

The Safety Breaker (The Next Generation Seatbelt System)

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Abstract: *In this modern era, we have developed number of technologies. Means of transportation is one of those. Road ways are one of the most commonly used means of transport. Each day millions are people across the globe travel by road. Roadways are considered one of the common and comfortable means of transport. Best advantage of roadways is that it provides door to door service. People have facility to reach till their home. But in case on railways we must get to the railway station. In case of airways, we must go airport for boarding flight. But in case of road if we have our own vehicle we can start. Various safety equipment are present in vehicles but people do not use it. Now time has come to develop a system which will force them to use these safety equipment.*

Keywords: Introduction, Road accidents, Road accidents reasons, Statistics of accident, about the safety breaker, various components of system (with description), Working, Problems of system, Overcoming problem, Conclusion and References

1. Introduction

This research is to reduce number of death in road accident. To develop a system and implement in vehicles so that it can reduce no of death and save thousands of lives across globe. The system will be very useful in future coming vehicles. It is specially for reducing death rate in car, truck, bus and other light motor vehicle accidents.

1.1 Road Accidents

A road accident is defined as any accident involving at least one road vehicle (ex-car), occurring on road open to public circulation.

In this at least one peso is killed or injured. It may be fault of a driver or any other persons. But it leads to only loss. If a person is seriously injured, he may get paralyzed and he/she has to be on bed for lifetime.

Or the person may lose his/her life.

If a person is seriously injured, he does not suffer alone, his family also suffer. Whole income is spent on medical expense of that person.

1.2 Road Accidents Reasons

Some of the main reasons of road accidents are as follows:

a) Distracted Driving

The number one cause of car accidents is not a criminal that drove drunk, sped or ran a red light. Distracted drivers are the top cause of car accidents today. A distracted driver is a motorist that diverts his or her attention from the road, usually to talk on a cell phone, send a text message or eat food. Speeding

b) Over Speeding

We've seen them on the highway. Many drivers ignore the speed limit and drive 10, 20 and sometimes 30 mph over the limit. Speed kills, and traveling above the speed limit is an easy way to cause a car accident. The faster you drive, the

slower your reaction time will be if you need to prevent an auto accident.

c) Street Racing

Glorified by the Fast and the Furious movie franchise, street racing is an underground culture of fast cars and deadly car accidents. With turbo engines and nitrous oxide boosters, cars often reach very high speeds during a street race, making any resulting car accident much more dangerous and unlikely to yield any survivors.

d) Rash Driving

If we don't drive carefully, and you may end up in a needless car accident. That's what often happens to reckless drivers who speed, change lanes too quickly or tailgate before causing a car accident. Rash drivers are often impatient in traffic so be sure to take extra care around aggressive drivers.

e) Not Using Safety Gears

There are various safety systems/ gears which are present in vehicles. For example, nonfunctioning air bags or not fastening seat belt. There could be other reasons also.

f) India's Statistics

India is a country where government make laws but people do not follow it. People here wear helmet so that they don't have to pay fine, they do not wear helmet for safety.

Serious road accident in the country occurs every minute and 16 die on Indian roads every hour. 1214 road crashes occur every day in India.

Two wheelers account for 25% of total road crash deaths.

20 children under the age of 14 die every day due to road crashes in in the country. 377 people die every day, equivalent to a jumbo jet crashing every day.

Two people die every hour in Uttar Pradesh – State with maximum number of road crash deaths. Tamil Nadu is the state with the maximum number of road crash injuries.

Top 10 Cities with the highest number of Road Crash Deaths (Rank –Wise): Delhi (City), Chennai, Jaipur, Bengaluru, Mumbai, Kanpur, Lucknow, Agra, Hyderabad, Pune

g) World's Statistics

As per the World Health Organization, road traffic injuries caused an estimated 1.25 million deaths worldwide in the year 2010. That is, one person is killed every 25 seconds. Only 28 countries, representing 449 million people (seven percent of the world's population), have adequate laws that address all five risk factors (speed, drunk driving, helmets, seat-belts and child restraints)

Nearly 1.3 million people die in road crashes each year, on average 3,287 deaths a day. An additional 20-50 million are injured or disabled. More than half of all road traffic deaths occur among young adults ages 15-44.

