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Car Safety System with Integrated Seat Belt Design

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Abstract: *Improvising traffic safety is a prime strategic technique used in addressing national and global road casualty reduction targets. Vehicle safety addresses the safety of all road users and currently comprises measures to help avoid a crash (crash avoidance) or reduce injury in the event of a crash (crash protection).Road traffic injuries are a major but neglected global public health problem, requiring concerted efforts for effective and sustainable prevention. What is worse, without increased efforts and new initiatives, the total number of road traffic deaths worldwide and injuries is forecast to rise by some 65% between 2000 and 2020, and in low income and middle-income countries deaths are expected to increase by as much as 80%. Improving vehicle safety is a key strategy used in addressing international and national road casualty reduction targets and in achieving a safer road traffic system. Many attempts has been done in field of vehicle safety but the previous attempts are complex, this paper focuses on the control of gear shift at high speed through the seat belt implementation. As soon as vehicle goes to 4th or 5th or higher gear, seat belt would be automatically buckled.*

Keywords: gear shift, controller, seat buckled

Introduction:

Automobiles influence humans daily on a global level. Industry analysts have calculated that the total vehicle number is 1.2 billion already and is expected to rise sharply. Such an amount and large applications are followed by the risks of accidents and mishaps on the road. Work-related roadway crashes are the leading cause of death from traumatic injuries all across the globe. They accounted for nearly 27,000 deaths between 2000 and 2010 in USA alone. The automotive industry in India is one of the largest in the world with an annual production of23.96 million vehicles in FY 2015-16, following a growth of 2.57 per cent over the last year. The automobile industry accounts for 7.1 per cent of the country's gross domestic product (GDP).The Two Wheelers segment, with 81 per cent market share, is the leader of the Indian Automobile market, owing to a growing middle class and a young population. Moreover, the growing interest of companies in exploring the rural markets further aided the growth of the sector. The overall Passenger Vehicle (PV) segment has 13 per cent market share. A lot of things are said and done to provide safety to the drivers. Safety in automobiles has always been a prime priority for both engineers and the customers. Automobile safety is the study and practice of design, construction, equipment and regulation to minimize the occurrence and consequences of traffic collisions. Road traffic safety more broadly includes roadway design and smart engineering of the vehicle system. Improvements in roadway and automobile designs have steadily reduced injury and death rates in all first world countries. Nevertheless, auto collisions are the leading cause of injury-related deaths, an estimated total of 1.2 million in 2004, or 25% of the total from all causes. Of those killed by autos, nearly two-thirds are pedestrians. Risk compensation theory has been used in arguments against safety devices, regulations and modifications of vehicles despite the efficacy of saving lives.Coalitions to promote road and automobile safety, such as Together for Safer Roads (TSR),brings together global private sector companies, across industries, to collaborate on improving road safety. TSR brings together members' knowledge, data, technology, and global networks to focus on five road safety areas that will make the greatest impact globally and within local communities. Despite technological advances, about 34,000 people die every year in the U.S. Although the fatality rates per vehicle registered and per

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vehicle distance travelled have steadily decreased since the advent of significant vehicle and driver regulation, the raw number of fatalities generally increases as a function of rising population and more vehicles on the road. However,sharp rises in the price of fuel and related driver behavioral changes are reducing 2007-8 highway fatalities in the U.S. to below the 1961 fatality count. Litigation has been central in the struggle to mandate safer cars.

1) Literature Survey:

In 1996, the U.S. had about 2 deaths per 10,000 motor vehicles, compared to 1.9 in Germany, 2.6 in France, and 1.5 in the UK. In 1998, there were 3,421 fatal crashes in the UK, the fewest since 1926; in 2010 this number was further reduced to 1,857 and was attributed to the 2009–2010 scrappage scheme. The sizable traffic safety lead enjoyed by the USA since the 1960s had narrowed significantly by 2002, with the US improvement percentages lagging in 16th place behind those of Australia, Austria, Canada, Denmark, Finland, Germany, United Kingdom, Iceland, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, and Switzerland in terms of deaths per thousand vehicles, while in terms of deaths per 100 million vehicle miles travelled, the USA had dropped from first place to tenth place. Government-collected data, such as that from the U.S. Fatality Analysis Reporting System, show other countries achieving safety performance improvements over time greater than those achieved in the U.S.

