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# Solar-Powered Automatic Braking System and Bumper Actuation with Bluetooth Control

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**ABSTRACT**

***Human life spans are shorter today than they were in the past because automobile usage is increasing by the day, and the death rate from accidents has risen dramatically. Many accidents occur as a result of brake failure, unconsciousness of the driver, and over-speeding of the vehicle, thus controlling the brake automatically helps decrease the impact of an accident. The bumpers which are currently used in vehicles are of rigid types. These bumpers have a specific capacity and when the range of the accidental force is very high then the bumper fails and the force is transferred toward the driver and passengers. To overcome this, our project is designed with an Ultrasonic Sensor, Bluetooth Controller, and Arduino for the effective function of the braking system.***

***Keywords***— *Ultrasonic sensor, Bumper, Automatic braking system*

## 1. INTRODUCTION

Our project "Solar Powered Automatic Braking System and Bumper Actuation with Bluetooth Control" is fully equipped with an Ultrasonic sensor, bumper, and automatic braking system. Driving is a common activity for most people. The number of vehicles is increasing day by day. Speed plays a vital role while driving. But, over speeding is also a major problem for causes road accidents. Manual braking is not enough the avoidance of accidents when the driver is not active. Further improvement has to be done in the braking system in order to brake a vehicle when the driver is not able to break i.e., it may need an automatic braking system. Without the support of the driver, this automatic braking system allows the vehicle to brake. The main aim of the ultrasonic braking system is that vehicles should automatically brake when the sensors sense the obstacle. This is a technology for automobiles to sense forward collision with another vehicle or an obstacle and to brake the vehicle accordingly, which is done by the braking circuit. This system includes two ultrasonic sensors which are an ultrasonic wave emitter and an ultrasonic wave receiver. The ultrasonic wave emitter is provided in front of an automatic braking system vehicle, producing and emitting ultrasonic waves at a predetermined distance in front of the vehicle. An ultrasonic wave receiver is also provided in front of the vehicle, receiving the reflected ultrasonic wave signal from the obstacle. The reflected wave (detection pulse) is measured to get the distance between the vehicle and the obstacle. The DC gear motor is connected to the wheels of the vehicle and power input is given to it from the Arduino board. Then the PIC microcontroller is used to control the servo motor based on detection pulse information and the servo motor is converted to automatically controls the braking of the vehicle. Hence, this system is designed to solve the issue where drivers may not be able to brake manually exactly at the required time but the vehicle can stop automatically by sensing the obstacles to avoid an accident. There are several kinds of braking mechanism systems that

 

would only be applicable mechanically, to move the ideology more deep and brief the automatic braking system will be more sufficient and satisfactory in addition to the mechanical braking system. In the present generation, a number of vehicles are coming into existence with newer technologies for the implementation of human comfort and other conditioning. To extend the ideology in a more brief manner and to take the step in a different way, an automatic braking system would fulfill the methods of extension of technical existences.

## 2 Literature Review

### 2.1[1] Kuchimanchi Chirantana [2] GVRD Satya Sai Kanth

The author proposed that automatic collision warning with braking systems brings major transportation benefits in terms of safety, efficiency, affordability and usability, and environment in order to achieve its development goals. This cost-effective method of avoiding collision along with automatic braking can be made available also to low-budget vehicles by which there can be a tremendous decrease in the death rate due to accidents. In this system collision detection is done by using an Ultrasonic sensor and collision indication is given by flashing LED and LCD display.

### 2.2 [1] N. Seeraman [2] G. Sathyapriya [3] G. Ganesan [4] G. Ajithkumar [5] S. Praveen Kumar

"IR OBSTACLE SENSORS FOR AUTOMOBILE BRAKING SYSTEM" report published in 2018, The Author proposed that The manual method of applying brakes is always dangerous as it leads to accidents. To avoid this, we can propose an automatic braking system. In this technology ARDUINO, RELAYS, and SENSORS are used for an effective braking system. The factors considered during the designing of the system are:

1. Braking distance
2. Distance of obstacle in front.

Hence, we can use this system in the four-wheeler vehicle and can reduce the number of accidents taking place on the road.

