Implementing A Next Generation System to provide Protection to Vehicles from Thefts and Accidents

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***Abstract*— In today's world, road accidents are killing more people than any serious health diseases or any type of epidemic. This has created an alarming situation for every individual to drive carefully and safely. Thus, this paper mainly focuses on reducing accidents caused by collision with another vehicle or by rash driving and drunken driving. It has used the Bluetooth Technology as an indicating device. This paper has presented a system which will make cars self-sufficient to take the decisions and remain protected from different types of accidents occurring inside as well as outside the cars by using sensors, GPS, Bluetooth and all these devices will be controlled by using Raspberry-pi. This paper has also provided an equal opportunity to provide security to the car by using Biometric authentication system.**

Keywords—Bluetooth, sensors, Collision, Camera, Fingerprint, Recognition

I. INTRODUCTION

Accidents are the unplanned, unexpected incidents which occurs suddenly. The main causes of the accidents are overspeeding, drunken driving, not obeying the road signs, losing control due to rash driving etc., these have made the automobile manufacturer an alarming signal to implement a device which will provide a prior indication to the driver regarding the probable accidents.

There are many features which were manufactured by various automobile companies for example Anti-Lock Braking System, Lane Departure Alerting System, etc. [11]. Along with this, many ideas were either proposed or formulated to provide safety to the vehicles like using a combination of Bluetooth module and RFID tags in cars to protect the vehicles from collision [1], Implementing a system to enhance the controllability of the car by using ABS which it will receive the interrupts by a controller according to the inputs being provided from the sensors and the communication between the controller and ABS will be done by CAN BUS [6], enabling the car to send the signal to the nearby police station by using ZigBee module which gets activated when the pressure sensors in accelerator and breaks determine that weather the car is in rash driving state or not depending on the traffic [4], making the cars stop if the driver is found to be drunk, which is sensed by using sensors [2], alerting the driver when an important road sign has been recognized by the processor [10]. There are also some devices implemented to help the car owner in protecting their children or pet from suffocation while getting locked in back seat of the car [3].

Thefts are the planned events which are deliberately performed by the humans to own someone's property without consenting the authorized person. This has also become an alarming issue because the number of car theft cases are increasing day by day. Many industries have implemented certain devices which would make the cars secure to a great extent. There are some ideas which has been formulated as well as proposed to provide a rigid security system to cars such as using Biometric authentication for unlocking the car [7] [8].

The features formulated in this paper contains a well-defined algorithm which will be explained further with the help of flowcharts and signal flow diagram followed by the experimental setup which will give an idea about the incorporation of all the features in a single processor. The outputs yielded from the setup will be discussed in the further topics followed by the observation or the conclusion along with the probable

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future scope for improving the overall system to avoid accidents to a great extent.

II. PROPOSED FEATURES

The features which are required to avoid: collision with other vehicles, rash driving, drunken driving, children getting locked in the back of the seat have been explained below.

A. Bluetooth Collision Warning System

This feature will protect the driver from getting collided by other cars. The main heart of this system is Bluetooth, which will give an indication about the existence of car(s) in its vicinity (within the range of Bluetooth). If Bluetooth detects the presence of a car, then it will activate the sensors placed in eight directions. Depending on the inputs from sensors, an interrupt will be sent to ABS or to the Lane Departure Alerting System. A complete procedure has been explained in Figure 1.

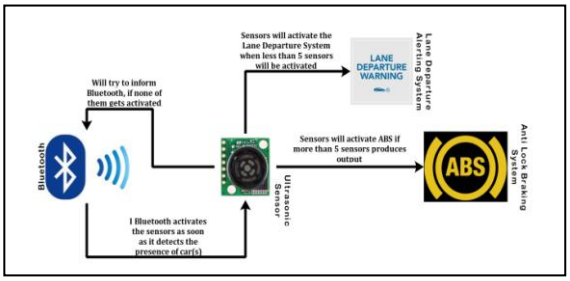

Figure 1: Bluetooth Collision Warning System

B. Hill mode

This is a unique feature which helps in enabling the car to apply brakes as soon as accelerator is released using while moving in an elevated plane. This feature can be easily understood by using the following Figure 2.