1.3 Safety Breaker

We the people of India are least concerned about our safety. We don't use safety until the condition comes to pay penalty. For an example, we do not wear helmet or we don't fasten our seat belt when we leave from home. We do so when we see a traffic inspector on traffic signal. That also not for our safety but to just save our self from penalty. Which sometimes results to a disastrous result. Vehicles just have a sensor for indication in present time this is not enough. It's time to take technology to the next level, people are least concerned about safety and we know the result very well. So, for welfare of humanity a new idea must be introduce. It's time to construct a system with help of electrical and electronics devices which will force vehicle drivers to use these safety elements. We cannot force each human for use of safety element. But we can design an electrical system which can force humans for its use. This concept will be an evolution in field of automobile industries with help of electrical engineering. Not only in India, this will be beneficial across the globe.

1.4 Various Component of System

This system is basically for car drivers so that they use safety devices present in car. For understanding construction and working of the breaker we need to understand how a car ignite. The purpose of the ignition system is to generate a very high voltage from the car's 12-volt battery, and to send this to each sparkplug in turn, igniting the fuel-air mixture in the engine's combustion chambers. The coil is the component that produces this high

It can be clearly understood by following diagram of an engine shown below.

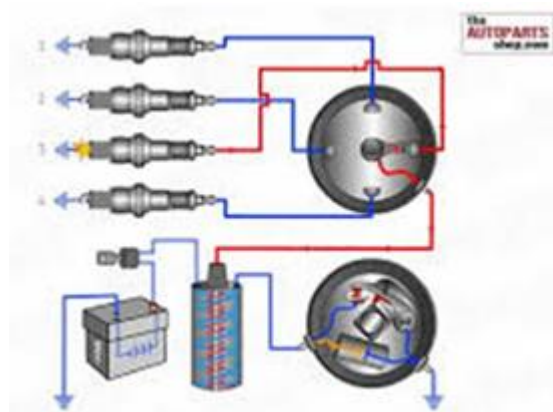


Figure 1.1: Key parts of an ignition system

a) Ignition System

The battery, which feeds electrical current to the ignition coil. The ignition coil, which transforms the 12 volts from the battery into the thousands of volts required to initiate the spark. The distributor, which sends the high voltage from the coil to the spark plugs, controlling the timing to ensure they spark at the right time.

The spark plugs, which fit into the head of the engine cylinders and ignite the fuel when the piston is at the top of its compression stroke.

It all begins in the ignition coil, which takes the relatively weak power generated by the battery and turns it into a spark strong enough to ignite a fuel vapour. What we refer to as the coil is actually a combination of two wire coils — the primary and the secondary. The primary coil or “winding” carries the low voltage from the battery and the secondary coil transforms it into high voltage before sending it to the distributor.

The distributor takes the high voltage electricity generated by the ignition coil and sends it through the rotor — a spinning part that contacts each of the spark plug wires. The spark plug wires deliver the voltage to their connected spark plugs in each cylinder of your engine, igniting the fuel vapour during the combustion stroke. This process repeats thousands of times per minute, powering our car.

b) Seatbelt Sensor

There's typically a list of sensors used, input to a computer.

- Weight sensor passenger seat
- Speed sensor
- Connection sensors in buckles

Basically, there's a list of conditional actions based on sensor states that cause the dash indicator to light and another conditional list to sound an audible alarm.

But many times, driver just ignore this sound and result is dangerous. The given picture show indication of seatbelt sensor.



Figure 1.2: Seatbelt Indicator

c) Automatic Relay

Automated relay is not a component of our sys. Automotive relays of all shapes and sizes can be found in just about every car, truck, and even boats. Relays in general are used to enable a low amperage circuit to switch on or off a higher amperage circuit, like turning on your headlights; it is only present in car ignition system.

