Automated Vehicle Control System

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Abstract—

In the present world intelligent instruments have become part of our lives. It won't take much time that we realize that most of our tasks are being done by electronics. Traffic accidents cause many injuries and thousands of fatalities worldwide. The major causes for the accidents are careless, reckless driving feeling asleep while driving. Major deaths are caused due to non-availability of treatment after accidents. Hence a safety system is necessary. By implementing seat belt control system which makes the person inside the vehicle to wear seat belt, lane departure warning system helps to maintain the lane. The collision detection system aims in indication of obstacle in front of vehicle and if the vehicle is met with an accident, the location will be traced using GPS and GSM system.

Keywords— Lane Detection, Obstacle detection, Collision Sensing, Vehicle Tracking, Microcontroller.

I. Introduction

In the last few decades, India has progressed at such an enormous rate that many companies have strongly established themselves here. These companies bring a huge amount of workforce with them. Arranging transportation to such a huge mass is a cumbersome task involving many intricacies. Hence Safety systems use sensors to make judgements about when the driver needs assistance to maintain safe control of the vehicle. Today passive safety systems such as airbags and seat belts are more or less standard in new cars. A passive safety system does nothing to prevent an accident but merely reduces the consequences of it. An active safety system on the other hand seeks to prevent the actual accident by aiding the driver in case of a dangerous situation.

A. Crash Statistics

According to the World Health Organization (WHO), around 1.2 million people are killed and at least 50 million injured due to vehicle-related accidents every year .The National Highway Traffic Safety Administration (NHTSA) estimates that in 2008, 34,017 fatal crashes involving 50,186 drivers and 37,261 fatalities were reported in United States. 5,870 of these deaths occurred in crashes that involved some form of driver distraction. Distractions include fatigue, conversation with passengers, cell phone usage and interaction with other electronic devices such as compact disk players and GPS navigation systems. The NHTSA report also points out that the number of fatal crashes caused by distracted drivers increased from 11% in 2005 to 16% in 2008.A study by the American Association of State Highway and Transportation Officials (AASHTO) reports that, 60% of all fatal crashes involve vehicles departing from their respective lanes. Thus, lane departure is one of the leading causes of accidents which are due to distraction. Deviation of the vehicle from the lane is also one of the leading causes of accidents involving rolling and collision with fixed objects.

Preventive measures may include:

1. A warning to the driver, or a correction to the vehicle motion.
2. A pre configuration of a protective system to respond if a crash occurs.

Hence safety systems such as lane guidance system, seat belt control, obstacle detection system and collision detection system play a major role in controlling the accidents. Our work focuses on the same.

B. Lane Guidance System

A system that monitors the position of the vehicle with respect to the centre of the lane and provides warning whenever it departs from the lane.

A large number of accidents occur due to lane departure, over the last decade, researchers have been working on developing lane-departure avoidance systems. Different aspects of lane-departure have been studied. Researchers have addressed the issue by examining vehicle dynamics, developing lane departure warning systems, devising detection algorithms, integrating sensor technology with the dynamics, etc.

C. Collision Detection System

The collision detection systems involve some form of vehicle–to–vehicle (V2V), vehicle–to–infrastructure (V2I), or infrastructure–to–vehicle (I2V) communication. It then alerts the driver about the vehicle and signals him to slow down the vehicle. Also when collision occurs the position of the vehicle will be sent to the predefined telephone numbers.

D. Seat Belt Control System

The seat belt control system is also used to control the extent of harm caused if the accident is met. Sensors are used for this purpose. The sensors senses whether the person driving is wearing the seat belt and gives the signal to the processor which holds the control of ignition system. If the person wears the seat belt, the ignition system is enabled by the processor and if he does not wears the seat belt, the ignition system will be blocked.

II. PROPOSED METHOD

In this proposed method, a novel method of lane guidance, obstacle detection, seat belt control and collision detection system used to control the number of accidents and the extent of harm caused due to accident. Also this work focus on provision to inform the related person about accident if occurred for providing required assistance.

A. Block Diagram

The block diagram of the proposed method is as shown in figure 2.1.

