Design and Fabrication of Emergency Braking System in Four-Wheeler

Dr. S. K. Choudhary[1], Himanshu ramteke[2], Rupam sonbarse[3], Ayush kuryawanshi[4], Pawan khangar[5], Mrunali sawarkar[6], Aman gawande[7], Amit Kumar[8]

Abstract

These days accidents are mostly happens by the delay with the driver to hit the break or by some human error. This project aims to produce a smart system based on ultrasonic sensor that can improve vehicle safety technology. when it is fully implemented in vehicle it could prevent in numerous road accidents. the application of sensor based system is a big step of improving the safety and performance technology of vehicles for upcoming 10 years automatic Braking System will play important and Key hole in the challenge of increasing vehicle safety

Introduction :-

Nowadays accidents are increasing and are uncertain accidents will occur every time and everywhere and can cause worst damaged, serious injuries and even death. according to statistics each year thousands of pedestrians are struck by vehicle. in India motor vehicle population is increasing at a faster rate than the economic growth this has brought with it the challenge of addressing adverse factors such as the increase in road accident. Since last few years vehicle Technology particularly in relation to breaking is growing rapidly like Anti Lock Braking System (ABS),traction control (TC). in this project we have developed an automatic braking system based on ultrasonic sensor it is an important part of safety Technology for automobiles specially designed to prevent possible collision or reduce speed of vehicle prior to a collision to obstacle of some sort. this system combine sensors such as radar, video infrared or ultrasonic sensors to scan for possible object in front of the vehicle and than use brake control to prevent collision if the object is in fact detected.

Components :

- ➢ Rubber Wheels: FRONT wheels have been pivoted for steering mechanism, rear wheels are being motorized for drive wheel.
- ➢ Spring : The brakes are operated by motorized mechanism, which is spring- loaded. The brake pads are pressed against the brake disc or brake drum purely mechanically by means of spring force.
- ➢ MS frame :(mild steel) (25mm*25mm*3mm)
- ➢ Brake shoe: Brake shoes carry the brake lining inside cylinder systems. They're a curved piece of metal, with a friction material fixed to one side.
- ➢ Ultrasonic sensor (0.02-4m): Ultrasonic ranging and detecting devices use high frequency sound waves called ultrasonic waves to detect presence of an object and it's range.
- ➢ DC Motors (12V) 30rpm: A DC motor is a fairly simple electric motor that uses electricity, gear box and field to supply torque, which turns the motor.
- ➢ Integrated Circuit (IC)
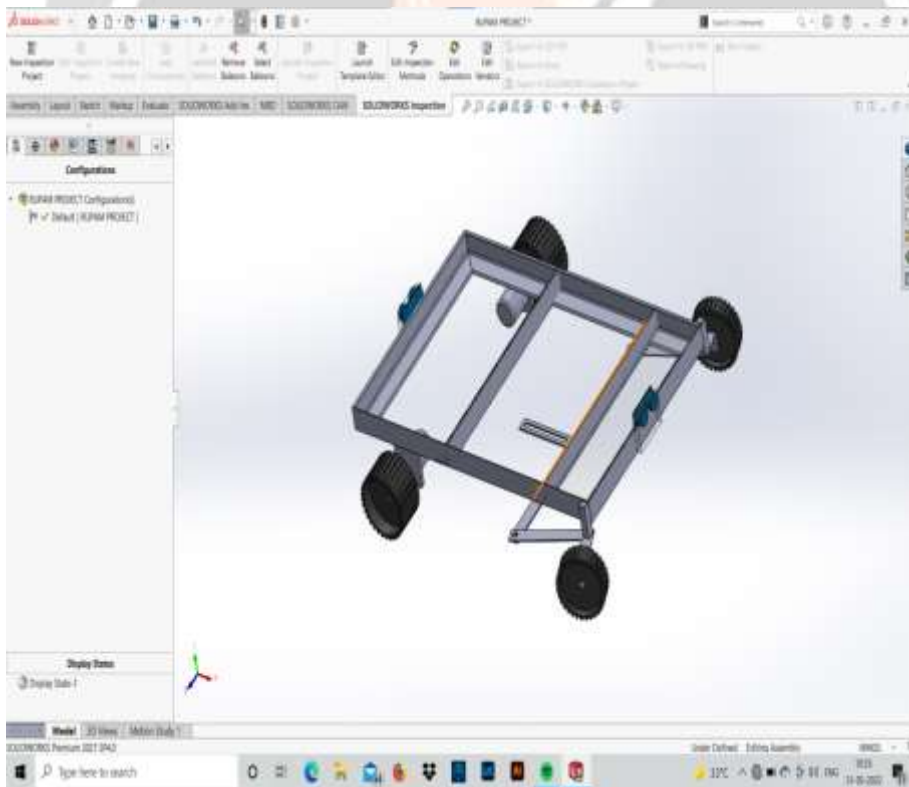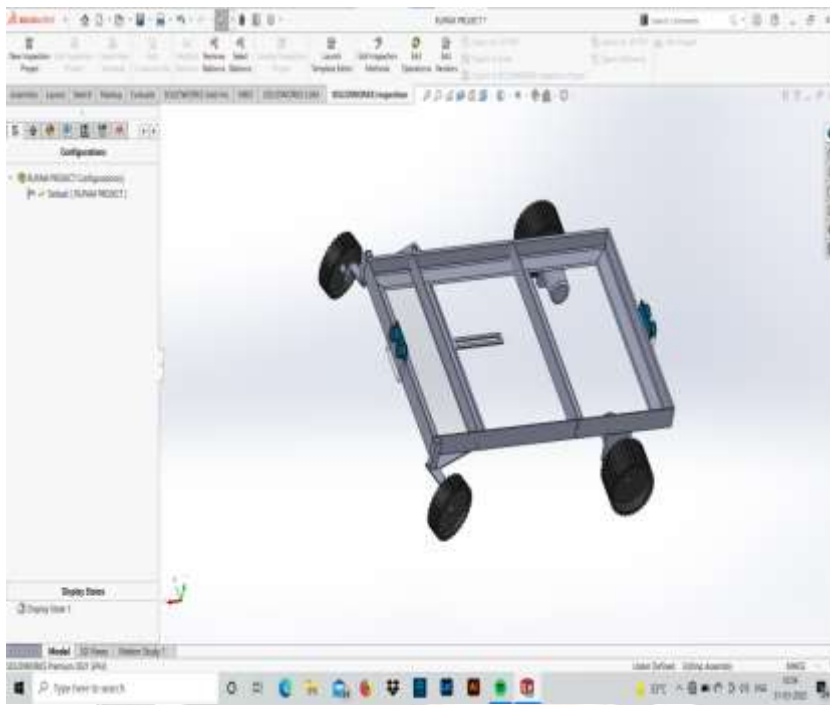
Working :-

