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# Design of Intelligent Embedded System for Automotive Crash Prediction

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## Abstract—

*The objective of this project is to efficiently avoid the collision of automobile vehicles and to provide a greatest security to the users in adverse or in bad weather conditions by using Collision Avoidance System (CAS). In bad weather conditions it is very hard to drive automobiles as smooth as in regular conditions. Generally most of the accidents are occurred due to this bad weather conditions only. Therefore in this paper we propose a systematic architecture to avoid the early accidents which are mostly possible due to bad weather conditions and as well as due to asynchronous speed among the vehicles. In our proposed method the relative speed and distance of all the vehicles around a particular vehicle is estimated using Ultrasonic sensors and based on those results the speed of that particular vehicle is controlled to avoid early collisions. using advanced technologies in cars for making it more intelligent and interactive for avoiding accidents on roads. In this project we are using Ultrasonic sensors and Accelerometer sensors. The ultrasonic sensors are consists of one transmitter and one receiver, and measures not only the distance to the objects but also the orientation of the object. The work in this project is to develop an inexpensive sensor system for an automobile that can predict an imminent collision with another vehicle, just before the collision occurs. Here we are connecting sensors to ARM controller. If the sensors get activated the controller will give warning sounds by using playback. Also it stops the vehicle by using motor.*

**Key words:** Ultra sonic sensor; Arm; Buzzer; Accelerometer

## 1.Introduction:

Driving is a compulsory activity for most people. People use their car to move from one place to other place. The number of vehicle is increasing day by day. It is produced tacked tightly and risk to accident. Nowadays, the numbers of accident is so high and uncertainly. Accident will occurs every time and everywhere and cause worst damage, serious injury and dead. Accidents are caused mostly due to the delay in applying of brakes. This work is designed to develop a new system that can solve this problem where drivers may not brake manually but the vehicles can stop automatically due to obstacles. This work is about a system that can control braking system for safety. Using ultrasonic as a ranging sensor, its function based on ultrasonic wave. After transmit by transmitter, the wave can reflect when obstacle detected and receive by receiver. The main target for this project is, car can automatically braking due to obstacles when the sensor senses the obstacles. The braking circuit function is to brake the car automatically after received signal from

the sensor. To prevent these accidents of vehicles from taking place we are using Automated Emergency Brake Systems and Ultrasonic Sensors. The main target for this project is, car cans automatically braking due to obstacles when the sensor senses the obstacles. The braking circuit function is to brake the car automatically after received signal from the sensor. The avoidance of accidents and mitigation regarding their consequences are the integrated techniques followed by us. Under the unique term "Perceptive Drive", we systematically pursue this method with numerous new assistance systems, greatly enhanced purposes and upheaval defensive systems. The Perceptive Drive changes the vehicle into a " perceptive associate". This identifies a particular range of dangers and proposes support through audible, visual and tactile warnings, also being able to augment the driver's reaction. Many systems are able to take required actions in an emergency situation, such as an automatic application of brakes to steer clear of an accident from taking place and reduce severity of injury. The driver is finally pleased and the level of comfort is increased. This perceptive and combination of innovative sensors and systems are a benchmark on the road to automatic and an accident preventive driving.

## 2.THE EXISTING ADVANCE SYSTEM FOUND IN HIGH END CARS

### 2.1 ABS (Anti-Locking Braking System):

ABS works with your regular braking system by automatically pumping them. In vehicles not equipped with ABS, the driver has to manually pump the brakes to prevent wheel lockup. In vehicles equipped with ABS, your foot should remain firmly planted on the brake pedal, while ABS pumps the brakes for you so you can concentrate on steering to safety.

### 2.2 EBD (Electronic brake-force distribution):

Electronic brake-force distribution (EBD or EBFD), Electronic brake-force limitation (EBL) is an automobile brake technology that automatically varies the amount of force applied to each of a vehicle's brakes, based on road conditions, speed, loading, etc. always coupled with anti-lock braking systems.

