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Safety Door Locking System of Cars with Effective Use of Sensors

Gandi Kumuda[1], D.Santoshi Navallika[2], D Rama Devi[3], Nithya Jindam[4], S Madhava Reddy[5]
[1, 2, 3, 4]*UG Mechatronics, Mahatma Gandhi Institute of Technology, Hyderabad-75*
[5]*Professor Department of Mechanical (Mechatronics) Engineering, MGIT, Hyderabad*

Abstract: ***Door locking system is arranged in cars to warn the driver that there are obstacles in the surrounding. By using this type of arrangement many accidents can be prevented on highways and ORR where the driver or passenger opens the door without checking his surroundings causing accidents. The entire arrangement is controlled using the RX23EA micro controller which has high precision and accuracy. The camera and radar sensors used here give the driver a 360-degree view of their environment. When the sensors sense the obstacle, it sends a signal to the micro controller as a result warning the person by switching ON the alarm and locking the doors. The main advantage is the usage of a power supply which makes sure that the locking system works even when the engine is OFF.***
Keywords: Camera, Radar Sensors, Door Locking System, Micro controller, Power Supply

I. INTRODUCTION

Cars nowadays have become automatic with advanced features like automatic seat adjustment, Forward collision warning system & automatic braking, Adaptive cruise control, etc. The main drawback of these cars is that these features only work when the engine is turned ON. But by using a power module the door locking feature will still be functioning even if the engine is switched OFF. Here, camera and radar sensors detect any obstacle sending a signal to the RX23EA micro controller which controls the motion of the actuator and activates the alarm system. This entire arrangement works even when the engine is turned off. By including a power module, the efficiency is improved.

By including a power module, the efficiency of car door locking Improves. When we need robust solutions, power modules are often best. Power modules are electrical components that contain a variety of components combined into a functional unit. The power module which we are using is selected in such a way that it resists the temperature from -20-degree to 40-degree Celsius. It has energy of 500mAh, the output which is produced should be 5v and this module has no maintenance and has long duration.

II. PROBLEM STATEMENT

India is one of the countries in which the number of road accidents is high. Each year, more than 150,000 people are killed due to road accidents. One of the major causes of such accidents is negligent door opening of parked cars in busy roads. Opening doors without looking at the surroundings might really cause serious accidents. As over speeding is also one of the reasons for accidents, opened doors of the other vehicle in front along with this is even worse. When a car driver opens the door recklessly and hits the vehicle coming towards it is called door-vehicle right of way collision.



Fig.1 Car door accident on busy road.

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The Mumbai court gave a judgment during an accident case that both the drivers are equally wrong and responsible for the accident. The person who is opening the door must be aware of the surroundings and the person who is driving must also be cautious. There is damage to the car as well as it might cause serious injuries to the other person sometimes leading to death too.
Statistics show that the US leads in the number of accidents than India, but India leads in the deaths caused by road accidents.



Fig.2 Road accidents and death list

The goal and the purpose of this paper is to prevent such accidents caused due to the door-vehicle right of way collision. This paper is about preventing collisions using the technologies available.
Being aware of your surroundings can be one of the solutions to prevent this situation. But having a proper system to prevent such accidents is essential these days as most people are negligent on the roads. Hence this paper is written to show how a door locking system is designed to prevent these accidents caused by collisions.
Here the system is designed in such a way that the door does not open while the vehicle is approaching the parked vehicle. Unlike other papers written on the same issue the main door locking system instead of the child locking system as it is only for the rear doors and not front doors. The car is given a system in which the components used would be an actuator, camera sensor, radar sensor, a micro controller, and an alarm system.

III. WORKING OF THE SYSTEM

This system can be explained using a block diagram below.

