SOLAR VEHICLE WITH SMART BRAKING SYSTEM

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Introduction:
In recent years vehicle technology has increased rapidly, particularly in relation to braking systems and sensing. ASS (active safety systems) are being researched and developed to prevent accidents and target mitigation. Braking system is such a vital component that is necessarily required when a vehicle is considered. It reduces the kinetic energy of the vehicle in conditions when a vehicle has to slow down and also it has to be stopped. Thus making sure the vehicle and the passengers inside it are safe. Thus a braking system is always used to ensure the safety of the drivers and passenger’s valued lives.

In this era of multitasking people tend to divert their attention while driving on their mobile phones and many other things. This neglect on the part of the driver is one of the most common causes of road accidents that lead to thousands of casualties every year. So the purpose of our project is to develop a system that can apply the brakes automatically as soon as it senses any obstacle within a predefined distance. In this system we propose the use of ultrasonic sensors, pic microcontroller, relay switch etc. to control the speed of the vehicle and apply the brakes automatically.

Intelligent braking system has a lot of potential applications especially in developed countries where research on smart vehicle and intelligent highway are receiving simple attention. Hence this particular project has lots of applications in automobiles. The sensor used here is ultrasonic sensor. The sensor is integrated in a logical manner so as to achieve the desired braking effect. The ultrasonic sensor is provided on the front position of a vehicle which emits ultrasonic rays in forward direction. The receiver mounted at the front receives the Reflected signal. The time required for the wave to strike the obstacle and to return back to the receiver gives the distance of the obstacle in front of the vehicle. These two information signals are fed to the microcontroller and then the microcontroller calculates the safe braking distance and applies the brakes automatically depending upon the safe braking distance.

The solar energy is utilized to supply power to the system. As solar energy has been harnessed by humans since ancient times using a range of ever-evolving technologies. The solar panels used in this project will continuously charge battery when exposed to sunlight, as battery supplies power to all electronic devices to function accordingly.

Objectives:
The conventional braking system used nowadays has two chief problems one is the wear and tear and other is unnecessary excessive temperature is attained. Excessive heating of brakes can result in fade. It can even cause temporary changes in the friction as they get hotter. Normally efficiency is regained when they cool again Brake pads. Hence
this project aims to provide the safety measures for driver and passenger eliminating the above mentioned problems.

The main objective of this project is to design the automatic braking system in order to avoid the accident. The components such as ultrasonic sensor and microcontroller are used to design a vehicle with full safety of its occupants.

There are many causes of accidents. Some of them are,

- Drunken driving
- Dreaming while driving
- Mechanical failures in the vehicle
- Negligence by the drivers

In all these cases the basic reason cited is failure to apply the brakes at the right time. In all the above cases if the brakes are applied at the right time, the accidents can be prevented. In conventional vehicles there are different mechanism operated for braking system like hydraulic, pneumatic, air, mechanical, etc. But all these braking mechanisms receive the signal or input power directly from the driver. Thus, braking of vehicles is totally manual operated. The driver also may not be able to pay the full attention during night travelling so there are many chances of accidents. There is also no provision to minimize the damage of vehicles during accident. Hence to overcome all of these challenges, we have designed smart braking system which senses the objects and avoids chances of accidents.

The Warning systems are integrated with safety systems which warn the driver about the potential threat. The warning system detects the potential threat level and decides whether a warning should be issued to the user through auditory and/or visual signals. Many accidents can be avoided if proper braking is applied in right time.

**Methodology**:

The system consists of ultrasonic sensors, kit of electronic control unit (microcontrollers, relays) to give input and output for sensor and circuit. The sensor receives 12volt supply and can measure hurdle up to 3m. The following figure shows the circuit connections of smart braking system.