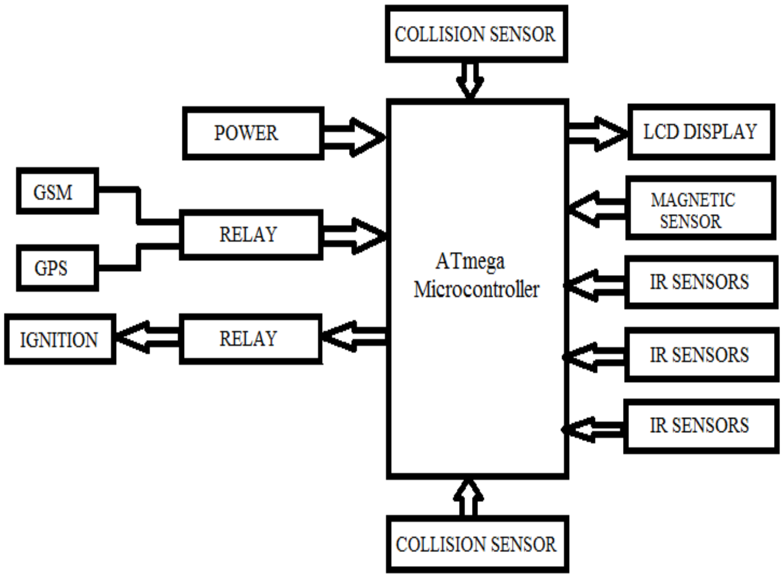

Figure 2.1: Block Diagram

This work is completely relies on microcontroller, which forms the heart of this project. The microcontroller obtains input from 3 IR sensors, two collision sensors and relay. The output from the microcontroller is fed to LCD or relay system which serves as the output devices. A 5v power supply is fed to the microcontroller and the relay circuit is supplied with 12v power supply. All inputs are processed in microcontroller, based on the result the output is obtained.

The AVR microcontrollers are based on the advanced RISC architecture and consist of 32 x 8-bit general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

Within one single clock cycle, AVR can take inputs from two general purpose registers and put them to ALU for carrying out the requested operation, and transfer back the result to an arbitrary register. Here, in this project the input to the microcontroller is given from IR sensors, Collision sensors and Magnetic sensor. The ALU can perform arithmetic as well as logical operations over the inputs from the register or between the register and a constant. The operations can be performed between any of the registers and can be stored in either of them. Based on the input detected, the microcontroller directs corresponding devices for necessary actions.

In order to maximize performance and parallelism, the AVR uses Harvard architecture – with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle. The program memory is In-System Reprogrammable Flash memory.

Since all AVR instructions are 16 or 32 bits wide, the Flash is organized as 16K x 16. For software security, the Flash Program memory space is divided into two sections, Boot Program section and Application Program section. AVR can perform single cycle execution, it means that AVR can execute 1 million instructions per second if cycle frequency is 1MHz. The higher is the operating frequency of the controller, the higher will be its processing speed.

B. Flow Diagram

The flow for the proposed work is as shown in the diagram shown in Figure 2.2

1. Here at the start as soon as powered on, the LCD will be initialised followed by GSM module.
2. After successful initialisation, it checks for application of seat belt using magnetic sensors. If applied, relay for the ignition control will be enabled or else the ignition control will be disabled.
3. The IR sensors will be then starts detection. If the lane departure is observed, the warning will be given to the driver through LCD and if any obstacle is detected in the way of the vehicle, the driver will be warned by a beep sound.

