Advanced Accident Avoidance System for Automobiles

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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 IR sensors and Ultrasonic sensors and based on those results the speed of that particular vehicle is controlled to avoid early collisions. Besides this facility we also provide an accident detection system which detects the accidents and by using GPS and GSM we send the information of the location of the accident place to the police station and relatives, which is most useful information to save the persons.

Index Terms *— Collision Avoidance system, IR and Ultrasonic sensor, vibration sensor, GPS and GSM*

I. INTRODUCTION

The increasing demand for flexibility as well as technological Even though there are several advanced technological innovations are available today for vehicle safety, the growth in the number of accidents is continues regularly. And most of these accidents are especially due to collision or intersectional accidents. One of the most important causes behind the intersectional accident is bad weather conditions. Recently it has been reported that nearly 36% of the accidents in the India are occurred due to bad weather conditions. Here bad weather condition means a high rain or high snow falling or bad dark light etc. in those specific conditions the drivers feel very hard to drive to recognize the vehicles and speed of the vehicles which passing around them and may cause to severe accidents. Therefore using this paper we proposes a systematic architecture to reduce the accidents occurred due to adverse bad weather conditions and we also provide an accident detection system and as well as we send the location information of accident to the police station and to relatives to save the lives by using GPS and GSM.

Our proposed collision avoidance system is operates in the following way: Initially the temperature sensor and humidity sensor are used to sense the weather conditions. If the weather conditions are adverse or bad then a warn signal will alerts the driver. Similarly IR sensors and ultrasonic sensors are placed in all directions of the vehicle except in back side and these sensors are regularly scans the road ahead for obstacles or vehicles and if any obstacle or vehicle find, then warning is given to the driver. If any vehicle is very near than predefined threshold value then automatically the speed of the vehicle reduces abruptly. Another facility that we provide besides it is an automatic accident detection and information passing system. Using automatic accident detection system, if an accident occur then we can immediately transmits the location and time of the accident to the police station and to the relatives which is very helpful information in saving their lives. The remaining of this paper is arranged as: section II describes about two main modules of proposed system i.e. CAS and AADIS and then section III and IV describes about these two main modules individually. Section v explained the hardware implementation of the system. And finally section VI contains the results of proposed system.

II. SYSTEM MODEL

The complete system model of our proposed system is divided as two main modules as:

1. Collision Avoidance System (CAS)
2. Automated Accident Detection and Information system (AADIS).

1. COLLISION AVOIDANCE SYSTEM

The main objective of the CAS is to avoid the early accidents due to adverse weather conditions. Below figure shows the block diagram for proposed method. Collision Avoidance System consists of several sensors to predict the weather conditions such that humidity sensor, temperature sensor etc. In our proposed system adverse weather conditions are considered as heavy rain cases and huge snow fall conditions. We use humidity sensor to predict the rain conditions i.e. using humidity sensor we calibrate the level of humidity in the surrounding environments.

If the estimated humidity level is below the already pre fixed threshold sensor alerts the system for heavy rain condition. Similarly temperature sensor is used to predict the snow conditions. Generally whenever snow falls then automatically the temperature is low. Therefore whenever the temperature sensor senses very low temperature than threshold level then it alerts the system for high snowfall condition. However after detecting the adverse weather conditions, the next step is to avoid collisions. To avoid early accidents we use small radar

sensors around the car to detect vehicles and their relative speeds and distances.