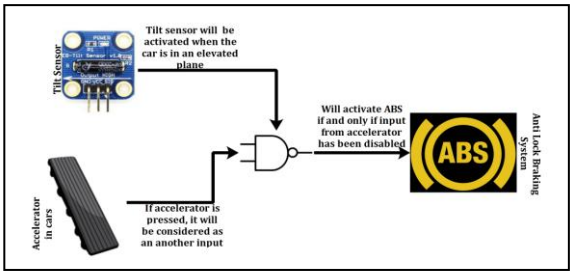

Figure 2:Hill Mode

C. Child in car Alerting System

This main objective behind implementing this feature is to protect a child, a disabled or an elder person, or a pet who got locked in the car and is in the back side of the seat. This feature will be enabled when the engine is switched OFF. It will automatically sense the temperature inside the car and will give the signal to the A.C. module, Window glass section through CAN BUS system and if any abnormality occurs in terms of temperature, then it would ring an alarm along with switching ON the parking lights. The Complete procedure has been pictorially described in Figure 4.

D. Rash and Drunken Driving Alerting System

This feature will help in avoiding the user to get into rash driving as well in drunken driving sate. This will be enabled by using a simple touch switch embed on the accelerator and brakes paddle, which will count the number of time the accelerator and brakes has been placed so that system will be able to determine whether the car is in rash driving state or not, along with this the system will also sense the speed of the car. If either or both of them shows any abnormality in its output , it will make the car in Halt state and will simultaneously give the location of the driver to the nearest police station using GPS. This communication will be enabled by an Accident Prevention Unit (similar to MSC in GSM Architecture). To sense the amount of alcohol being consumed by the driver, an infrared sensor can be deployed on the steering wheels which provide an interrupt to the GPS and will perform the same procedure as performed in case of rash driving. The signal flow diagram has been presented in Figure 5 to have a better understanding about the feature.

E. Road Sign Identification

This feature will help the cat to recognize road sign coming across the road and helping the car to perform the deaired task. The images will be captured by a camera which will be deployed on the dashboard. The flow of the signal has been shown in Figure 3.

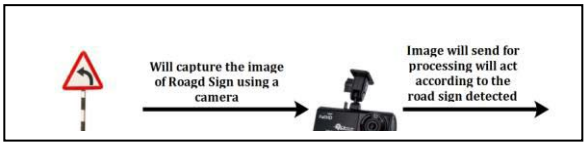

Figure 3:Road Sign Identification

F. Fingerprint Based Start/Stop Button

This feature will recognize the fingerprint of the user trying the getting the control of the car. The system will verify the fingerprint, if the fingerprint matches

with the available then it will allow the user to drive the car but if the fingerprint is not valid then it will start the alarm. This feature will be deployed in place of Start/ Stop Button. A complete flow diagram has been shown in Figure 6.

III. EXPERIMENTAL SETUP

The features discussed above (mainly the safety features) have to be incorporated in a single device. This can be done by using a central Controlling unit or a Processor. In this paper Raspberry pi has been considered because of its 40 GPIO pins, high Clock Rates, ability to do multitasking, a camera and USB ports. The sensors to be used for implementing the whole device includes seven SFR01 and one MAX-BOTIX 1260 Ultrasonic sensors for detecting the presence of cars in a particular direction, a D3T MEM human presence sensor for detecting the presence of a human being or an animal sitting at the back seat of the car, a Temperature Sensor, an infrared sensor for detecting the amount of alcohol content in air exhaled out by the driver , along with these it will also have a Bluetooth USB Dongle which should have an ability to detect the presence of cars upto a range of 20m, a touch switch at accelerator and brake paddles, a GPS module and a CAN BUS for enabling serial communication with the other units of the cars. The connection diagram of each component with the Raspberry Pi along with its position in a car has been shown in Figure 7 and Figure 8.