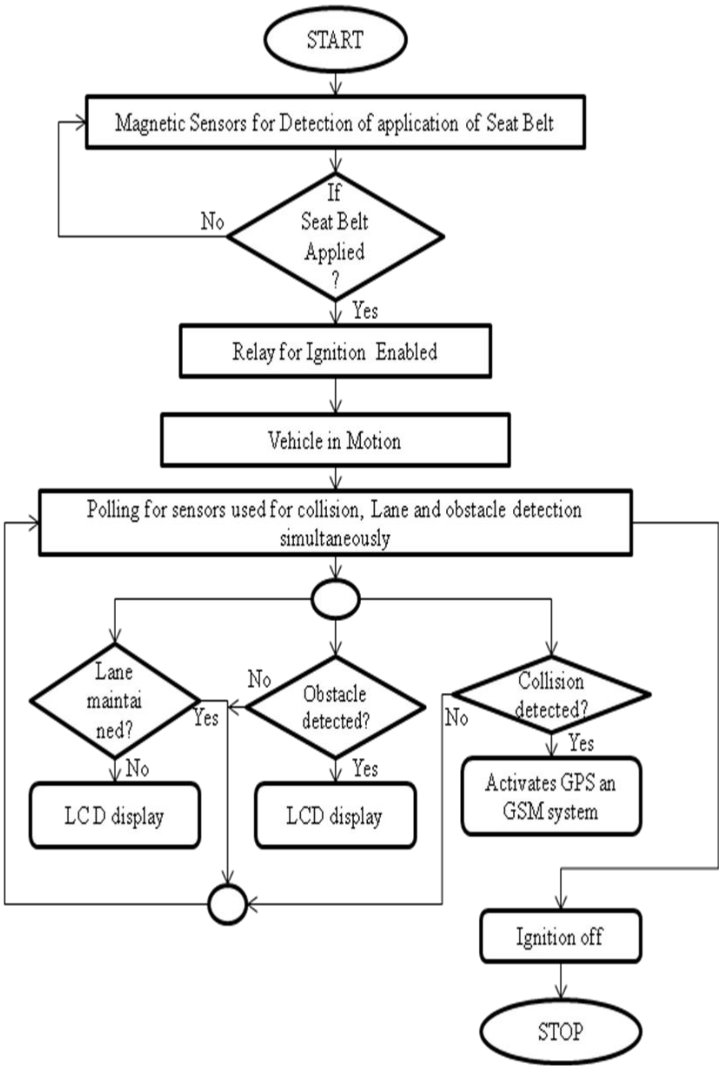

Figure 2.2: Flow Diagram

4. Along with the IR sensors, Collision sensors also start detecting. If the collision occurs, the collision sensors detect the collision and send the signal to the microcontroller which in turn activates GPS and GSM system.
5. This GPS and GSM system gets the location information and sends the same to the predefined number.
6. All the above operations will be handled by the microcontroller.

III. RESULTS AND ANALYSIS

The following subsections show the results of various modules that are used in this work.

A. Lane Guidance System

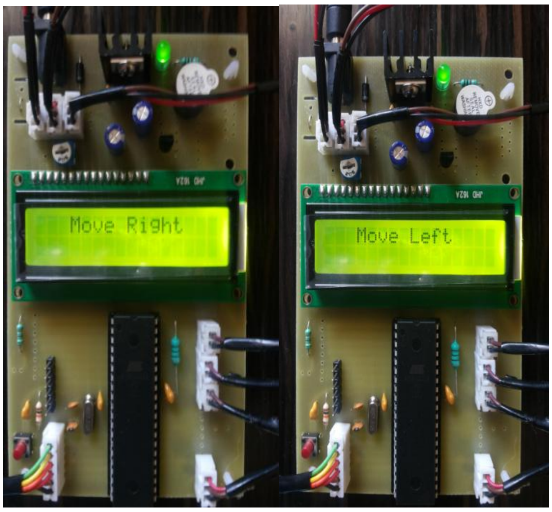

Figure 3.1: Lane Guidence

The Figure 3.1 shows the warning indicated to the driver when the vehicle departures from the lane. The first part shows the warning indicated by the IR sensor placed on the left side of the vehicle. As soon as the vehicle crosses the lane on left side then the photodiode in IR sensors gets the reflected infrared rays hence a high signal is generated which sends a warning message to driver which is displayed on LCD as MOVE RIGHT. The second part shows the warning indicated by IR sensors placed on the right side of the vehicle. As soon as the vehicle crosses the lane on right side then the photodiode in IR sensors gets the reflected infrared rays hence a high signal is generated which sends a warning message to driver which is displayed on LCD as MOVE LEFT.

B. Seat Belt Control

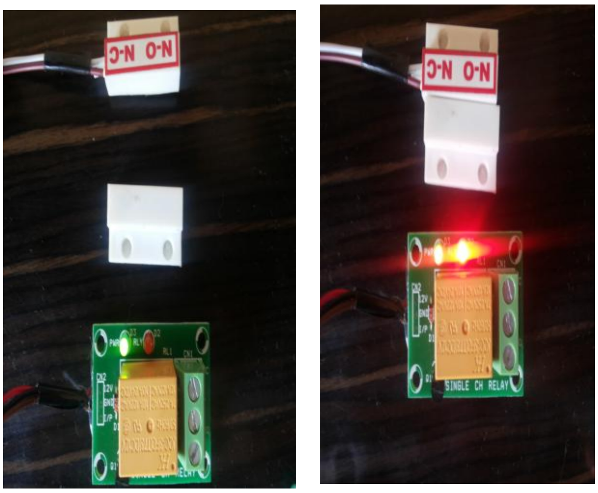

Figure 3.2: Seat Belt Control

The first part of Figure 3.2 shows the open condition of seat belt. Such condition is detected, when the two parts of the magnetic sensors are apart. Hence the ignition control system will be deactivated by the microcontroller. The same will be indicated to the driver by a warning signal, in the form of a beep sound. The second part of Figure 3.2 shows the closed condition of seat belt. Such condition is detected when the two magnetic sensors are brought together. Hence the ignition control system will be enabled by the microcontroller.

