# NEW TECHNOLOGICAL INNOVATION AND CHALLENGING ISSUES IN CAR

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**Abstract: Accidents happen very quickly in day to day life. Breaks in-front of you would slam your foot in a fraction of second, along with your body. To overcome this instance an ejector seat has been designed as an idea of improvement with current existing safety tools which protect people when a car crashes. Traditional airbag is limited in that it protects people after car is crashed and in many situations it would be too late, and also it cannot protect people when the car falls off a cliff. The ejector seat ejects people with different weights to the same height when danger is detected.The prototype results show that it can detect relative distance and speed accurately with a small error of +/-2 cm, and the weight can be measured to an accuracy of +/- 2 grams. The seat is ejected and when relative distance and speed reach a threshold that we calculated to be reasonable for deadly situation, and the springs which are used to eject are compressed to desired position to make sure that different weights are ejected to the same height. This situation is immediately sent to the nearby server helpline through GSM module, and help is availed at once.**

**Keywords: Ejector Seat, Solenoids, Ultra sonic sensor, GSM module, Triangulation technique Liquid Crystal display and microcontroller.**

## 1. INTRODUCTION

This research idea may be used to decrease death of car crashes. In regular routine life every day the broadcast channel delivering the minimum one incident of car accident. High speed collisions cause largest proportion of deaths every year. Many companies have spent time researching how to make cars safer using more practical methods such as airbags. However, airbags cannot save life in many conditions. It concludes front collision, offset collision, and oblique collision in high-speed condition. Thus, this research paper provides an innovation idea may be it will work out depends upon the feasibility. Here the technology adopts ejection seat to save lives of drivers when they face those conditions. This concept intends to make a model which can physically eject the drivers free of imminent crashes in a real car. While we acknowledge this is likely not the most practical response in a real-world scenario, the design decisions behind the system could prove a strong proof of concept for future safety projects.

### A. Objectives

#### 1) Benefits and Goals

- Focussed on more reliable protection for traffic accidents
- During high speed condition save lives from front collision, offset collision, and oblique collision
- Even though different weights all the seats are ejected to the same heights

**2) Functions and Features**

- Detect deadly situation, i.e. detect condition that relative distance and speed exceed threshold that are calculated reasonable for a deadly situation
- Whenever deadly situation happened all the Seats are ejected.
- In each seat sited weight will differ.

**B. Design Scheme**

**1) Design**

For any electronic circuit the important one is the power supply. In this mission the power deliver is needed to the detection device, microprocessor, and ejection machine. The power system needs to have 5V outputs with the intention to ensure sensors and microprocessor works. The solenoids and stepper cars that utilized in ejection device want 12V to work
Figure 1 shows the power supply unit.