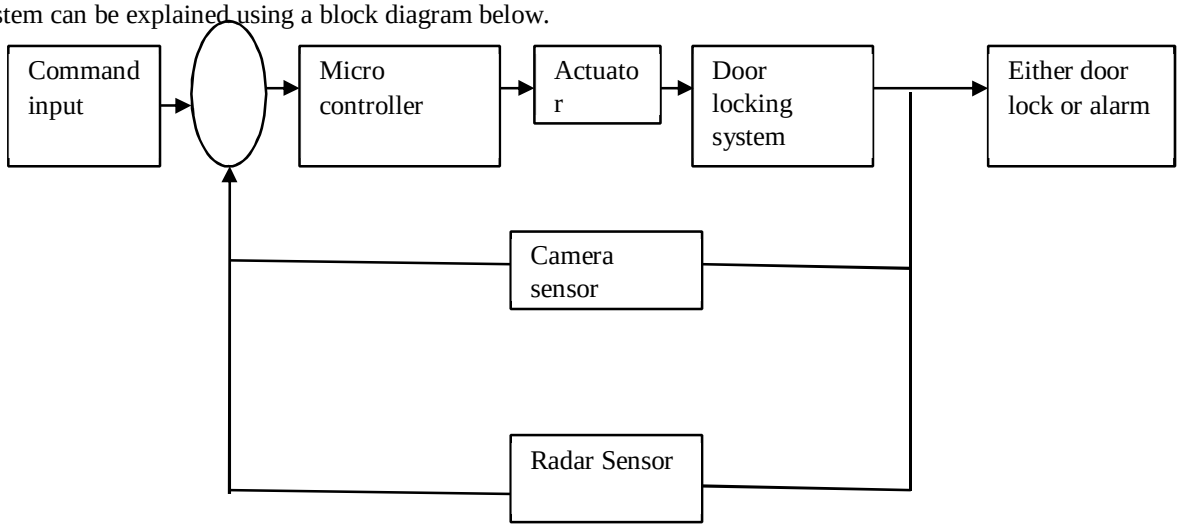


Fig.3 Block diagram on working of locking system.

This block diagram shows that the vehicle detection is done with the help of camera and radar sensor. When the person inside the parked car is about to open the door and another vehicle enters the set-up range, the sensors tell the micro controller that the vehicle is approaching and gives signals to the actuator to lock the doors. The entire system works on a separate power supply as logically the person turns off the engine and battery after parking. The power supply is thus provided to all the components to work.

The actuator is here connected to the door locking system waiting for the instructions to be given by the controller. A setup range is set to the micro controller, the camera sensor shows the 360-degree view of the surroundings and when any vehicle enters that setup range the camera sensor along with the radar sensor are continuously sending signals to the controller. The controller thus receives the signals and accordingly actuates the actuator by locking the door. Here the controller and the sensors are of high precision hence they work accurately to prevent these accidents.

In this system it is also stated that if the car door is already open and another vehicle enters the setup range the sensors send the signals to the controller and an alarm is turned on cautioning the person to close the door to prevent an accident.

IV. DESCRIPTION OF ALL THE COMPONENTS USED IN THIS SYSTEM

A. Actuator

The power-door-lock actuator is a combination of a DC electric motor and a series of spur gears. This actuator, when mounted vertically in a car door, moves the metal hook up or down.



Fig.4 Actuator

The small DC motor turns the series of spur gears which help in gear reduction. A rack and pinion gear set are connected to the last gear which drives the mechanism which in turn moves the actuation rod.

The rack present in the gear set converts the rotational motion of the motor into linear motion for the movement of the lock.



Fig.5 DC motor used in actuator

B. Door Locking System

The Door locking system consists of a latch, knob, rods, and an actuator. The actuator is a power-door-lock actuator which is placed below the latch. There are two rods which connect the actuator to the latch and the latch to the doorknob which is present on the car door's top part. The power-door-lock actuator is connected to the micro controller which sends signals and tells the actuator when to act. The RX28EA controller and the LM7805 power module supplies power to the actuator in timed intervals to lock and unlock the door. The actuator connected to the latch when moved up, connects the door handle present on the outside of the car to an opening mechanism and when the latch is moved down, the outside door handle is disconnected from the mechanism thereby locking the door.

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Fig.6 Door locking system.

C. Camera or Image Sensors

The camera sensors are used to see and interpret objects on the road. These cameras give 360-degree views of their surroundings and show the traffic conditions around them. The cameras that are available these days are used for displaying highly detailed and realistic images. These image sensors can automatically find the objects after detecting them and figure out the distances. For example, these sensors can show other cars, traffic signs and signals, pedestrians etc.