The picture shows structure of this relay:

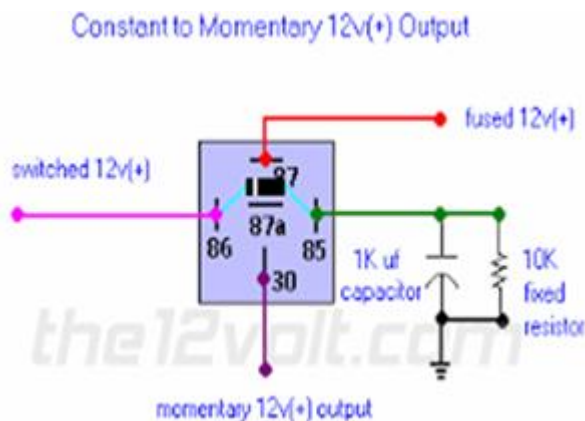


Figure 1.3: Automatic relay

As we see a pink wire arising of relay which is giving 12v supply for ignition of vehicles. The safety breaker will be attached to this 12v output supply.

d) Overcurrent Relay

This over current relay is major component of our system relay that operates or picks up when it'scurrent exceeds a predetermined value (setting value) is called Overcurrent Relay. Overcurrent protection protects electrical power systems against excessive currents which are caused by short circuits, ground faults, etc. Its main function in our system will be that it will break the circuits after 12v supply.

1.5 Working of System

We are using an overcurrent relay as a safety device in our system. For this we are placing the relay of 12V between key (switch) and automatic relay.

As we see above there is a seat belt sensor which glows and gives an alarm for wearing seatbelt. We know this need at least some volts to blink indicator and ring alarm. So, after

ringing and blinking we are connecting this supply with overcurrent relay.

That means this voltage will be supplied to overcurrent relay of 12 V, that means when sensor's power will reach to relay voltage in voltage in overcurrent relay will become higher than rated ex- 12.5V the relay will cut the circuit before power reaches to key(switch). And car will not ignite.

As soon as the driver and passenger wear the seat belt the supply to sensor and relay will stop, as soon as relay get its rated voltage (12V) it will connect the circuit and power will re reach to key (switch) which vehicle is further use for ignition of cars. With help of this system we can develop a technique that vehicles will not ignite until seatbelt is worn. This will save driver's life as well as passenger in case of accident.

This will be very helpful to mankind, saving their life.

Following is circuit diagram showing the system.

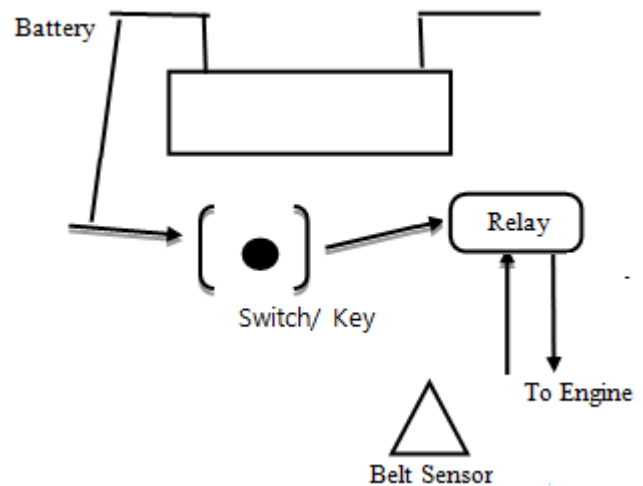


Figure 1.4: Circuit Diagram of System

2. Problem with System

As we see it is cutting whole supply and shutting down vehicle as soon as sensor is sensing the signal. If due to any error sensor fails or seatbelt sensor becomes active at a high speed ex- 100km/hr. speed it will lead to a massive accident, because due to this the vehicle wheel will get blocked immediately

3. Solution to Problem

If the breaker fails at high speed it will cause loss of life. To overcome this problem, we can do two things -

a) Using second relay in circuit

As above mentioned if vehicle stops suddenly at high speed it may lead to major accident. To overcome this problem, we use another relay in system.

We use a Tachometer generator.

Most modern tachogenerator are permanent magnet types. These devices use a rotating armature, one end of which is attached to a machine shaft, to measure rotational speed. The armature rotates within a fixed magnetic field, so that its rotation induces electromotive force (voltage) proportional to the shaft's speed. The armature contacts are connected to a voltmeter circuit, which converts the voltage into a speed value.

Small permanent magnet motors can be used as tachometer generators in some applications.