**2.3 SRS Air Bags (Supplemental Restraint System Air Bags):** An airbag is a vehicle safety device. It is an occupant restraint consisting of a flexible envelope designed to inflate rapidly during an automobile collision, to prevent occupants from striking interior objects such as the steering wheel or a window, the sensors may deploy one or more airbags in an impact zone at variable rates based on the type and severity of impact; the airbag is designed to only inflate in moderate to severe frontal crashes.

**2.4 Immobilizer:** An immobilizer is an electronic device fitted to an automobile which prevents the engine from running unless the correct key (or other token) is present. This prevents the car from being “hot wired” after entry has been achieved.

**2.5 Parking Sensors:** Parking sensors are proximity sensors for road vehicles which can alert the driver to unseen obstacles during parking man oeuvres. Parking sensors generally fall into two categories. i) Electromagnetic parking sensors ii) Ultrasonic parking sensors.

**2.6 Cruise Control:** Cruise control (sometimes known as speed control or auto cruise) is a system that automatically controls the speed of a motor

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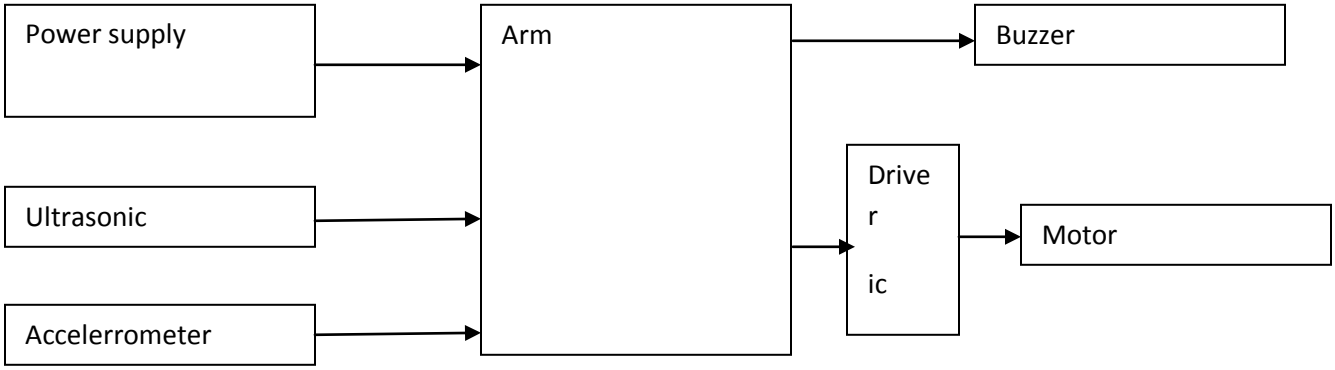
vehicle. The system takes over the throttle of the car to maintain a steady speed as set by the driver.

## 3.System Implementation:




### 3.1.Power supply:

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to otherThis power supply section is required to convert AC signal to DC signal and also to reduce the amplitude of the signal. The available voltage signal from the mains is 230V/50Hz which is an AC voltage, but the required is DC voltage(no frequency) with the amplitude of +5V and +12V for various applications_In this section we have Transformer, Bridge rectifier, are connected serially and voltage regulators for +5V and +12V (7805 and 7812) via a capacitor (1000µF) in parallel are connected parallel as shown in the circuit diagram below. Each voltage regulator output is again is connected to the capacitors of values (100µF, 10µF, 1 µF, 0.1 µF) are connected parallel through which the corresponding output(+5V or +12V) are taken into consideration.

### 3.2.ARM:

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as THUMB, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind THUMB is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

• The standard 32-bit ARM instruction set.

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• A 16-bit THUMB instruction set.

The THUMB set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because THUMB code operates on the same 32-bit register set as ARM code.

THUMB code is able to provide up to 65% of the code size of ARM, and 160% of the performance of an equivalent ARM processor connected to a 16-bit memory system.

### 3.3.Ultra sonic sensor:

An ultrasonic sensor transmits ultrasonic waves into the air and detects reflected waves from an object. There are many applications for ultrasonic sensors, such as Intrusion alarm systems, automatic door openers and backup sensors for automobiles. Accompanied by the rapid development of information processing technology, new fields of application, such as factory automation equipment and car electronics, are increasing and should continue to do so. Using its unique piezoelectric ceramics manufacturing Technology developed over many years, Murata has developed various types of ultrasonic sensors which are compact and yet have very high performance. The information contained in this catalog will help you to make effective use of our ultrasonic sensors.

