

Passenger Safety System

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Abstract – Passenger Safety System is an innovative technology for humanity. It ensures the safety of the passenger during accidents. PSS can decrease the rate of death in accidents. In accidents where the vehicles fall in a pond, PSS helps the passenger to escape easily. It also helps to reduce rescue time in road accidents.

I. INTRODUCTION

In today's fast world, everything has become very fast and speed has become the other name for life. This theory is applicable to all the different aspects of life. And so it includes fast driving and riding as well. To add to this the auto manufacturers are coming up with faster cars and bikes every day. This has led to an increase in the number of accidents every year and it seems to increase at a rapid rate. Although different governmental and nongovernmental organizations do carry out workshops and other training programs to make people aware of careless driving, yet this whole process has not been very successful till date.

Various anti-collision systems are under development in various European nations. But such systems will be very expensive and in order to implement them, infrastructure of the transportation system will have to be upgraded. It may take more than 80 years to implement such a system in our nation. The aim of project PSS is to develop a system which can save the passenger in the time of accidents.

During accident if the vehicle falls into a stream, normally the door locks will be in closed position. Due to the failure of the centre lock system, the driver will not be able to

disable the lock. Also before falling into the stream he will not be able to deactivate the centre lock manually because of panic. In this situation the only possible way to get out of the vehicle is to break the glass of the window which is in fact a tough job under such a situation. Psychological factors affect the reaction time and the situation gets worse. Only a strong person (mentally and physically) can break the glass under this situation. Even if the driver deactivates the lock, due to high pressure of water, he will not be able to open the door.

During accidents on road, in most of the cases the doors get jammed due to the impact. Rescue team cannot take the person out by breaking the front or rear glass panel due to adverse effect of such action on the passenger's health. The only way to rescue the passenger is to cut the door which causes time loss.

II. CASE STUDY

Any car accident is frightening, but an accident in which your vehicle is thrown into the water, with you trapped inside, is absolutely terrifying. Such accidents are particularly dangerous due to the risk of drowning and in Canada alone, 10 percent of drowning deaths can be attributed to being submerged in a car [1], and about 400 North Americans are dying from being submerged in a car every year [2]. According to some studies, over 10,000 water immersion auto accidents happen each year in US [3]. However, most deaths are a result of panic, not having a plan and not understanding what is happening to the car in the water.

A car takes an average of 1 minute to sink completely [4]. That's enough time for the passengers to escape from the car. First the passenger should unbuckle the seat belt. Then the window should be rolled down before the power is down. But in most of the cases the power will be down as soon as the car hits the pond. In this situation the passenger will have to break the window manually. Breaking the rear or front glass panel is impossible. They are manufactured to be unbreakable [4]. So breaking the window is only possible way. It is also hard to break the window. A sharp edged object can be used for this. Now the passenger can easily get out through the window easily.

But to get out through the window is not an easy job for everyone. It depends on the physical fitness and mental strength of the person. The impact of the accident may affect the fitness and the panic will reduce the mental strength. Now the only way to get out is through the door. But due to the pressure difference, the doors will not be able to be opened till the pressure is equalized [5]. i.e. the car is completely immersed in water. There is only a narrow chance of escape in such situations because the person may not even try to open the door.

A survey was conducted among drivers in and outside the nation about these accidents and they claimed that assistance in such a situation will be of immense importance. Discussions with the officials of National Transportation and Research Centre (NATPAC) also concluded that such a device which can assist passengers during an accident will be of great help. By implementing a system which can assist passengers during accident, survival rate can be increased dramatically. A system which helps the passengers to escape from the drowning car can save many thousand lives around the globe and hence this is of utmost importance. In this scenario PSS comes as a savior.

III. OBJECTIVES OF PSS

III- A PRIMARY OBJECTIVES

- 1) Detect accident
- 2) Automatically roll down the window
- 3) Automatically unbuckle the seat belt
- 4) Automatically open the door (under specific conditions)

III- B SECONDARY OBJECTIVES

During such accidents, automatically call the rescue team, ambulance and the police. A GSM module which is a part of PSS can serve this function.

Due to the current in the river position of the vehicle may be unknown. RF beacon can be used to detect the vehicle.

IV. TECHNICAL DETAILS

The system has sensors to detect that the vehicle has hit some water body. Sensors can be conductivity sensor or pressure sensor. Water has very low conductivity. So amplifiers should be used to amplify the output signal. This signal is fed to the controller. According to the algorithm the controller takes the decision.

When the system hits the pond, first action should be rolling down of the window. This action should be completed before the battery of the car is down. The output of the controller should be given to a driving unit which drives the motor of the power window.

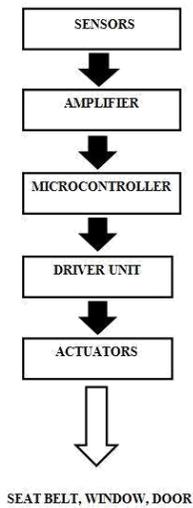


Fig.1 Block diagram

After this the seat belt should be unbuckled automatically. A motor can be used here to unbuckle the seat belt. Signal to this motor will be send by the controller. A driver unit is necessary to actuate the motor.

Now the person can get out through the window. If he is not able to get out through the window he can pull the emergency switch of the PSS to open the door. Even if he does not pull the switch, the door will be opened automatically after few seconds, say 30 sec for example.

An option to delay the opening of the door is optional, in case there are more people in the vehicle and they all are able to get out through the window taking time. Opening of door increases sinking speed. Even if they pull the switch to delay the opening of the door, the door will be opened automatically when the water level reaches the window level.