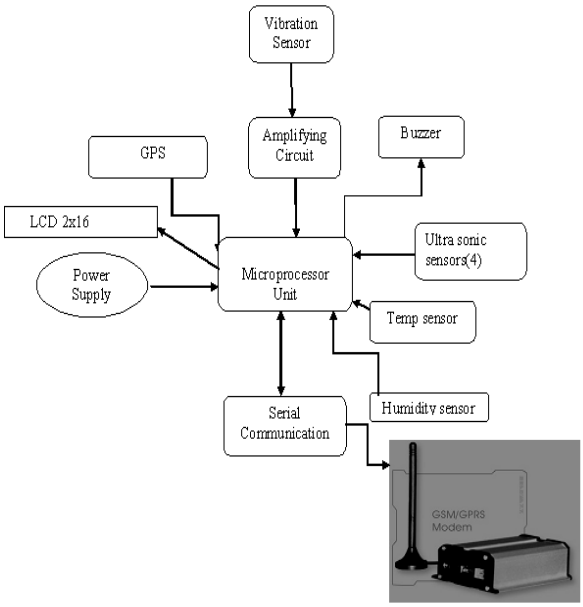

Fig 1: Block Diagram for CAS

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Generally these sensors are IR sensors and Ultrasonic sensors. In our proposed method we use IR sensors to detect the in front vehicles and ultrasonic sensors to detect adjacent vehicles. These sensors regularly transmit bursts of radar waves with high frequency. The transmitted high frequency bursts bounce off the nearest vehicles and return back to the sensor. At sensor, another unit connected to the sensor to estimate the time between signal leave and bounce back. This information is used to estimate the relative velocity, distance and position of the vehicle immediately. Thus If any abrupt changes are happen in these factors which intentionally cause an accident, then the will assist the driver to avoid the collision.

In this project we effectively avoids the collision by properly applying the brake at right time in right direction i.e. if driver turns right without accurately observing the oncoming vehicles, the this system will issue a throttle command to the vehicle and at same time a brake command is applied. Same process will be applied in every turn of the vehicle. These commands are issued in a manner that does not cause the violation of predefined speed limits (either traffic laws or comfort levels), more precisely, the braking command will not cause the vehicle velocity to become less than a minimum speed, while the accelerating command will not cause the vehicle velocity to become greater than a maximum speed. This implies that automatic control commands applied to prevent collisions at the intersection do not create hazardous driving conditions for other vehicles not directly involved.

2. AUTOMATED ACCIDENT DETECTION AND INFORMATION SYSTEM (AADIS).

BLOCK DIAGRAM

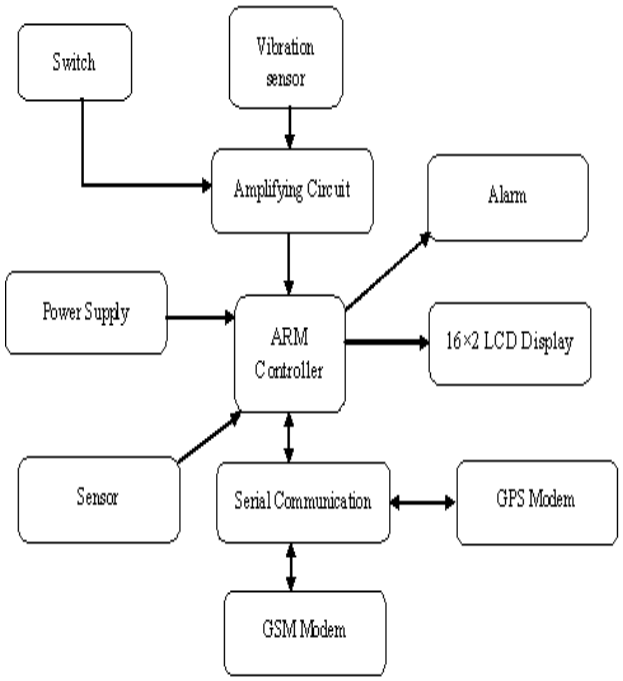

Figure 2: Block diagram of Vehicle Accident Automatic Detection and Remote Alarm Device

Figure 2 represents the block diagram of AADIS, which consists of different modules and individual modules are interfaced to 32 bit ARM controller. Power supply unit Step downs the input voltage to 12v DC from 230v AC.