## 3.4. Accelerometer

The MMA7361L is a low power, low profile capacitive micro machined accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature compensation, self test, 0g-Detect which detects linear freefall, and g-Select which allows for the selection between 2 sensitivities. Zero-g offset and sensitivity are factory set and require no external devices. The MMA7361L includes a Sleep Mode that makes it ideal for handheld battery powered electronics.

## 3.5. DC MOTOR

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

### 3.6. BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or electronic. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke.

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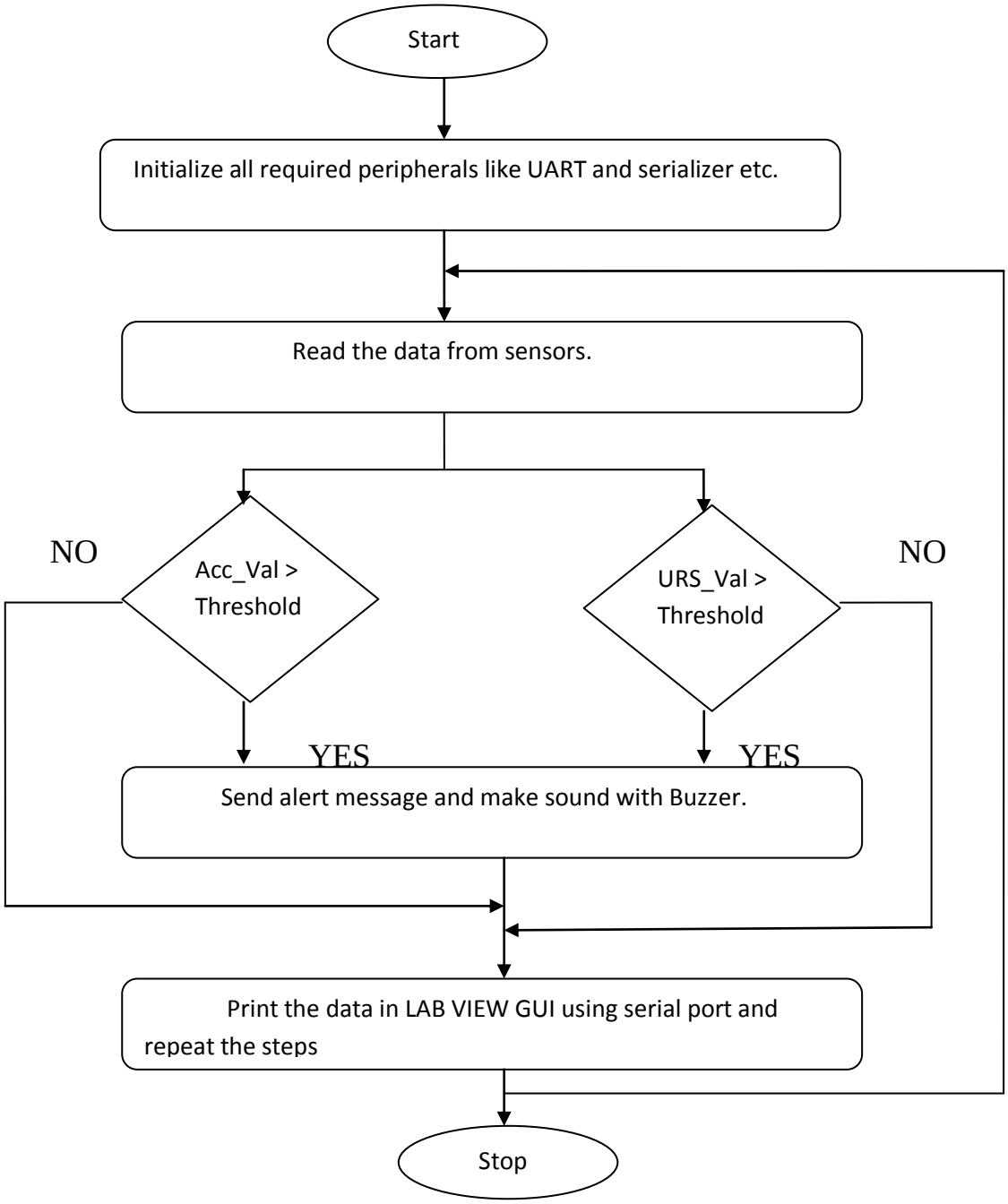
## 4.FLOW CHART OF THE PROJECT