1.a) Classification of Safety Systems

Safety Systems for automobiles can be classified into two factors on the basis of their use before

and after the accident to minimize the loss.

1.a.1) Active Safety Systems: Active driving safety refers to devices and systems that help keep a car under control and prevent an accident. They are designed in a way to reduce the possibility of an accident in the first place. These devices are usually automated to help compensate for human error -- the single biggest cause of car accidents.

Examples of active safety

- Good visibility from driver's seat,
- Low noise level in interior,
- Legibility of instrumentation and warning symbols,
- Early warning of severe braking ahead,
- Head up displays,

1.a.2) Passive Safety Systems: Passive driving safety refers to systems in the car that protect

the driver and passengers from injury if an accident does occur.

Examples of passive safety

- Passenger safety cell,
- Deformation zones,
- Seat belts,
- Load space barrier-nets,

1.b) Metropolitan Status

Adults who live in non-metropolitan areas are less likely to wear seat belts than adults who live in metropolitan areas.Thousands of deaths each year can be avoided if everyone uses seat belts. Even with numerous laws and attempts to make the drivers wear seat belts, a large number of people still do not wear it. Mostly the youngsters are observed to break the seat belt rules. By eliminating a large number of vehicle crashes, highly effective crash avoidance technologies can reduce fuel consumption by also eliminating the traffic congestion that crashes cause every day on our roads. Reductions in fuel consumption, of course, yield corresponding reductions in greenhouse gas emissions. Preventing significant numbers of crashes will, in addition to relieving the enormous emotional toll on families, also greatly reduce the enormous related societal costs—lives lost, hospital stays, days of work missed, and property damage—that total in the hundreds of billions of dollars each year. Moreover, these dramatic changes will offer significant new opportunities for investments in the underlying technologies and employment in the various industries that develop, manufacture, and maintain them. To help ensure that these economic, environmental, mobility, and safety benefits are more likely to emerge from the current streams of innovation, all interested parties need to work cooperatively. Research shows in the USA that, primary enforcement seat belt laws make a big difference in getting more people to buckle up. A primary enforcement seat belt law means a police officer can pull a vehicle over and issue a ticket just because a driver or passenger covered by the law is

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not wearing a seat belt. A secondary enforcement law only allows a police officer to issue a ticket for someone not wearing a seat belt if the driver has been pulled over for some other offense. In 2015, 32 states did not have a primary enforcement law covering all seating positions.

2) Design Methodology:

The objective is to make seat belt mandatory for the driving of the car at a relatively higher speed. We wish to design a circuit which locks the gear lever from going in 4th and 5th gear positions. Seat belt of the car is used as a simple key of this circuit utilizing the metallic contact of the seat belt plug. Further we will use servomotors and utilize their basic rotator movement to lock the gear levers to move freely. When the car ignition is off, gears are locked that is, the basic position of the gears is in locked state. When ignition is on, and car is started the gear lever is still locked. Lock position enables the lever to move freely for first gear, second gear, third gear and the reverse gear Now when the person has to drive at a high speed, he needs to fasten his seat belt which is the key to our smart system. When seat belt is fastened, gears are unlocked and free to move in all gear positions.