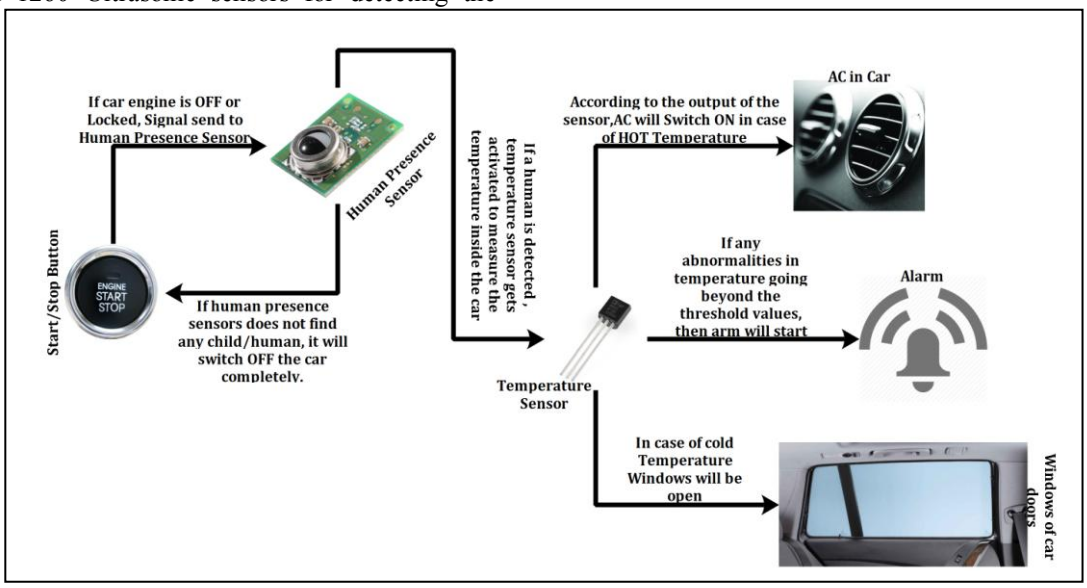

Figure 4:Child in Car Alerting System

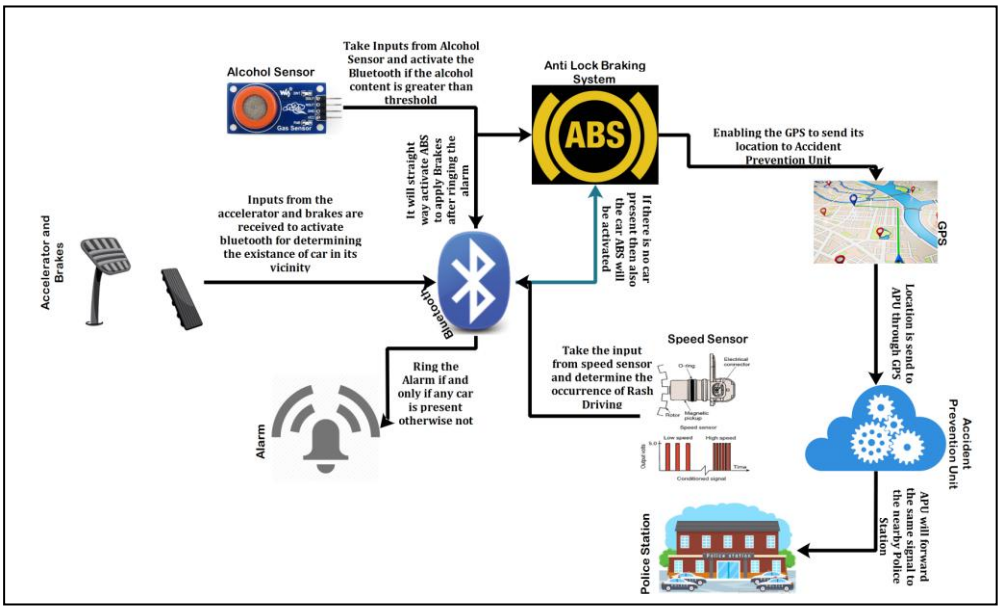

Figure 5:Rash and Drunken Driving Alerting System

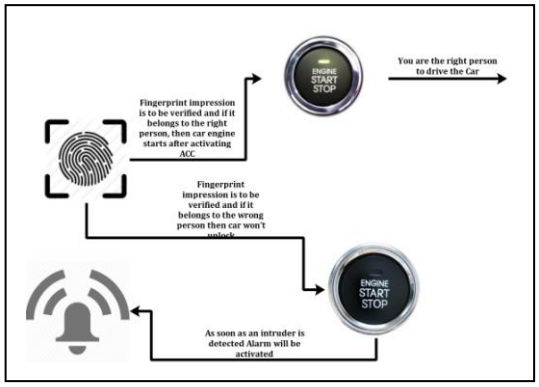

Figure 6:Fingerprint Start/ Stop Button

IV. RESULT

The features have been simulated via a software in which the inputs and outputs were considered in digital format. In this '1' means enable, '0'means Disable and 'X' means Don't care Condition.

TABLE 1: RESULT OF CHILD IN CAR ALERTING SYSTEM

B1	B2	B3	B4	Result
0	X	X	X	No Operation
1	0	X	X	No Operation
1	1	0	0	Stable Condition
1	1	0	1	Close the Glass of the window and Switch ON the AC
1	1	1	0	Open the Glass of the window and Start the Alarm
1	1	1	1	Not Possible

B1= Engine Status (ON or OFF)
B2=Human Presence Sensor Output
B3=Temperature sensor giving output when greater than 26 degree Celsius
B4=Temperature sensor giving output when less than 15 degree Celsius

TABLE 2: RESULT OF HILL MODE

B1	B2	Outcome
0	X	No Operation
1	0	Brakes will be applied
1	1	Brakes Will Not Be Applied

B1=Tilt Sensor Output
B2=Output from Push Button on Accelerator

TABLE 3: RESULT OF RASH AND DRUNKEN DRIVING ALERTING SYSTEM

B1	B2	B3	B4	Operation
0	0	0	0	No Operation
0	0	0	1	Assisted by Bluetooth Enabled Collision System
0	0	1	0	Will Slow Down the Speed below 85kmph
0	0	1	1	Will slow down the car and Send the location to the nearby Police Station via Accident Prevention Unit through GPS
X	1	X	X	