## 5. RESULTS OF THE PROJECT

The following figure 5.2a shows the kit arrangement of the project. In this project we connect all the sensors to the ARM7 controller. The work in this paper is motivated by the need to develop an inexpensive sensor system for an automobile that can predict an imminent collision with another vehicle,before the collision occurs.

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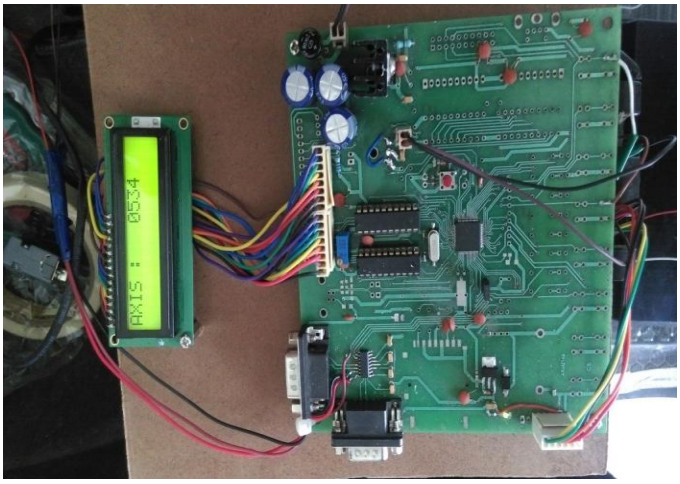


Figure 5.1 Kit arrangement of the project

Figure 5.2 shows ultrasonic sensor. An ultrasonic sensor transmits ultrasonic waves into the air and detects reflected waves from an object. Ultrasonic sensor placed infront side of the vehicle.


Figure 5.2Ultrasonic sensor

Figure 5.3 shows accelerometer. The accelerometer sensor are used to measure the distance from another vehicle in close proximity, to estimate relative position of the vehicle from the measurements.

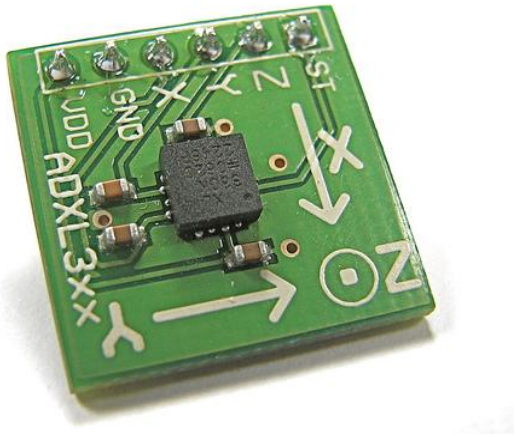


Figure 5.3 Accelerometer

The output from the sensors are given to the microcontroller and an LCD is used to display the results i.e., left detected objects, right detected objects, ,at the front side we are using the ultrasonic sensors which gives the distances. In this project we are using external battery to give power supply to the kit as shown in below figure.