If the vehicle falls upside down, the door will be opened after a delay of say 5 second. It gives time for the passenger to prepare what to do after opening the door.

At the same time when the vehicle hits the pond, the GSM module and the RF Beacon will be activated. The GSM module will be calling to the emergency rescue, ambulance and the police.

PSS should be made water proof in order to achieve the objective. When the vehicle sinks in the pond the battery will be short-circuited which result in power failure. Hence PSS should have a backup battery. The charging wires from the alternator should be connected to the battery using diodes which prevents it from short-circuiting. PSS system with the backup battery should be water proofed.

V. CURRENT STATUS OF DEVELOPMENT

V.A MINIATURE PROTOTYPE

The prototype of the system was developed successfully. The system was mounted on a demo car. The system uses PIC 16F877A controller with clock frequency 20MHz.

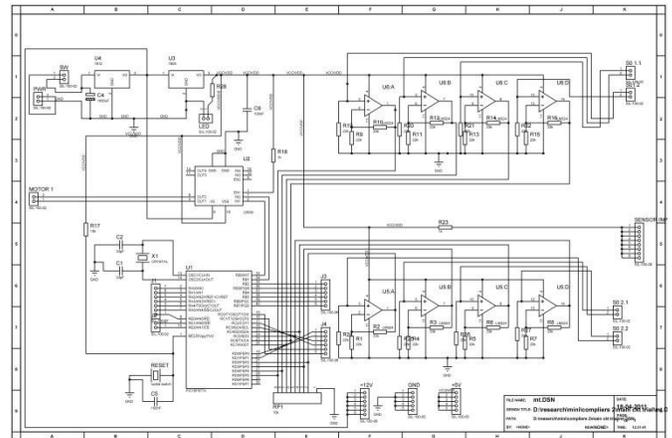


Fig.2 Circuit diagram

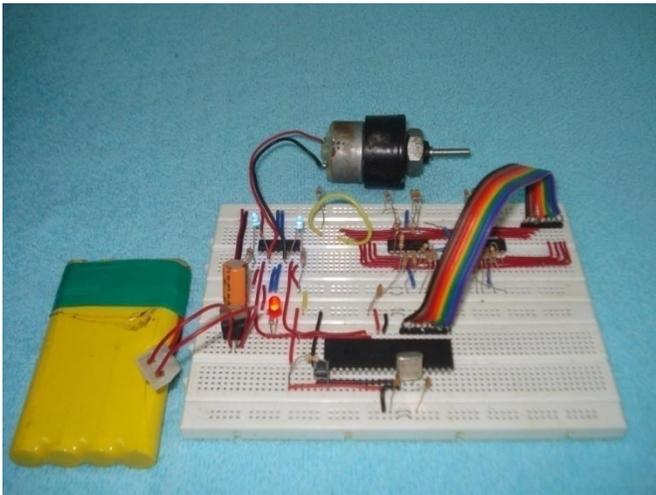


Fig.3 Breadboard setup

It has eight sensors to detect the presence of water. The controller checks the status of the sensors and takes decisions according to the algorithm. Signal from the sensors is connected to the amplifiers. Output from the amplifiers is connected to the controller.



Fig.4 System mounted on a demo car. It can be programmed according to the hardware

This system is mounted onto a demo car. In the demo, the doors alone are controlled. The sensors detect the presence of water. The sensors are paired and the pair of sensors is placed at four corners of the car. The two sensors

are placed at a distance. The algorithm is written such that the device will respond only when both of the sensors will confirm detection. It is to avoid miscalculations and to confirm that the device will not trigger accidentally.

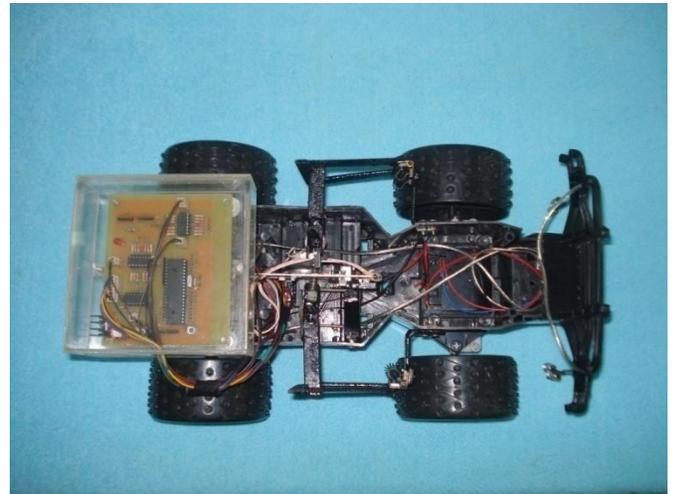


Fig.5 Demo car- top view

The tests were conducted under different conditions. Water samples of different conductivities were used for the test. Tests conducted with the demo car were satisfactory.

V.B REAL WORLD PROTOTYPE



Fig.6 Work in progress

After the successful completion of the demo, implementing of PSS on a real world car is in progress. A SIM 300 GSM Modem is used to call the rescue team.



Fig.7 GSM modem: SIM 300 Modem

VI. FUTURE SCOPE

Cause of death in road accident in majority of the cases is loss of blood. In most of the cases the doors get jammed due to the impact. Rescue team cannot take the person out by breaking the front or rear glass panel due to adverse effect of such action on the passenger's health. The only way to rescue the passenger is to cut the door which causes time loss. So if we reduce the rescue time we can save many lives.

The air bags deploy after 0.04 sec of impact [6]. After this the doors can be opened partially so that the doors will not get jammed. Seat belts make sure that passenger is not thrown out.

VII. REFERENCE

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