**2) Circuit**

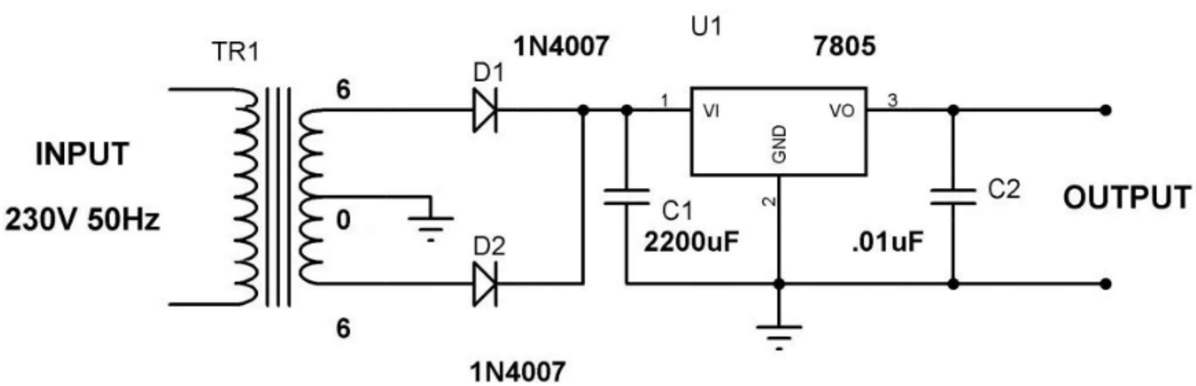


Figure1. Power supply circuit

**C. Detection System**

**1) Design**

For the detection system, the distance sensor is used to detect the car's environment. The HC-SR04 Ultrasonic distance sensor is used to measure the relative distance and speed between the car and the nearest object to the front, oblique and offset sides. Here, back side crash not considered because car was rarely rear-ended in high-speed condition. Distance sensors will send analogue electrical signals and measurements to microprocessor module.

**2) Calculations**

Generally the weakest part of human beings is head. Let us consider the maximum force for head of human-beings is 22.8 kN. According to Newton's laws of the motion, F is equal to the mass m of that object multiplied by the acceleration vector a of the object:

Force = Mass * Acceleration------------------------ (1)

Assume the weight of head is 5 kg. Thus, the deadly acceleration can be defined by:

Acceleration = Force / Mass = 22.8 kN /5 kg= 4560 m/ s---------- (2)

Because collision time is 0.001 s, the calculated the deadly speed is

Deadly speed = Acceleration / time = 4560 /0.001 = 4.56 m/s------------- (3)

In case of real car, the assumed that 15 m/s rated speed is a deadly speed with belt and airbag. The reason for choosing 15 m/s is that 55 kph speeds has larger increasing number of death people than that with less than 55 kph speed. Thus, in case of model car, 1 m/s rated speed is test speed with 1/15 scale. Also, the test includes acceleration between car and objects. It has positive acceleration and 1m/s rated speed in short distance, then the ejection system would work.

For distance sensor, the assumed one 60 meter is enough distance to find acceleration and speed. Thus, HC-SR04 Ultrasonic sensor is used to find acceleration and speed in range of 0.02 m to 4 m. It is works well in scale of 1/15. Thus, we give 1.5 s to ejection system to eject. In our case of real car, the ejection seat will eject when car is in 22.5m front of collision. In our case of model car, the ejection seat will eject when car is in 1.5m front of collision. This is our understanding of deadly condition.

### 3) Circuit

The sensor HCSR04 used 5 V power supply and has two data pins that send data to microcontroller. The setup of the sensor is shown in figure 2.

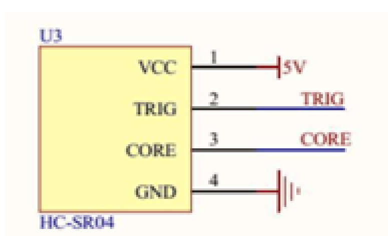


Figure2. Circuit schematics of HC-SR04 ultrasonic distance sensor

## D. Ejection System

### 1) Design

The ejection system is designed to eject people when the deadly situation is detected, and also eject different weights to the same height. We use mechanical springs and solenoids to eject the seat, springs are compressed and solenoids lock them in place, and once the deadly situation is met, the solenoids will pull back and unlock the spring to eject the seat. For ejection height control, we use the load sensor to measure the weight on the seat, and based on different weight, the stepper motors and sprockets will compress the springs to the length that can eject different weight to the same height which is 0.5m.

**2) Calculations**

Let us consider the height of ejector is 0.5 meter and the gravity constant is 9.8 m/$s^2$. So the potential energy is

Weight (Wt) * height (ht) * gravity (gt) ------------------ (4)

The total potential energy of the spring with compressed length x and constant k=2500N/m:

$$\frac{1}{2}kx^2 \text{ ---------------(5)}$$

According to law of conservation of energy, equate (4) and (5) to get:

Weight (Wt) * height (ht) * gravity (gt) = ½ $kx^2$ ---------------------- (6)

The equation calculates the number of steps needed for a stepper motor to rotate to distance x:

$$\#steps = \frac{d}{C} \times (100cm/m) \times \frac{360°}{aps} \qquad \text{-------------------------------------- (7)}$$

C: circumference of motor, C=16.35cm

aps: angle per step, aps=0.018°

So by equation (6) and (7) we can get the number of steps that is need for the stepper motor to rotate to a certain length that can eject different weights to height 0.5 meters.