Fig.7 Camera sensor

D. Radar Sensors

Radar sensors for cars are typically made for blind spot detection, lane change assistance, collision mitigation etc. In this system we will be using a certain number of radar sensors to have a 360-degree view of the surroundings. Using these sensors, the system will transmit electromagnetic wave signals and that will be recaptured to determine the distance, velocity, and angle of the object. Radar sensors of either short-range (24 GHz) or long range (77 GHz) can be used to determine the vehicles.



Fig.8 Radar sensor

E. Power Module

The hardware components are LM7805 Voltage regulator IC,230V to 9V 2A 50Hz, Stepdown Transformer, 2A Bridge Rectifier, Electrolytic Capacitors (470µF 50V), 0.01µF Ceramic Capacitors, Breadboard, Connecting Wires

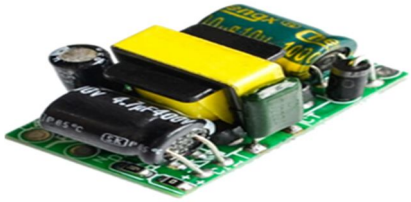


Fig.9 AC-DC 12V 450MA Power supply

F. Lm7085 Regulator IC

LM7085 is a 5V three-terminal positive voltage regulator IC**.** It has three pins i.e.

1) INPUT - A positive voltage is given as input to this pin.
2) GROUND - Common to both Input and Output.
3) OUTPUT-Output regulated 5V is taken at this pin of the IC.

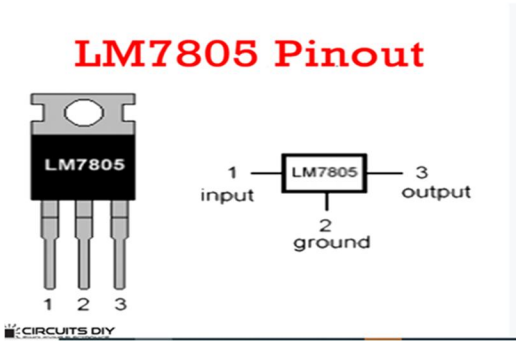


Fig.10 Lm7805 Regulator IC

Working principle: An input voltage of 230V is applied to the primary transformer which steps down to 9V 2A through mutual induction between the primary winding and secondary winding to maintain the frequency of 50HZ. Thereafter a 9V AC signal goes through a bridge rectifier which is responsible for converting an AC signal into a rippling DC signal.

This rippling DC signal goes through the capacitors C1 &C2 for smoothing the output before passing it on to the LM7805 voltage regulator IC to regulate the constant 5V DC signal as output. The DC signal then passes through the C3 capacitor to remove residual noise

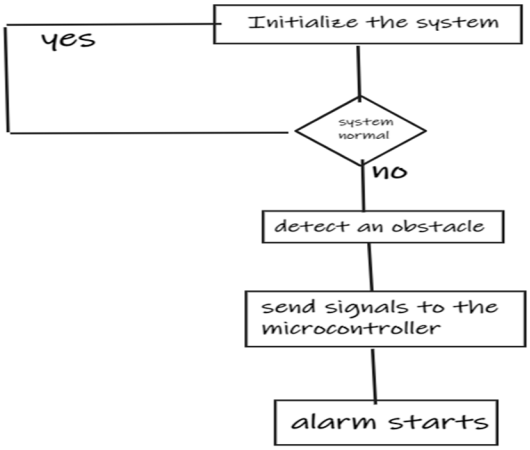
Features:-

- Safe operating area protection
- Thermal shut down
- Very robust

Output current up to 1A with a proper heat sink

Alarm system:

The prime objective in this system is to reduce the accidents that happen due to the opening of car doors suddenly. Alarm systems detect problems that occur by using micro controllers or optical sensors. When another vehicle enters the set range of sensors and micro controller, it sends the message to the control panel and the alarm starts.