ARM controller is the heart module to this entire system, which provides high data processing speed ability to use as a thumb. The complete process of AAIDS is as follows: whenever accident happens the vibration sensor senses the accident by sensing the sudden vibrations in the vehicle body and transforms this signal to the controller through the amplifying circuit. As and when the input is received by the controller, the buzzer (alarm) is ON and the message is sent to the rescue team with the help of the GSM module. The rescue team reaches the site of the accident with the help of the location given in the message. The location or the geographical coordinates where the vehicle is present are detected by the GPS module.

Design process: Collision Avoidance System

Here we use ARM7 controller and it has got five ports namely PORTA, PORTB, PORTC, PORTD and PORTE. PORTA and PORTE are meant for analog input data. Vibration sensor is connected to the port A, PORTS B, C and D is used for input

and output purpose. LCD is connected to port B of the controller to which all data pins of LCD are connected. Vibration sensor is connected to RA0. RA0 pin take as the analog inputs from sensors and convert them to digital values. The alarm circuit is connected to port D.

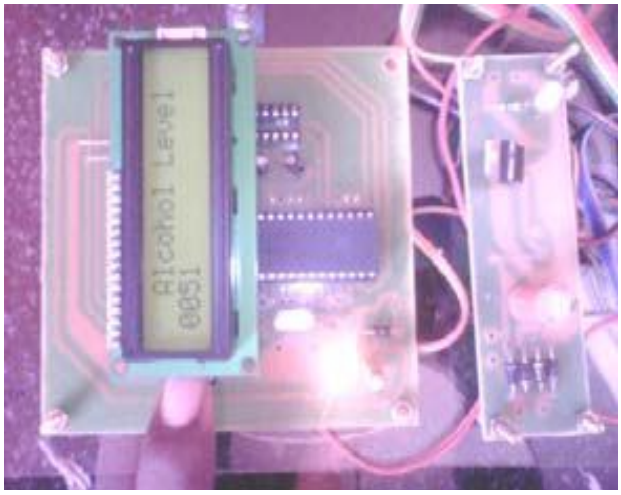

Fig. 3: Sensory unit

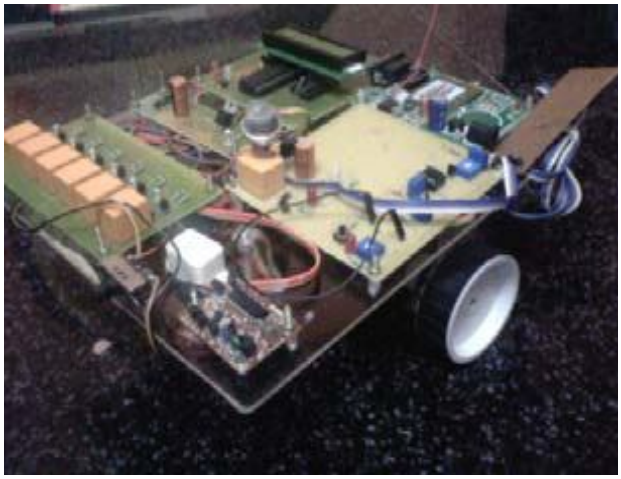

Fig. 4: Collision Avoidance System

III.HARDWARE IMPLIMENTATION

Automated Accident Detection and Information System (AADIS).

From the figure 5 the design structure consists of a control unit ARM7 LPC2148, accident detection module includes three-axis accelerometer sensor MMA7660FFC, user interface module includes LCD, and a message sending module. When the collision occurs the vibration sensor detects the collision automatically. When the vehicle rolls over the roll angle is given by the Z –axis of the accelerometer sensor. The alert signal is sent when the roll angle is greater the set reference value.

Control Unit

The control unit consists of The LPC2148 microcontroller which consists of 32/16 bit ARM7TDMI-S CPU, flash memory ranging from 32 KB-512KB. It is cost effective and reliable. Pipelining is employed in order to simultaneously operate all parts of processing and memory systems [11]. The CPU has two types of instruction sets Arm (32-bit) which gives maximum performance and Thumb (16-bit) which gives maximum code density. The major advantage of ARM is its ability to manipulate 32-bit integers with a single instruction. The main advantage of Thumb is its ability to switch back to ARM which gives high speed to operate fast interrupts and other algorithms. This provides better performance than 16-bit architecture, and better code density than a 32-bit architecture.