**3) Ejector system**

Let us consider the situation already roof system of the car is opened. By releasing the solenoid spring this is connected to the seat. If the car is moving at a very high speed and opposite vehicles also coming closer and if reaches to the collision which means that fire has going to be happened. This case solenoid release the spring and the seat has ejected and parachute is opened.

**E. Microcontroller**

All the data from sensors will be sending to this microprocessor AT89c51, and it outputs to solenoids/stepper motors after processing the data. Figure 3 gives a circuit schematic of AT89c51 and figure 4 shows that general block diagram.

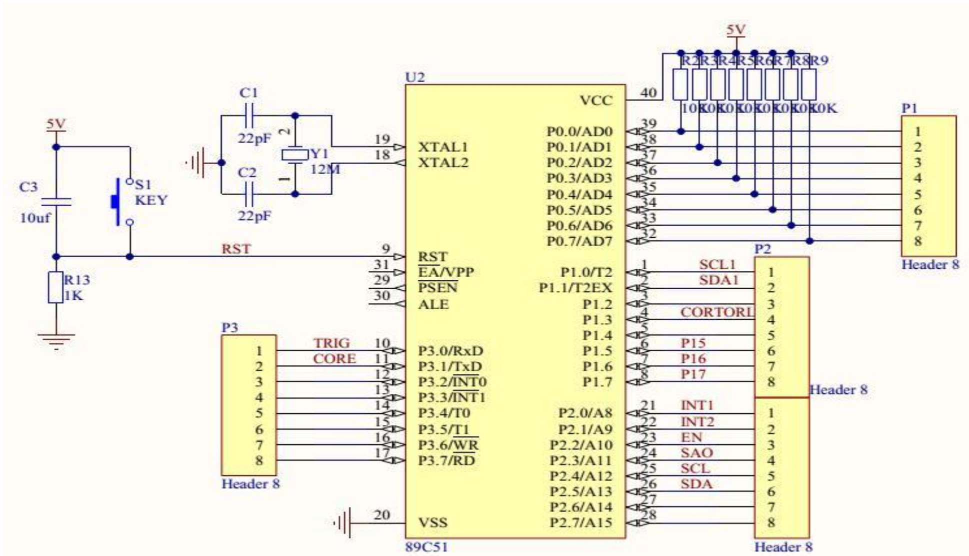


Figure3. Circuit schematics of AT89c51

## 2. LITERATURE SURVEY

In[1] proposed a survey is showing that roughly 70 percent of respondents use their smart phones while driving. Texting is the most common, with 61 percent saying they have read, sent or replied to texts while driving, but respondents also indicated they use email, Face book, Twitter while driving. The National Safety Council estimates that texting while driving raises the likelihood of a crash by eight times and that crashes involving texting or talking on a cell phone.

In[2] proposed factors that affect ejection risk in roll over crash which will determine the ejection, occupant characteristics, crash and vehicle in rollover crash to protect people from accidents. A proportion of occupants who were ejected in spite of airbag deployment passed through the sunroof and other portals as opposed to the adjacent side window compared to occupants who were ejected in rollovers without a curtain airbag deployment.

In[3] proposed two data systems which is used to explore the occupant injuries related to vehicle rollover crashes. One data system is FARS (Fatality Analysis Reporting System) which indicates annual rollover caused fatalities decreased. The other data system is CDS(Crashworthiness Data System) which contain several data files like General Vehicle, Occupant Assessment, Occupant Injury, Vehicle External and Accident.