## 3. OBJECTIVES

The conventional braking system used nowadays has two chief problems: One is the wear and tear and the other is unnecessary excessive temperature is attained. The excessive heating of brakes can result in the fade. It can even cause temporary changes in the friction as the temperature rises and they get hotter. Normally efficiency is regained when they cool the again Brake pads. Hence this project aims to provide safety measures for drivers and passengers eliminating the above-mentioned problems. The main objective of this project is to design an automatic braking system in order to avoid an accident. The components such as ultrasonic sensor, Bumper, and microcontroller are used to design a vehicle with full safety for its occupants. There are various reasons for 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 cases if the brakes are applied at the correct time, the accidents can be prevented. In conventional vehicles, there are different mechanisms operated for braking systems like hydraulic, pneumatic, air, mechanical, etc. But all these braking mechanisms receive the signal or input power directly from the driver. The driver also may not be able to pay full attention during night traveling so there are many chances of accidents. There is also no provision to minimize the damage to vehicles during accidents. Hence to overcome all of these challenges, we have designed a smart braking system that senses the objects and avoids chances of accidents. The Warning systems are consolidated with safety systems that warn the driver about the threat. The system detects the threat level and decides whether a warning should be given to the user through auditory and/or visual signals. Many accidents can be avoided if proper braking is applied at the right time.

## 4. DESIGN OF THE MODEL

**Figure 1: Design of the Model Software PTC CREO 8.0**

## 5. WORKING PRINCIPLE

An Ultrasonic Sensor is fixed over in front of the vehicle. A solar plate is used to supply power to the whole circuit. As the solar plate is connected to the battery, it charges the battery. As soon as the Ultrasonic sensor detects the obstacle or moving object in front of it, if the driver does not take necessary action or apply brakes then the circuit is broken and the DC gear motor stops working, and hence it stops the vehicle.

## 6. BLOCK DIAGRAM

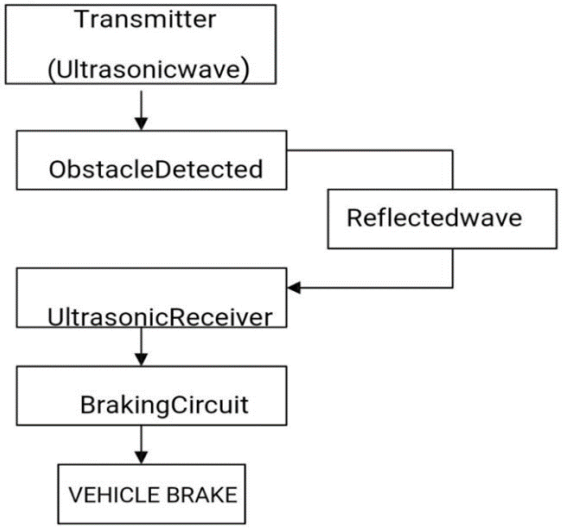


**Figure 2: Block Diagram**

## 7. PRINCIPAL COMPONENTS OF AUTOMATIC BRAKING SYSTEM

### 7.1 Solar Panel

A solar panel (also solar module, photovoltaic module or photovoltaic panel) is a connected assembly of solar cells, also known as photovoltaic cells. A PV panel is a collection of PV modules and a system of PV panels is called an array. They are used to convert sunlight into electricity that can be used to power electrical loads. Photovoltaic modules use light energy from the sun to generate electricity through the photovoltaic effect.

 

**Figure 3: Solar Panel**

### 7.2 Rack and Pinion

A rack and pinion is a type of linear actuator that comprises a circular gear (the *pinion*) engaging a linear gear (the *rack*), which converts rotational motion into linear motion. Rack and pinion steerage make use of equipment set to transform the round movement of the steerage wheel into the linear movement required to show the wheels. It additionally presents an equipment reduction, so turning the wheels is easier.

**Figure 4: Rack and pinion**

### 7.3 Battery

An electric battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its negative terminal is the anode and its positive terminal is the cathode.


**Figure 5: Battery**

### 7.4 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328P.

(a) It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog feed-ins, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header and a recalibrate switch.

(b) Simply connect it to a laptop with a USB cable or power it with an AC-to-DC adapter or battery to get started.


**Figure 6: Arduino Uno**

### 7.5 Bluetooth Module (HC-05)

For the communication between a mobile phone and a microcontroller Bluetooth module (HC-05) is used. HC-05 is a low-power 1.8V operation and is easy to use with Bluetooth SPP (serial port protocol). Serial port Bluetooth modules have a Bluetooth 2.0+EDR (enhanced data rate), 3Mbps modulation with a complete 2.4GHZ radio transceiver, and baseband. Using Bluetooth profile and android platform architecture different types of Bluetooth applications can be developed.


**Figure 7: Bluetooth controller**

### 7.6 ULTRASONIC SENSOR


**Figure 8: Ultrasonic Sensor**

Ultrasonic ranging and detecting devices use high-frequency sound waves called ultrasonic waves to detect the presence of an object and its range. The normal frequency range of the human ear is roughly 20Hz to 20,000Hz. Ultrasonic sound waves are sound waves that are above the range of the human ear, and thus have a frequency above 20,000Hz. An ultrasonic sensor necessarily consists of a transducer for the conversion of one form of energy to another, a housing enclosing the ultrasonic transducer, and an electrical connection.