C. Collision Detection System

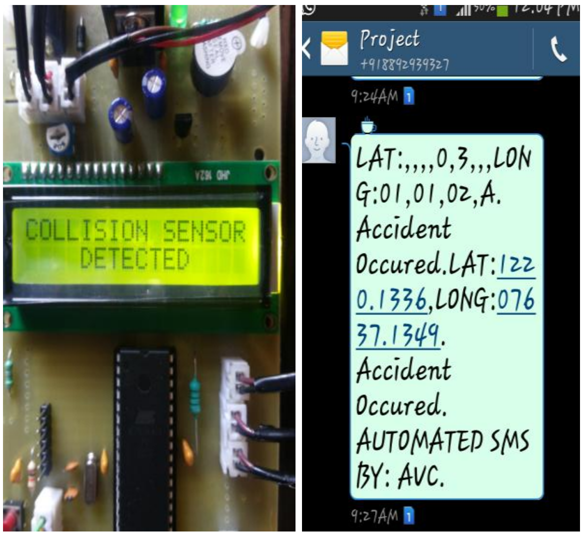

Figure 3.3: Collision Detection and Message Service

Here IR sensors are used for obstacle detection. Whenever any obstacle appears in the way of the vehicle, the IR sensor senses the same and sends the signal to the microcontroller. The microcontroller then sends the signal to the driver in order to alert him. The Figure 3.3 shows the process of collision detection, acquiring location and messaging the location information to the predefined numbers. Whenever the accident occurs, the collision sensor detects the accident and sends the signal to the microcontroller. Microcontroller in turn activates GPS and GSM system. The GPS system acquires the location information, i.e. latitude and longitude, and GSM using this location information sends the same in the form of message to the predefined number. The latitude and longitude obtained by the user should be decimal adjusted so that to get the correct location of the occurrence of the accident. Providing these coordinates in the Google maps one can find the location of the accident occurred. This is as shown in Figure 3.4

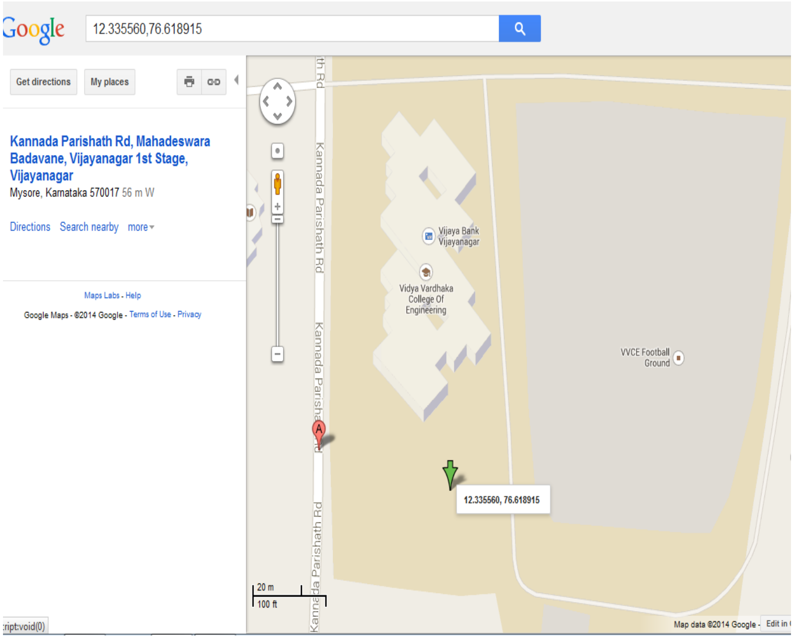

Figure 3.4: Location Information

IV. Conclusions

The automated vehicle control system is a very unique project with lot many features built into it, to make the driver more comfortable and safer. This project is feasible as very less expensive parts are used. This project is helpful in reducing the number of accidents which occur due to driver's negligence and carelessness by incorporating lane detection module which gives a warning to the driver to go in a particular lane. By using this module the driver will be guided about leaving the lane which is very helpful when the vehicle crosses the lane without the knowledge of the driver and a sensor is used to detect and indicate about the presence of obstacle at certain distance in front of vehicle it is very helpful when the driver is distracted while driving.

Another module used in this project is seat belt control. Usually the drivers won't wear the seat belt while driving the vehicle due to which the consequences can be fatal when accident occurs. By implementing this module it will alert the driver to wear the seat belt, only after the ignition control will be enabled otherwise the ignition control will be disabled. Thus by using this module we can reduce the extent of harm when accident occurs.

Collision detection system uses GPS and GSM to indicate about the occurrence of accident at any region at any time. It is very useful when the accident occurs in remote place as the location information of the accident occurred is sent to predefined number and which helps to take necessary action as soon as possible. This project can also be incorporated in heavy vehicles such as trucks, etc

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