1	0	X	1	Rash Driving in Heavy Traffic has been Detected, So Send the location to the nearby Police Station via Accident Prevention Unit through GPS
1	0	X	0	Rash Driving in Light Traffic has been Detected, So Send the location to the nearby Police Station via Accident Prevention Unit through GPS

B1= Outputs from Push Buttons in accelerator and Brakes
B2=Alcohol Sensor Output
B3=Speed Sensor Output

B4=Bluetooth Output

B1, B2, B3, B4, B5, B6, B7, B8=Ultrasonic Sensor Status

TABLE 4: RESULT OF RASH AND DRUNKEN DRIVING ALERTING SYSTEM

B8	B7	B6	B5	B4	B3	B2	B1	Operation
0	0	0	0	0	0	0	0	No Operation
0	0	X	X	X	X	X	0	Car will move from Right
X	X	X	X	X	0	0	0	Car will move from Left
0	0	X	X	X	0	0	0	Car will Forward
Is the sensor at the front is activated irrespective of the other sensors								Car will slow down its speed and will stop if the distance between the two cars is less than 6m
If more than 6 sensors get activated including the sensor in the front of the car								Car will Stop

TABLE 5: RESULT OF ROAD SIGN IDENTIFICATION

Total Number of Images Used	Identification of Colour	Identification of Shape	Identification of Road Sign
37	35	34	31
Recognition Rate (%)	35/37=94.59	34/35=97.14	31/34=91.20

Images were segmented by using enhancing the Red Channel and then the shapes were recognized by using Correlation method. The road Signs were recognized by using Neural Network in which the training to the system was given by using 9 images from the given 37 image Database [9].