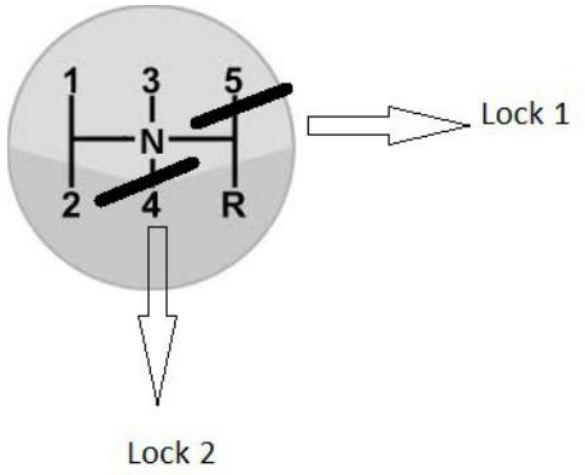


Fig 1. Gear arrangement

2.a) Components/Equipments:

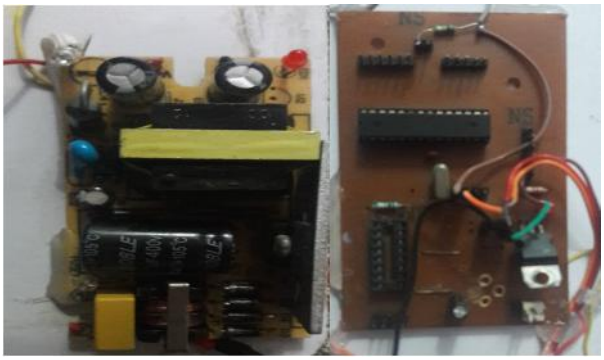
2.a.1) Servomotor:

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal,either analogue or digital, representing the position commanded for the output shaft Dulger[1].

Fig 2. Servomotor

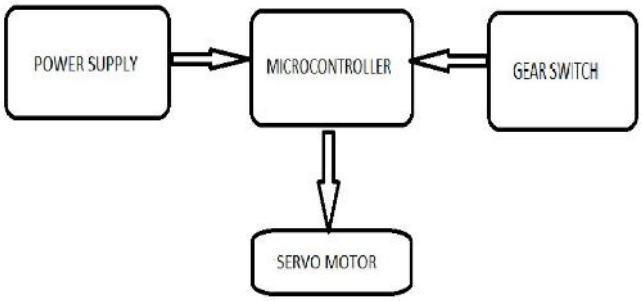
2.a.2) Atmega:

It is a computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. An **Atmega** is such a board, and contains a **microcontroller**, typical an 8-bit AVR such as the ATmega8 Dull[6].



Block Diagram:

Program for the Mcrocontroller To Control the



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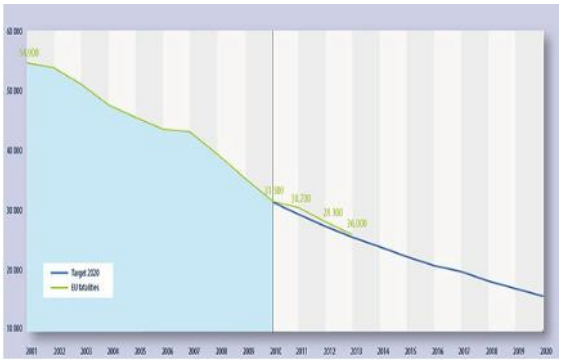
Servo Motor:

```
#include <Servo.h>
Servo myservo;
int Belt = 5;
int pos = 0;
int val = 0;
void setup() {
pinMode(Belt,INPUT);
myservo.attach(6);
}
void loop() {
val= digitalRead(Belt);
if(val==HIGH)
{
myservo.write(90);
}
if(val==LOW)
{
myservo.write(0);
}
```

Conclusion:

We have observed that with the advance technology in automobile safety along withautomation control systems has led to drastic drop in fatality rate and further drop is projectedby 2020 in European Union (ref graph below).



Still in India the most advance system in safety is promoted to high end vehicles some times out of reach for many. A change needs to be focused on Vehicle Law with mandatory safety system in any vehicle which can save lives. A more economically sustainable needs to be introduced as the present state of the art technology like air bags is beyond the reach of many.

Future Prospects:

1) We will simulate the circuit with the maximum similarity possible.
2) Additional features will be added which can be supported by the microcontroller such as vehicle tracking.

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