## 8. CIRCUIT DIAGRAM

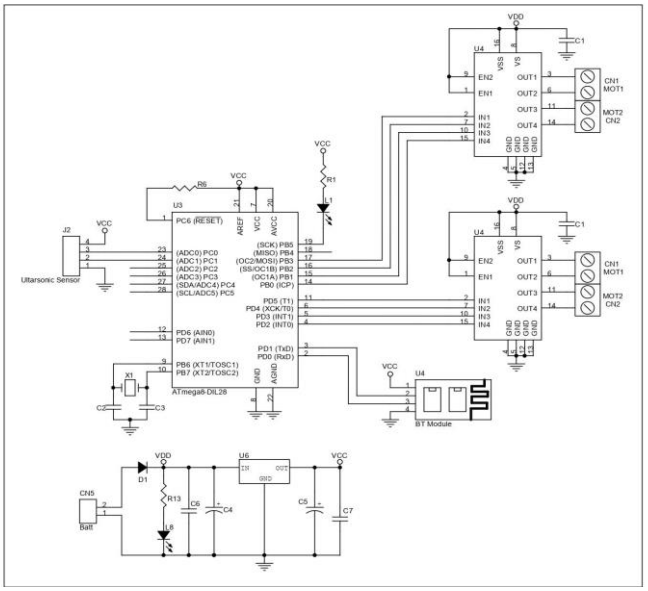

**Figure 9: Circuit Diagram**

 

## 9. FUTURE SCOPE

The future extension is to plan and foster a control framework in light of a car slowing mechanism called ―Automatic Braking System. The Automatic Braking System with ultrasonic sensor would caution the driver when the distance among vehicles and deterrent is inside the detecting range zone then the brakes are applied. This is the new capacity in this model plan that could be utilized for every one of the vehicles. By making it more secure, this framework will give better assurance to the vehicle's wellbeing and stay away from misfortunes. Consequently, the wellbeing arrangement of vehicles will be created and may have more market requests. It very well may be additionally utilized for huge sorts of weighty vehicles like transports, trucks, cranes, farm haulers, and so on. We can without a doubt get the data about the impediment location sense zone as indicated by vehicle conditions. It is very helpful to the public area and clients. It additionally keeps away from mishaps in huge or metropolitan urban areas. So we feel it is a superior thought for naturally slowing down vehicles with moderate expense.

## 10. CONCLUSION

We successfully completed the fabrication of an automatic braking system and bumper actuation prototype, and this project presents the implementation of an Automatic Braking System for forwarding Collision Avoidance, intended for use in vehicles where the drivers may not be able to brake manually, but the vehicle's speed can be reduced automatically due to the detection of obstacles. It reduces the number of accidents and saves many people's lives. By doing this project practically, we gained knowledge about the operation of an automatic braking system, and with future study and research, we hope to develop the system into an even more advanced speed control system for automobile safety, while acknowledging that this will undoubtedly necessitate a significant amount of work and learning, such as programming and testing. We gained knowledge about the operation of an automatic braking system by doing this project practically, and we hope to develop the system into an even more advanced speed control system for automobile safety with this future study and research, while realizing that this will undoubtedly require a lot of work and learning, such as the programming and operation of microcontrollers and the automobile structure. As a result, we believe that incorporating all components in an Automatic Braking System will maximize safety while also giving such a system a larger market space and a competitive edge in the market.

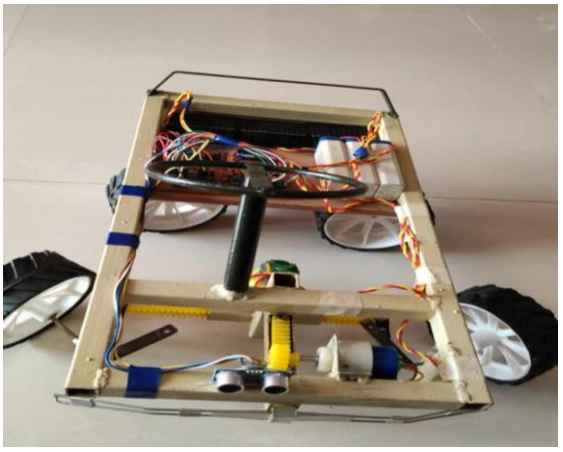

**Figure 10: Model**

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