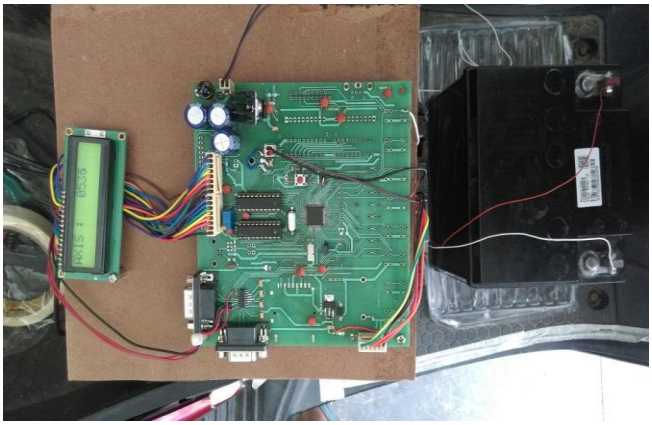

Fig 5.4.Using External battery to give power supply to the kit

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And also a playback which is recorded with warnings based on the results from the sensor are recorded previously are played whenever we get appropriate signals from the sensors in order to warn or inform to the driver in the vehicle.

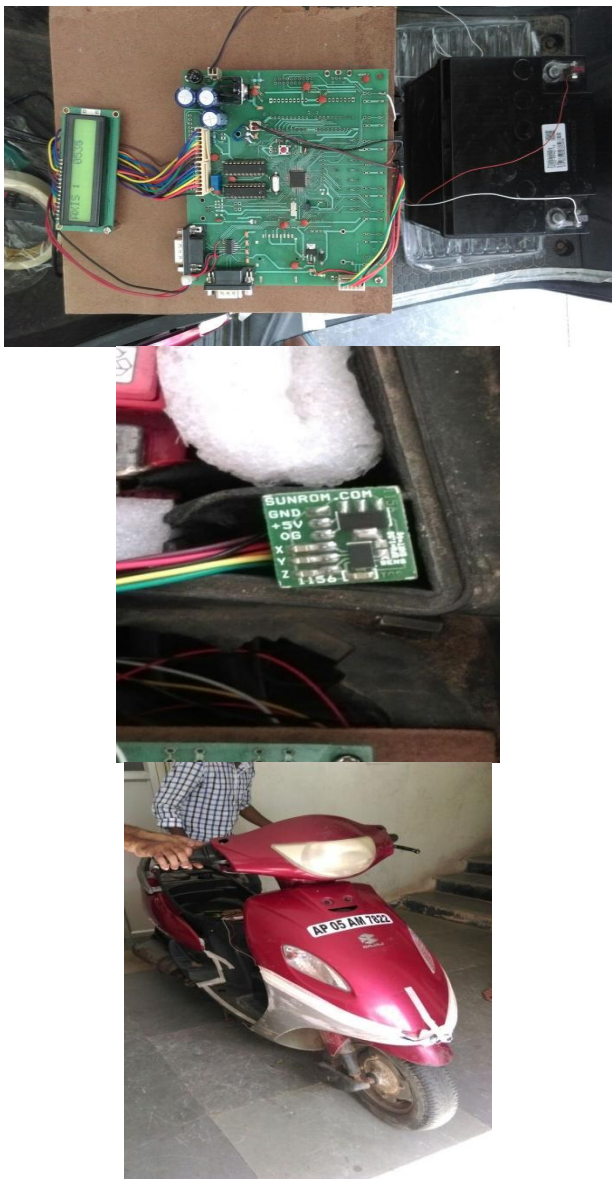


Figure 5.5 Crash prediction using ultrasonic sensor and Accelerometer

When the vehicles are very close to the host vehicle and imminent collision may happen the motors of the vehicle is going to stop.

## CONCLUSION

This paper has focused on the development of a novel and unique automotive sensor system for the measurement of relative position and orientation of another vehicle in close proximity. The sensor system is based on the use of Accelerometer sensors, which measure magnetic field. A system based on the use of accelerometer sensors and a custom-designed ultrasonic sensor system together to estimate vehicle parameters, position, and orientation. The use of the combined sensors results in a reliable system that performs well without the knowledge of vehicle- specific magnetic field parameters. The experimental results in this paper confirm that the developed sensor system is viable and that it is feasible to adaptively estimate vehicle position and orientation even without knowledge of vehicle dependent parameters.

## FUTURE SCOPE

In this paper we have proposed and analyzed the effectiveness of an active vehicles anti-collision system, in which Ultrasonic range finder, excitation circuit and are working properly. Future we can improve this system with GPS to log the position of collided vehicles to the emergency helpline.

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