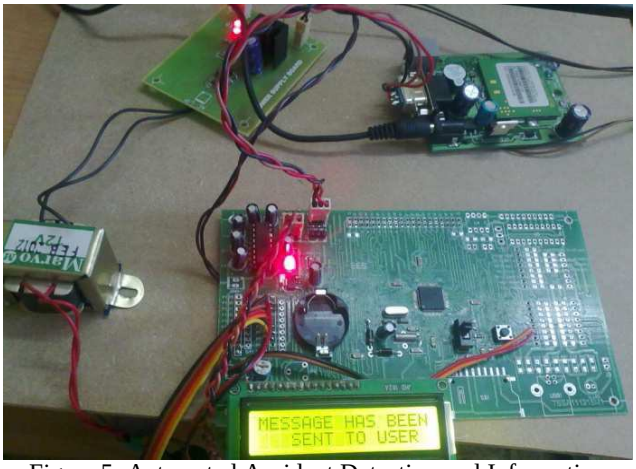

Figure 5. Automated Accident Detection and Information System (AADIS)

GPS Module

A satellite based navigation system GPS (Global Positioning System) is used to sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any environmental conditions anytime in the world for free. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). Global Positioning System was originally developed for military. Because of its popular navigation capabilities and because GPS technology can be accessed using small, inexpensive equipment, the government made available this system to civilian purpose also. The USA owns GPS technology and the Department of Defense maintains it. The GPS technology consists of 24 satellites which are continuously rotating around the earth continuously. Each and every satellite transmits the radio signals and consists of an atomic clock to exact their time and location. Another equipment known as GPS receiver is used to receive these radio signals. And once this receiver locks at least any

four of these satellites it can retrieve its location from known reference positions. It is a high performance, low power satellite based model. It is a cost effective and portable system which accurately detects the location [13].

GSM Module

For efficient transmission of digital voice and data service, Global System for Mobile communications (GSM) is a very advanced technology. GSM is a very well-known standard for digital mobile communication which is widely used in every part of the world. Mostly the operating frequency for GSM is either 900MHZ or 1800 MHZ at the data rate of 9.6 kbps.
A Tri-band GSM/GPRS module SIM300 is used for message sending which is operating at the frequencies of EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz and it provides GPRS multi-slot class 10/ class 8 (optional**)** capabilities and supports the GPRS coding schemes. By using antenna connector and antenna pad interface is achieved using SIM300 module. Here the customer is connected to antenna pad board and the antenna connector is $MM9329-2700_{\text{type}}$. The main feature available with SIM 300 is it is designed in power saving mode and current consumption is low as to 2.5mA in $SLEEP_{\text{mode}}$. Both GPS and GSM are interfaced to the control unit using serial communication protocol [10].

Accident Detection Module

It consists of a three-axis accelerometer sensor MMA7660FFC with sensitivity +/- 1.5g, with digital output. It is interfaced to the control unit by I2C (Inter Integrated circuit) protocol. It is low cost and has high shocks survivability (10,000 g). It has low current consumption (0.4 microamps) and low power consumption analog voltage (2.4v-3.6v) and digital voltage (1.71v-3.6v)> It has an auto sleep / wake feature for low power consumption. Tilt orientation detection can be done accurately.

RESULTS AND COMPARISIONS

This paper gives a defend way of approaching the problem. Here first we try to avoid the most general accidents which are occurred due to bad weather conditions. And if the accident occurred then the accident location can be located easily and the detection of accident is precise unlike the prior approaches, where detection of accident is done by either of the two sensors. In this approach the accident is detected by both the vibration and micro electro mechanical sensor and the information of accident location will be sent to already predefined numbers.

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BIO DATA

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