![Block diagram of Smart Braking System](image)

The ultrasonic sensor is connected to the microcontroller which is powered by the microcontroller itself. The microcontroller is further connected to the solenoid which operates with help of the 12V battery controlled by the 12V relay.
Integration of Sensor Relay Switch and Microcontroller

The ultrasonic sensor is used to transmit the ultrasonic rays. If any obstacle is detected in a path, the rays are reflected back. The reflected rays are received by the receiver circuit called “ULTRASONIC RECEIVER”. The ULTRASONIC TRANSMITTER circuit is used to transmit the rays. The ultrasonic receiver circuit receives the reflected ultrasonic rays from the obstacle and giving the control signal to the control circuit. The control circuit is used to activate the solenoid valve. This system works when driver does not apply brake manually. When any obstacle is detected by ultrasonic sensor the signals are sent to microcontroller to activate braking system. Thus the brakes are applied. This system can help to save the people inside the vehicle and also will save the external body of vehicle from getting damaged.

Preparation Of Components:

Designing of base frame was first most important task of the project. The various factors such as load capacity, speeds etc. were considered. The material used was mild steel. It was fabricated with help of various operations such as drilling, arc welding, surface finishing etc. all the joints were formed using arc welding process.

The dimensions of frame are as follows.
- Length = 90cm
- Width = 60cm
- Thickness = 3.5cm

Fabrication of Base Frame

The suitable material (mild steel) was chosen to make the base frame. The dimensions of the frame are as listed above. The joints were formed with help of arc welding process. Arc welding is the fusion of two pieces of metal by an electric arc between the pieces being joined. The electrode is either a rod that simply carries current between the tip and
the work or a rod that melts and supplies filler metal to the joint.

CAD drawing of base frame

![CAD drawing of base frame](image.png)

**Results:**
Based on the practical tests the following results were obtained.

- The brakes were applied to the vehicle automatically as the object appeared in front of the vehicle with in distance of 70cm. It also continues to move on its path automatically once the object disappears from its travel path.
- The input energy was derived from the solar energy with help of solar panels and was supplied to the components used in the system.
- After detecting obstacles and applying brakes, the audio system was activated to alert the driver.

This designed braking system works more efficiently and smartly without causing wear and tear of the components, thus increasing the life of components. It also helps the driver in high traffic region, where he needs to apply brakes frequently and thus saving fuel and energy. Solar energy is the key to a clean energy future. No greenhouse gas emissions are released into the atmosphere when you use solar panels to create electricity. And because the sun provides more energy than we’ll ever need, electricity from solar power is a very important energy source in the move to clean energy production. Hence a solar panel of 25 watts power was used in our project to meet the energy requirements. The battery of capacity 12 volts and 7ah was used to store the energy produced from solar panels.

**Conclusion:**
The following conclusions may be drawn based on the solar vehicle with smart braking system.
• Smart braking is one of the smart options which can be implemented in various applications for stopping a moving body without jerky motion.
• As ultrasonic sensor can detect any kind of obstacle, this system will prevent collision of the vehicle with pedestrians or at least reduce the injuries occurring.
• The sensor based braking system, if executed in automobiles it deflects heaps of mishaps and can spare human lives and property.
• Though air bags are used in automobiles for the safety purposes, these are given to high end cars and are expensive. By implementing this project we can reduce cost of high end cars by giving similar kind of safety.
• Air bags are helpful to provide internal safety to people sitting in vehicle, whereas in our project we will be giving internal plus external safety to car from damage. Thus, we will reduce cost of cars and also provide better safety by implementing this sensor based smart braking system in automobiles.

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Scope For Future Work:

i. **Automobiles:**
   This sensor based braking system can be used in driverless cars, in which it works more efficiently. Even in high traffic region it works better and driver need not pay much attention and waste his energy in applying brakes frequently.

ii. **Industries:**
   This system can be used in industries for material handling. The trollies used for material handling can be installed with this system and can be operated independently without help of operator, thus saving manpower.

iii. **At monuments for physically disabled:**
   This system can be used as a facility for physically disabled and also for elderly people who visit to the monuments. This system is designed such that it can withstand load up to 60kgs. As it is continuously charged by the solar energy it can be used for whole day.