TABLE 6: RESULT OF FINGERPRINT START/STOP BUTTON

Total Number of Images in Database	Number of Fingerprint as Legal	Number of Fingerprints Recognized as Legal	Number of Fingerprints as Illegal
80	5	7	73
Rejection Rate (%)			73/75=97.33%

Fingerprint Images were extracted by using Fourier Transform and Gabor Filter[5]. The extracted images were processed and the features were extracted.

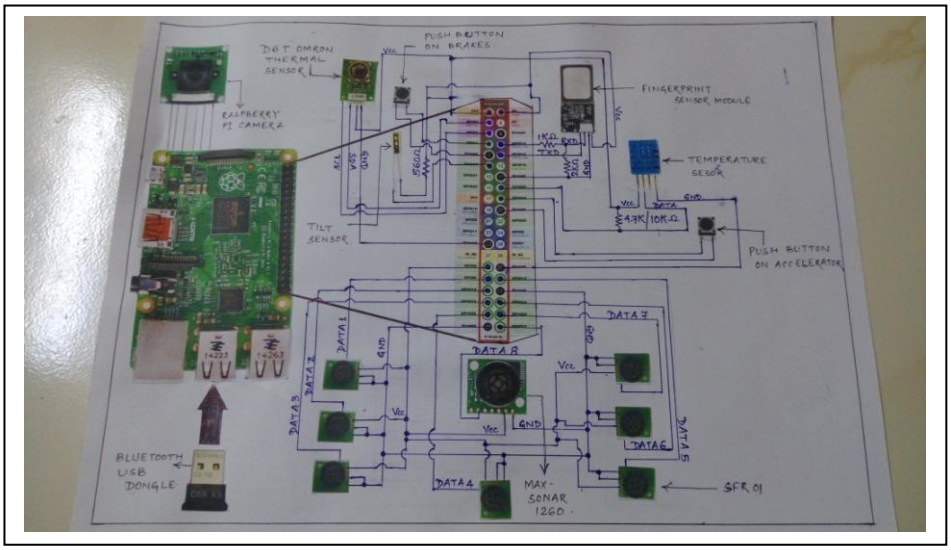

Figure 7: Connection Diagram of the Proposed System

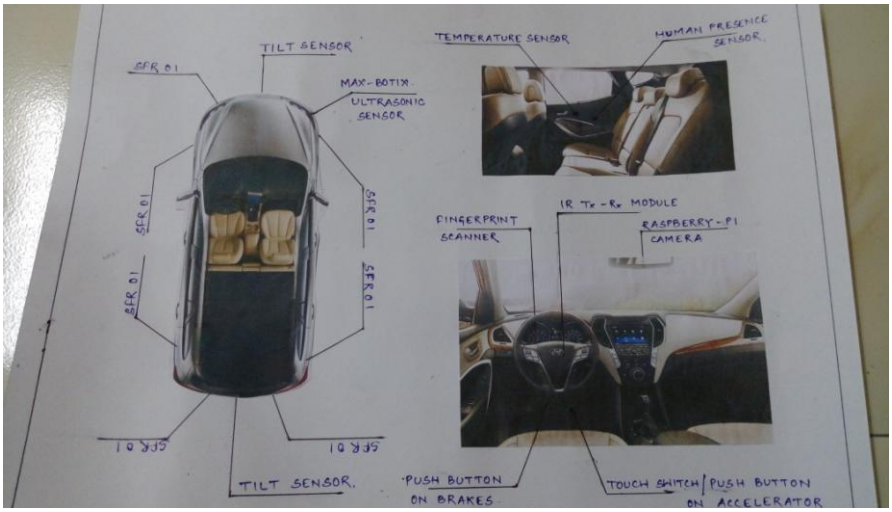

Figure 8: Positions of various components to be used in the proposed system in the Car

V. CONCLUSION AND FUTURE SCOPE

The features discussed above have been found to be interdependent on each other. The devices which were used to design a complete system were found to be compatible with the processor taken into consideration, the components were also found to be easily accessible, high in precision and last but not the least,the proposed system was found to be consuming as minimum power as possible.

VI. ACKNOWLEDGEMENT

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