A direct current (DC) permanent magnet tachogenerator design is shown below. In this device, the commutator between the armature and voltmeter circuit serves to Convert internally generated AC voltage into DC for compatibility with the voltmeter.

The following picture shows the setup for tachometer generator-

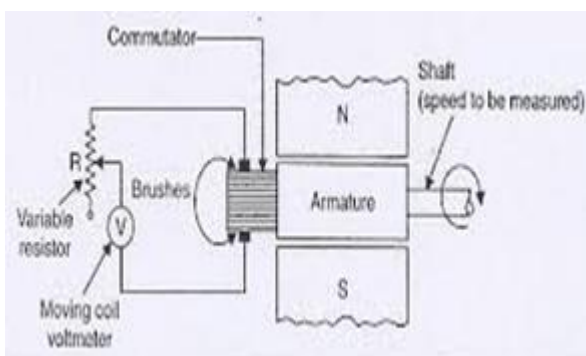


Figure 1.5: Tachogenerator

So, we see that tachometer generator give an output voltage when the shaft moves. This can be considered as the feedback voltage in our system.

In our system, we will fix it in moving part of vehicle (axel, wheels etc.) when the vehicle start to move this and it will give out some voltage. This voltage we take and give in second relay. When this extra voltage is added in relay which is more than rated voltage of relay the relay will automatically break the path of seatbelt sensor so at high speed the car will not turn off, which will be safe.

This could be better understood by following diagram of system which shows the arrangement if all equipment of our system:

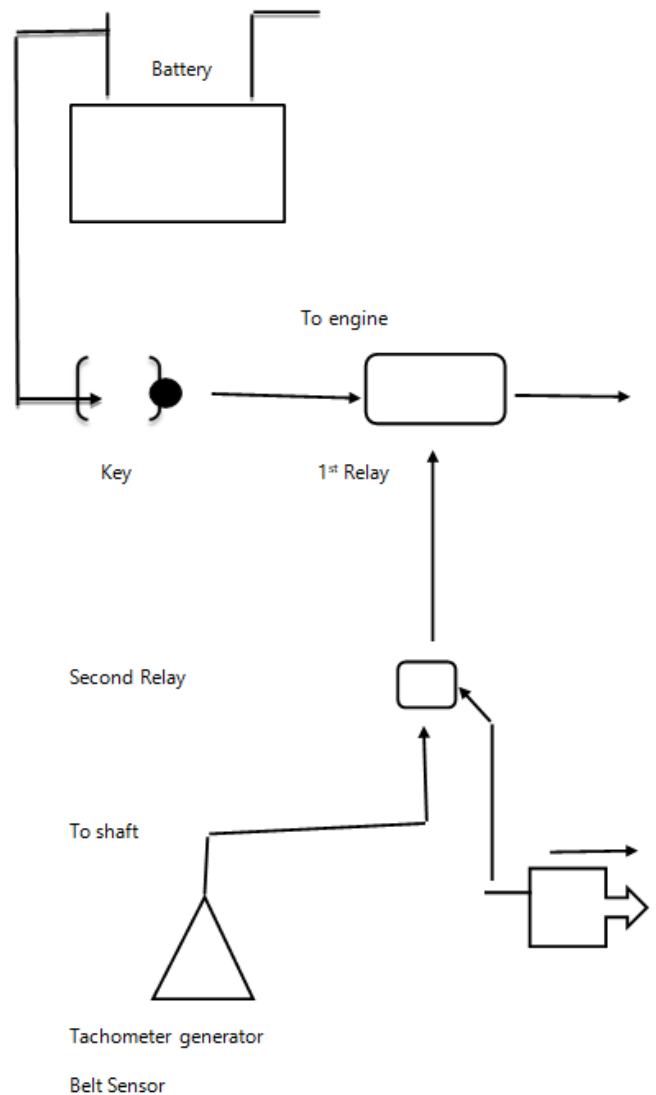


Figure 1.6: Improved circuit diagram

Using a Breakable Path

We know seatbelts are attached in a buckle. So, in second method instead of using a simple buckle we use a box though which we pass 12v starting supply. It will have a buckle holder below which a spring will be attached. When belt buckle will be inserted the spring will get suppressed and circuit will get completed. 12v supply will reach to switch (key). For non-driving seat, same system is applied but we should give a buckle to complete circuit in case no passenger is sitting. But this buckle will have a number as we have in vehicle so that one vehicle should have only one ignition buckle. Ex- UP-14DA-2345.