Initially, the Ultrasonic sensor will transmit the ultrasonic waves in frequency of 20KHz. If there's any obstacle in the path, the ultrasonic waves gets reflected. This reflected ultrasonic waves are received by the Ultrasonic sensor. The Ultrasonic sensor receives the reflected ultrasonic waves and also the signals are passed to the negative feedback circuit. The feedback loop features an micro-controller which has a timer circuit, Therefore the timer circuit is ready up with interval. The feedback loop is employed to activate linear actuator setup. that the threaded screw within the linear actuator moves within the clockwise direction and pulls the treadle and therefore the brakes are applied. Simultaneously the bumper moves forward with help of rack and pinion connected with a motor.

In this automatic braking system , there's a four wheel cart during which rear wheels are being motorized for drive wheel. Front wheels are pivoted for steering mechanisms. New friction brakes are designed for emergency braking. The brakes are operated by motorized mechanism , which is spring-loaded. The drive of the car is remote operated. Two sensors are used for front and rear for avoiding damage to the car at the time of parking. The sensors used are a capacitive type which might sense both metal and non-metal obstacles. Also , two relays are used after the sensors which activate the braking motor when obstacles are sensed either in forward or reverse direction.

The Fundamental Of Sensor

Sensor is an device that maps an environmental attribute to a quantitative measurement. collect information about the globe. Each sensor is predicated on a transduction principle which is conversion of energy from one form to a unique form.

The Fundamental of Ultrasonic Sensor

Ultrasonic ranging and detecting devices use high frequency sound waves to detect the presence of an object and its range. The systems either measure the echo reflection of the sound from objects or detect the interruption of the sound beam because the objects pass between the transmitter and receiver. An ultrasonic sensor usually uses a transducer that produces an electric output in response to received ultrasonic wave. The conventional frequency range for human hearing is roughly 20 to twenty,000 Hertz.

➢ **Braking Distance**
We have kinetic energy

$$K.E. = 1/2 mV^2 \quad \dots(1)$$

We have the velocity i.e. 200km/hr =55m/sec

We have work done = force*distance

Work done = F*s   …. According newton's 2nd law
            F = m*a

            = m*a*s

The ultrasonic sensor used in project has range is 4m

s = 4m

Work done = m*a*4   …(2)

According the work energy theorem, the work done on an object is the change in its kinetic energy W= **Δ(K.E)**

½*mV^2 = m*a*4

a = 55^2/8   (a=retardation)

a = -378 m/s^2

by the kinematic equation,

V^2 = u^2- 2a s

0 = 55^2 – 2* (-378) *s

s   = 4m

So braking distance is 4m.

> **Braking Force**
The braking force refers to the total amount of force exerted on a moving body that cause it to a halt.

F= (0.5*m*V^2)/d

F is required force to stop distance d

m is mass of car

v is velocity of car before braking

d is the stopping distance

mass of vehicle =2kg

F   = (0.5*2*55^2)/4

F   = 756.25 N

So, the Braking force is 756.25N

Conclusion :

we have successfully completed the fabrication of automatic braking system in four wheeler prototype and our project presents the implementation of an Automatic braking system for avoiding forward as well as backward collision , intended to use in vehicles where the drivers may not brake manually . But the speed of vehicle can be reduced automatically due to sensing obstacles. It reduces the level of accidents and save the lives of so many peoples. By doing these practically we gained the knowledge about working of automatic braking system and these future study and research, we hope to develop the system into an even more advanced speed control system for automobile safety, while working on project we realize that this certainly requirerequires tons of work and learning, like programming and operation of microcontrollers and the automobile structure. Hence we believe that the incorporation of all components in Automatic braking system maximize safety and also give this systems a bigger market space.

Reference:-

Pneumatic system--- Majumdhar, new Age India International (P) Ltd

Pneumatic control system --- Stroll & Bernaud, Tata Mc Graw Hill Publication

Automatic Electronic in Passenger car – A Numazawa.