In[4] proposed for children who do not have same height or weight to use seat belts, the strap will tends on the wrong place. Many parents believe that booster seats are not necessary. The researchers enable to distinguish between the causes of faulty judgements of the risk reduction with booster seats and to know the safety benefits of booster seat.

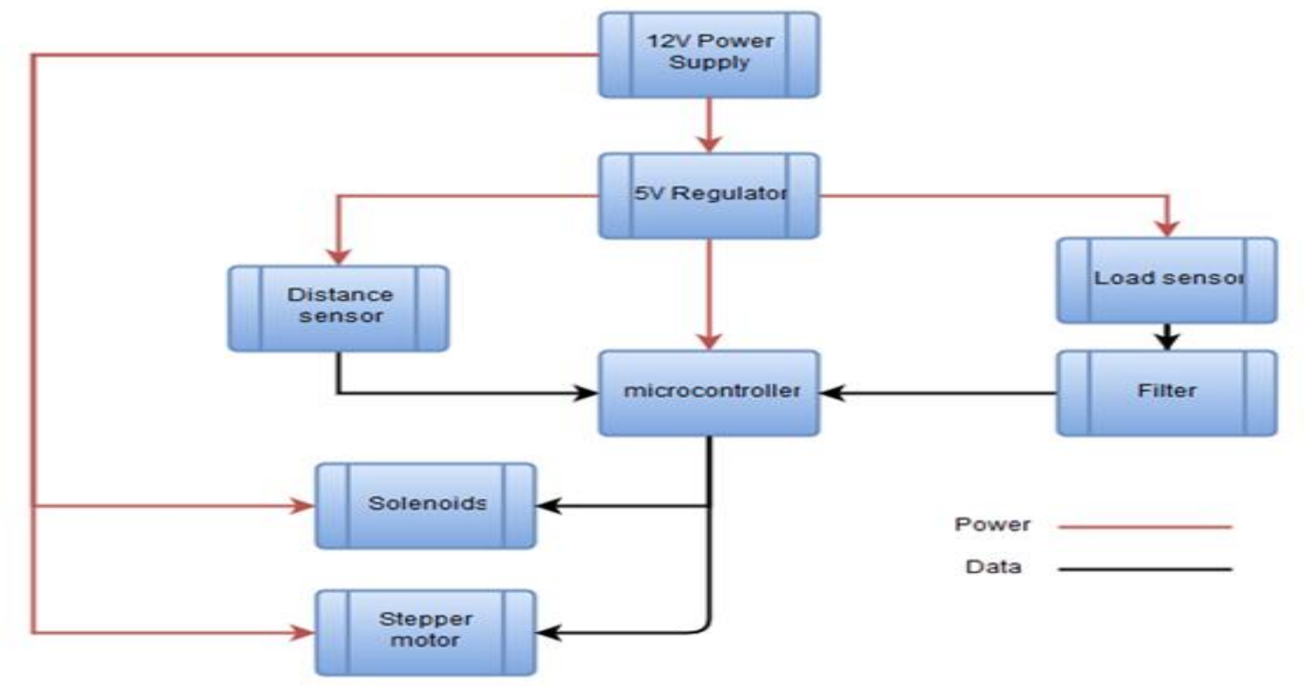


Figure4. General Block diagram

## 3. VERIFICATION

### A. Detection and Ejection Control System

The ultrasonic distance sensor can hit upon in variety 3cm to 200cm in our experiment with an accuracy of +/- 2cm. Speed is calculated because the average speed in every size and assumed it's miles the actual time velocity. The velocity dimension has an accuracy of +/- 2cm/s.

When distance and speed reaches threshold, solenoids can pull back immediately. Figure5 shows block diagram of motor relates to car speed and figure 6 shows ultra sonic sensor output and figure 7 shows simulation output.