So, we see when driver and passenger fasten seatbelt then only vehicle ignite. For understanding breakable path's working we need to understand seatbelt structure.

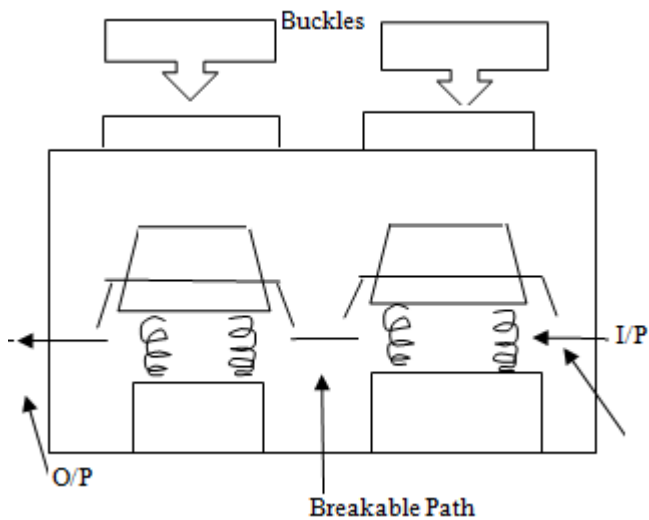


Figure 1.7: Structure of breakable path

Here also we see that without fastening the belt the car will not ignite. An extra buckle is given in case no one is sitting on front passenger seat with no one on it. Same as number of car. It will be named as ignition buckle

Following diagram show arrangement and structure of ignition buckle:

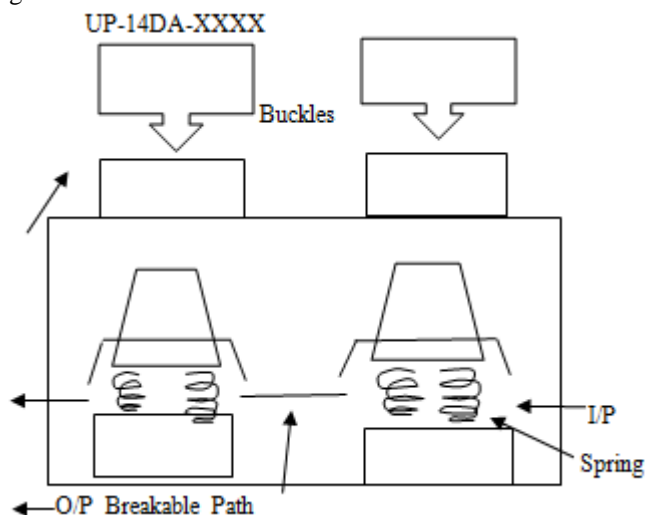


Figure 1.8: Structure of breakable path with Ignition Buckle

4. Conclusion

So as we see by both the methods our vehicle does not ignite. Until we use our safety gear seat belt.

We see by using simple device like relay or by using a simple breakable path we make a brand new technique or system which forces rider to wear the safety system i.e. Seat belt.

References

[1] Developing safety system for monitoring seat belt and Controlling speed accordingly to avoid fatal injuries. International Journal of Scientific and Research Publications, Volume 5, Issue 10, October 2015, ISSN

2250-3153. <http://www.ijsrp.org/research-paper-1015/ijsrp-p4692.pdf>

[2] How people disable dashboard indicator of car. <https://www.youtube.com/watch?v=xq61UM-xAyU>
 [3] Road accident statistics in India. <https://sites.ndtv.com/roadsafety/important-feature-to-you-in-your-car-5/>
 [4] List of countries by traffic-related death rate – Wikipedia. https://en.wikipedia.org/wiki/List_of_countries_by_traffic-related_death_rate
 [5] Ignition system – Wikipedia. https://en.wikipedia.org/wiki/Ignition_system

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