INPUT);
	pinMode(5, INPUT);
	while(1){
		if((digitalRead(4)==0) && (digitalRead(5)==0))
		{
		HighAlcohol = false;
		}
		else{
			if(!HighAlcohol){
				if(digitalRead(4)==0)
				{
					speed = speed + 5;
					if(speed >=100)
					{
						speed = 100;
					}
					cout << "Inc. Speed" << speed <<endl;
					usleep(2000000);
				}

				if(digitalRead(5)==0)
				{
					speed = speed -5;
					if(speed < 0)
					{
						speed = 0;
					}
```

```
                                        cout << "Dec. Speed" << speed <<endl;
                                        usleep(2000000);
                                }
                        }
                }
                usleep(100000);
        }

}

void StopMotors(){

do{
//Set speed
SetSpeed(speed);
speed = speed - 5;
usleep(1000000);
} while(speed > 0);

speed = 0;
//set speed
SetSpeed(speed);

}

void SetSpeed(const int& sp){

        char SSend[] = "S";
        write(uart1_filestream, SSend, strlen(SSend));

        string speedstr = to_string(sp);
        unsigned char tx_buffer[5];
        unsigned char *p_tx_buffer;

        p_tx_buffer = &tx_buffer[0];

        for(int q =0;q<speedstr.size();q++)
        {
        *p_tx_buffer++ = speedstr[q];
        }

        write(uart1_filestream, &tx_buffer[0], (p_tx_buffer - &tx_buffer[0]));
        write(uart1_filestream, "¥n", strlen("¥n") );
```

```
        usleep(200000);
}

void thread_read_GPS(){

        uart0_filestream = open("/dev/ttyAMA0", O_RDONLY | O_NOCTTY);

        if (uart0_filestream == -1)
        {
                printf("Error - Unable to open UART.  Ensure it is not in use by
another application¥n");
        }
        else
        {
                printf("Opened Serial port sucessfully - %d¥n",uart0_filestream);
        }

        struct termios options;
        tcgetattr(uart0_filestream, &options);
        options.c_cflag = B9600 | CS8 | CLOCAL | CREAD;             //<Set baud
rate
        options.c_iflag = IGNPAR;
        options.c_oflag = 0;
        options.c_lflag = 0;
        tcflush(uart0_filestream, TCIFLUSH);
        tcsetattr(uart0_filestream, TCSANOW, &options);


        char *rx_buffer = (char *)malloc(256);
        int rx_length;

        while(1){
                int pos = 0;
                vector<string> str;

                while(pos<255)
                {
                        rx_length = read(uart0_filestream,rx_buffer+pos,1);
                        if(rx_buffer[pos] == '¥n') break;
                        pos++;
                }

                rx_buffer[pos] = 0;
```

```
                string datarec(rx_buffer);

                char delimonator = ',';
                string acc = "";

                for(int i =0;i<datarec.size();i++)
                {
                        if(datarec[i]==delimonator)
                        {
                                str.push_back(acc);
                                acc="";
                        }
                        else
                        {
                                acc +=datarec[i];
                        }
                }

                if((str[0]=="$GPGLL") && (str[6]=="A"))
                {
                        string subLat1 = str[1].substr(0,2);
                        string subLat2 = str[1].substr(2,str[1].length());
                        Lat = (stof(subLat2)/60)+stoi(subLat1);
                        if(str[2] == "S")
                        {
                                Lat = -Lat;
                        }

                        string subLon1 = str[3].substr(0,3);
                        string subLon2 = str[3].substr(3,str[1].length());
                        Lon = (stof(subLon2)/60)+stoi(subLon1);
                        if(str[2] == "W")
                        {
                                Lon = -Lon;
                        }

                        GPSValid = true;

                }
                usleep(1000);
        }
}
```