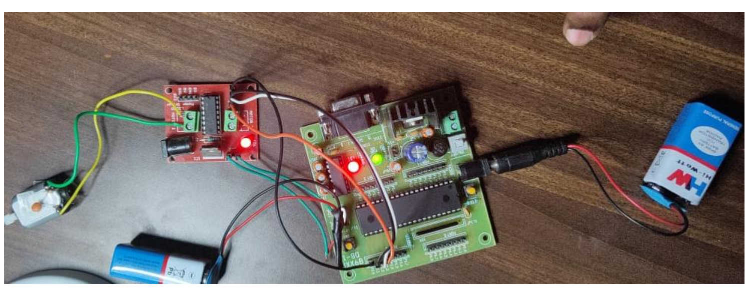

Figure5. Block Diagram of motor speed relates to CAR speed

The load sensor can measure weight in range 0 to 5kg, with accuracy of +/- 2g.

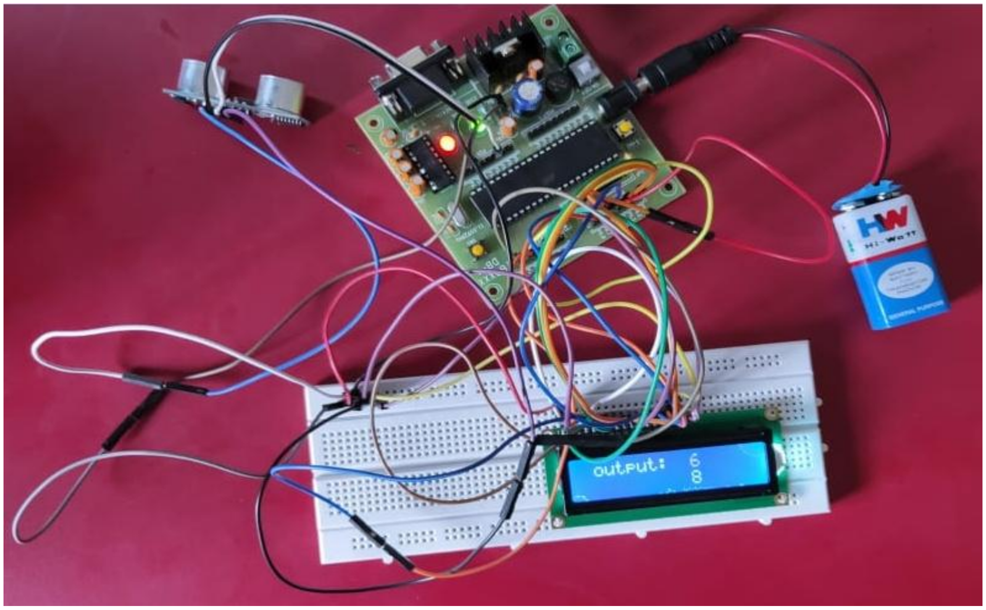


Figure6. Ultrasonic sensor interfacing with 89c51

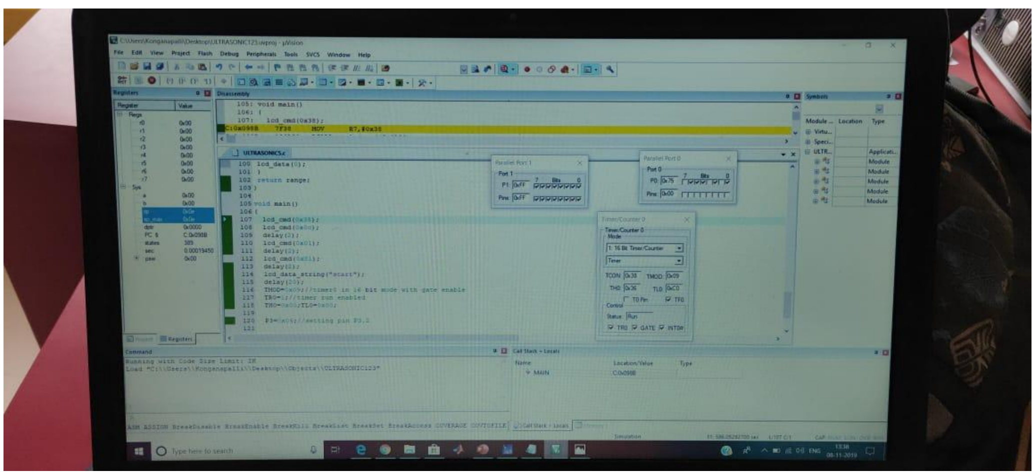

Figure7. Simulation diagram

## 4. CONCLUSION

### A. Accomplishments

Here tested every module correctly, which includes relative distance, weight measurement and number of steps calculation, displaying distance, spring period on the LCD display, solenoids pulling again whilst given ejection sign, and output PWM to stepper motor to make it rotate to certain step. As a device, we've accomplished solenoids pulling lower back whilst deadly state of affairs is detected.

### B. Future work/Alternatives

The main focus for future improvement is improving the reliability of our design.

First, we want to fix the hassle the our cutting-edge solenoids are not effective sufficient to release the spring, so we will either select extra effective solenoids, or lessen the friction by using using a pulley that is similar to the one used on drawers.

Second, a parachute need to open while humans are ejected to the best factor and is ready to falling all the way down to make sure that human beings land thoroughly.

Third, the roof of the car ought to open at the identical time that the ejector seat is ejected.

The ultimate one is that we ought to eject humans to the lower back-proper direction. Due to inertia, humans will preserve their initial velocity when they are ejected, and this might purpose them hitting object in the front of them. Also, we can eject to the proper course to prevent setting human beings on the road thinking about that cars run at the proper side of the street. There are some greater things that we will enhance. We can enhance the accuracy of distance and velocity measurement. Also, we can enhance our power machine by the usage of inexperienced strength and renewable electricity.