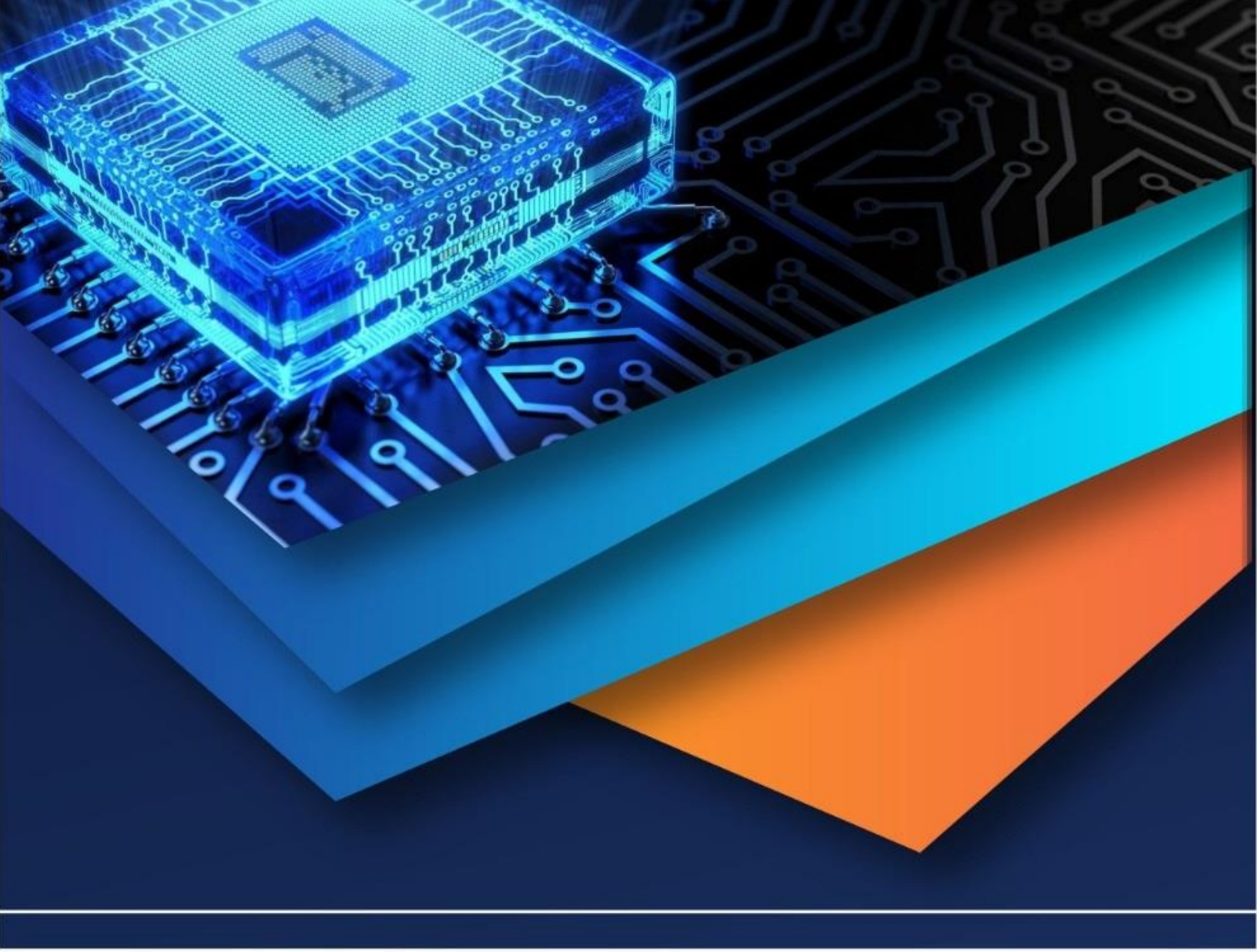


V. RESULTS AND CONCLUSIONS

As we have used radar and camera sensors instead of using Lidar sensors that are mostly used in the high-end cars, this method of locking system with an alarm is a cost-effective way. We have also used the main door locking system instead of the child locking system which increases the safety of the car and helps to prevent accidents. The sensors here are used for distance and obstacle detection. This system is simpler in design. As we have a separate battery used, it is also battery efficient. This system can be used in any type or any model of cars. The sensors here can be used in any type of environment i.e., the sensors are rugged.

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