The primary consciousness for destiny development is enhancing the reliability of our design.

The final one is that we must eject people to the returned-proper route. Because of inertia, people will hold their initial velocity while they're ejected, and this might purpose them hitting object in the front of them. Additionally, we are able to eject to the proper route to prevent setting human beings on the road considering that automobiles run on the proper side of the road. There are a few extra things that we are able to enhance.

## 5. REFERENCES

[1] James R. Funk, Joseph M. Cormier, Charles E. Bain, Jeffrey L. Wirth, Enrique B. Bonugli, and Richard A. Watson ,' Factors Affecting Ejection Risk in Rollover Crashes ',Ann Adv Automot Med. 2012 Oct; 56: 203–211.

[2] Jingshu Wu, PhD, Stephen Summers, Stephen Ridella, PhD, Ellen Lee, Thomas Kang, James Myers National Highway Traffic Safety Administration (NHTSA), Washington, DC,' Occupant Injuries Related to Rollover Crashes and Ejections from Recent Crash Data , Wu,2017.

[3] Emergency ejector seat,Donald J.Halsey,2019.

[4] Takuro Ishikawa, Andy Jiang, Mariana Brussoni,Valerie Reyna, Rebecca Weldon, Beth Bruce ,' Perceptions of injury risk associated with booster seats and seatbelts: the ejection stereotype hypothesis', Vol.15, No.1 | 2017 | hypothesisjournal.com

[5] Jason Redmond, U.S. Traffic Deaths, Newsweek 2015 http://www.newsweek.com/us-traffic-deaths-injuries-and-related-costs-2015-363602

[6] Deadly acceleration, Baike baidu

[7] Who wants airbags, Mary C. Meyer and Tremika Finney, 2005

[8] IEEE, IEEE Code of Ethics, Online http://www.ieee.org/about/corporate/governance/p7-.html

[9] Scott Carney, Lab Safety, Lecture 2 ppt https://courses.engr.illinois.edu/ece445/lectures.asp

[10] Electrical Safety in the lab, university of Illinois at Urbana-Champaign

[11] Texas Instruments, Active Low-Pass Filter Design: