

Intelligent Car System for Accident Prevention

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Abstract - This project is about making cars more intelligent and interactive which may notify or resist user under unacceptable conditions, they may provide critical information of real time situations to rescue or police or owner himself. Driver fatigue resulting from sleep deprivation or sleep disorders is an important factor in the increasing number of accidents on today's roads. In this paper, we describe a real-time online safety prototype that controls the vehicle speed under driver fatigue. The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents. The main components of the system consist of number of real time sensors like ultrasonic, RFID and a software interface with GPS and GSM for location.

Key Words: AVR, Sensor, GPS / GSM, RFID, LDR, Bluetooth

1. INTRODUCTION

Each year, car enthusiasts salivate at the prospect of seeing what bleeding-edge designs automakers will unveil on the car show circuit. Those same enthusiasts are often disappointed when the amazing concepts still haven't made it to the auto dealer's showroom floor several years later. 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. The existing approaches used for safety measure and preventing accidents are Emergency braking systems (EBS), traction control and stability control. Even infrared (IR) sensors are also widely used as proximity sensors and for obstacle avoidance, but not successful due to some drawbacks.

1.1 Proposed System

Intelligent systems are in used with every aspect of systems, CARs are the critical systems which are real time and lives are involved. This System not only deals with component monitoring, does even more than that like Passenger activity monitoring, Behavior analysis, System behavior, Notification & co-ordinate.

Ultrasonic Sensor, RFID are the vital and of great importance from the perspective of passenger safety and traffic safety. Impact detection and notification is also one of the lifesaving and critical information provider system.

2. Literature Survey

2.1. Various Approaches

In order to build up this project we had various options such as:

- GPRS
- BLUETOOTH
- GSM
- RFID

2.1.1. Using Bluetooth

During the past two decades, the advancement in microelectronics and VLSI technology dipped down the cost of many consumer electronic products to a level which was affordable for the common man. The first quarter of 2001, saw the vending of about 32.5 million PCs. The sale of cellular phones is predicted to reach 1 billion in 2005. With increase in the number of electronic devices, comes in the need of connecting them together for maximum interoperability and utilization. These devices connect with each other using a variety of wires, cables, radio signals and infrared light beams, and an even greater variety of connectors, plugs and protocols. Bluetooth is devised to replace these cables. Bluetooth is a global standard for wireless connectivity. Bluetooth technology facilitates the replacement of the cables used to connect one device to another, with one universal short-range radio link operating in the unlicensed 2.45 GHz ISM band. The main objectives of Bluetooth technology can be described as follows,

Features

- Cable replacement: Getting rid of the various types of cables and wires required for interconnectivity between various devices would enable the lay man to use all electronic devices without wasting time and money.
- Small size: the Bluetooth device is very small so that it can be attached to any device required like the cell phones without adding much to the weight of the system.
- Low cost: Bluetooth is aimed to be a low cost device in the near future.
- Low power: The utilization of power is very less (within 100 mW) as it is short range equipment and so it facilitates the use of small batteries for its usage.

Besides the characteristics mentioned above, Bluetooth can imitate a universal bridge to attach the existing data networks, and also as a mechanism for forming ad-hoc networks. Designed to operate in noisy frequency environments, the Bluetooth radio uses a fast acknowledgement and frequency hopping scheme to make the link robust.

2.1.2 Using GSM & GPRS Modem

General packet radio service (GPRS) is a packet-based wireless data communication service designed to replace the current circuit-switched services available on the second-generation global system for mobile communications (GSM) and time division multiple access (TDMA) IS-136 networks. GSM and TDMA networks were designed for voice communication, dividing the available bandwidth into multiple channels, each of which is constantly allocated to an individual call (circuit-switched). These channels can be used for the purpose of data transmission, but they only provide a maximum transmission speed of around 9.6Kbps (kilobits per second). GPRS distributes packets of data from

several different terminals in the system across multiple channels, making a much more efficient use of the bandwidth currently available for bursty applications such as internet access. In theory, using all eight channels in a GSM network at once, a GPRS connection can achieve a data transfer rate of up to 114Kbps. These higher data rates will allow users to interact with multimedia websites and similar applications using a mobile handset or notebook computer. In theory, GPRS services should be cheaper than circuit-switched connections, with the network only being used when data is being transmitted.

GPRS communication is designed to complement but not replace current circuit-switched networks, being used solely as an extra means of data communication. In practice, connection speeds will be significantly lower than the theoretical maximum, depending upon the amount of traffic on the network and upon the number of simultaneous channels supported by the handsets. In practice, GPRS is an evolutionary step towards enhanced data for global eve. As a packet-switched technology, GPRS supports the internet protocol (IP) and X.25, packet switched standards currently used in wire line communications. As such, any service that is used on the fixed internet today will also be able to be used over GPRS. Because GPRS uses the same protocols as the internet, the networks can be seen as subsets of the internet, with the GPRS devices as hosts, potentially with their own IP addresses.

GPRS is based on a modulation technique called Gaussian minimum-shift keying (GMSK). This is where the rectangular pulses corresponding to the bit stream are filtered, using a Gaussian-shaped impulse response filter, producing lower side lobes than would otherwise be the case. This modulation technique does not allow as high a bit rate across the air interfaces as eight-phase-shift keying (8 PSK) modulation, which is being introduced in EDGE systems.

Enabling GPRS on a GSM or TDMA network requires the addition of two core modules, the Gateway GPRS Service Node (GGSN) and the Serving GPRS

2.1.3 Using RFID

There are many applications of RFID which are being used in cars. Now-a-days, for security purpose, RFID technology is being used. This is done with the help of a RFID tag and a RFID Reader. The RFID readers are installed on the cars and there is a server that gathers information from these tags. As the user tags the reader, the reader's reads the information placed inside the tags placed on cars. In this way the system is able to identify the car and the charges are made.

2.1.4 Using Ultrasonic sensor

After ultrasonic waves were produced, ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range that obstacle detected is depends on the range of ultrasonic sensors that used. The ultrasonic wave detects any kind of physical obstacle, hence it will produce a reflected wave. Once the

obstacle is detected there is a reflector which reflects the ultrasonic waves. An ultrasonic receiver is used for this which does the receiving of the ultrasonic waves, reflected from the road surface to generate a reception signal. There is ultrasonic transducer that will transform back the sound wave to electrical energy. This signal amplified by an amplifier. The amplified signal is compared with reference signal to detect components in the amplified signal due to obstacles on the road surface. The magnitude of the reference signal or the amplification factor of the amplifier is controlled to maintain a constant ratio between the average of the reference signal and the average of the amplified signal. This allows the ultrasonic sensor to examine the existence of vehicles. Once this is complete the sensors give an alarm as to an obstacle detected. The processed signal will be send to the braking circuit. The braking circuit here is also known as the Emergency Braking System. The Emergency Braking System is known as an independent road safety system designed for vehicles. This is able to detect incidents where the speed relative to this and the distance between the target and the host suggests here that a collision is impending. At the braking circuit, brake pressures are applied here automatically. This provides maximum brake boost instantly as soon as the driver engages the brakes. After this if the driver's steering actions or the brake that he applies is not sufficient to avoid a collision then the Emergency Braking System with the maximum pressure given by the brakes will be to support mitigation of the impact. This system is recognized as Emergency Braking System and it ensures full reduction in speed. The emergency braking system plays a major role in this and it is the highest escalation step for a very safety system to immediately respond to a critical incident.

3. Block diagram of the proposed system

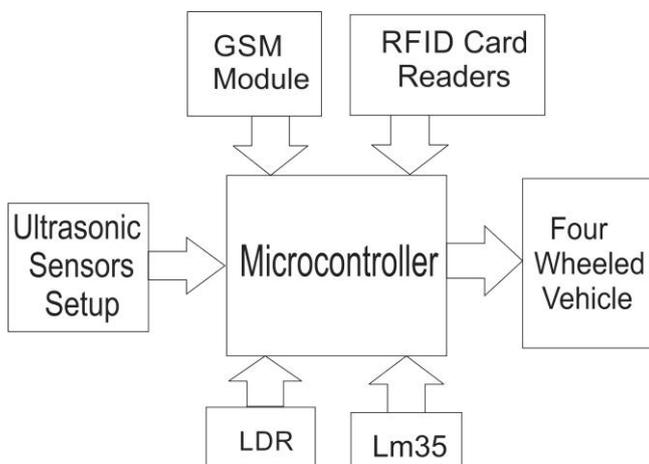


Fig -1: Block diagram of intelligent car.

3.1. Microcontroller

Microcontrollers as the name suggests are small controllers. They are like single chip computers that are often embedded into other systems to function as processing/controlling unit. For example the remote control you are using probably has microcontrollers inside that do decoding and other controlling functions. They are also used in automobiles, washing machines, microwave ovens, toys etc, where automation is needed.

Micro-controllers are useful to the extent that they communicate with other devices, such as sensors, motors, switches, keypads, displays, memory and even other micro-controllers. Many interface methods have been developed over the years to solve the complex problem of balancing circuit design criteria such as features, cost, size, weight, power consumption, reliability, availability, manufacturability. Many microcontroller designs typically mix multiple interfacing methods. In a very simplistic form, a micro-controller system can be viewed as a system that reads from (monitors) inputs, performs processing and writes to (controls) outputs. Embedded system means the processor is embedded into the required application. An embedded product uses a microprocessor or microcontroller to do one task only. In an embedded system, there is only one application software that is typically burned into ROM. Example: printer, keyboard, video game player.

Microprocessor - A single chip that contains the CPU or most of the computer

Microcontroller - A single chip used to control other devices

Microcontroller differs from a microprocessor in many ways. First and the most important is its functionality. In order for a microprocessor to be used, other components such as memory, or components for receiving and sending data must be added to it. In short that means that microprocessor is the very heart of the computer. On the other hand, microcontroller is designed to be all of that in one.

The microcontroller we are using over here is ATmega8. An 8 bit RISC architecture controller. The reason we are using atmega8 is because of the architecture, low cost and the best of all is that it is open source.

3.2. Ultrasonic Sensor

There are ultrasonic signals which are similar to audible sound waves, except its frequencies are much higher. Ultrasonic sensor (US) can provide the initial information on distance to obtain the parameters for further methods to perform task. They are signals that are almost like audible sound waves, except those frequencies are higher. The

ultrasonic transmitter has a piezoelectric crystal that resonates up to a required frequency. We have ultrasonic transducers that have piezoelectric crystals which reverberate to a desired frequency. This converts the electric energy into acoustic energy and also vice versa. The sound waves, which are transmitted in the shape of a cone, are reflected back from a target to the transducer. Here an output signal is fabricated to perform some kind of designating or control function. Minimum distance from the sensor is necessary to issue a delay in time so that the echoes can be elucidated. There are few variables that can affect the operation of ultrasonic sensing. Some of them are reflective surface roughness, target surface angle or changes in temperature or humidity. These targets could have any kind of reflective form such as round objects. Ultrasonic transducer produces an ultrasonic signal. These signals are generated through a sensing medium. The very same transducer is used to detect receiving signals. In many cases, the sensing medium is mostly and always air. One ultrasonic transducer is typically present in an ultrasonic sensor which does the transformation of an electrical energy into sound and vice versa a sound into an electrical energy. A housing enclosing the ultrasonic transducer. Optionally an electronic circuit for signal for signal processing and an electrical connection also enclosed in the housing. The ultrasonic sensor measures the distance from the selected point of the ground to the vehicle. The measurement of the ultrasonic sensor is based on the time of flight of an ultrasonic pulse to its reflected wave from the ground. The optimization technique with constraints is used to get the reflected pulse, which are been detected by the usage of threshold comparator. The sub-wavelength is detected with the technique of taking the frequency response into consideration. Low cost components are only compressed in this sensor. This sensor is adaptable for any kind of weather condition.

3. 3. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

The reasons being:

- 1) LCDs are economical
- 2) Easily programmable
- 3) Have no limitation of displaying special

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

3. 4. Bluetooth

Bluetooth technology can be found in many devices ranging from smartphones and home entertainment products to watches and medical devices. One popular use is using your phone to connect to the car to listen to music for example. Bluetooth technology is a short-range communication technology which has a low cost and uses low energy. When two devices connect to each other they can "pair" with each other, as long as they are within each other's proximity. Afterwards a link is maintained, even if there is no data flow. A feature of Bluetooth wireless technology is the ability to handle data and voice transmissions simultaneously. It also operates in the unlicensed industrial, scientific and medical (ISM) band at 2.4 to 2.485 GHz, using spread spectrum frequency hopping full duplex signal. Frequency hopping spread spectrum is a transmission technique where the frequency used is changed or switched at random time intervals. This causes the transmission to be more secure; since it is hard to intercept and has minimal interference with other transmissions.

Bluetooth 4.0 is the newest iteration of the Bluetooth wireless technology and is already implemented in some smartphones such as the Samsung Galaxy S3 and the Iphone 5. It will also be implemented in many more smartphones in the coming year. The most significant characteristic of Bluetooth 4.0 is energy efficiency, thus providing a much better battery life for devices. Therefore, a new protocol was added to the Bluetooth Core Specification which is the Bluetooth low energy (BLE). BLE was designed for devices that collect small chunks of information frequently, therefore it is not optimized for file transfer or streaming even though it has a data rate of 1Mbps]. This design allows a device to be on a button-cell battery and last for many months. A new feature that was added to Bluetooth v3.0 and 4.0 is the compatibility with

NFC, thus allowing devices to “pair” through tapping these devices together.

BLE is also known as Bluetooth Smart, and the devices that implement Bluetooth 4.0 have two distinct variations. They are divided into Bluetooth smart ready devices which are devices that uses the full range of Bluetooth 4.0, and Bluetooth smart devices, which are devices that gather specific information and sends it to Bluetooth smart ready devices. There are also two different wireless radios, the dual mode radios which are in the Bluetooth smart ready devices. These radios support both classic connections and BLE connections. The Bluetooth smart devices have a single mode radio which allows them to only make Bluetooth low energy connections.

3. 5. Light Dependent Resistor

A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. There are many different symbols used to indicate a **LDR**, one of the most commonly used symbol is shown in the figure below. The arrow indicates light falling on it.

A **light dependent resistor** works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity (Hence resistivity) reduces when light is absorbed by the material.

When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy is incident on the device more & more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing and hence it is said that the resistance of the device has decreased.

4. Advantages:

- 1) Security of the vehicle
- 2) Record driving data, collision data and position data.
- 3) Analyze the accident details.
- 4) Send location of car and its maintenance to base station through GPS & GSM technique.
- 5) Shows engine temperature.

5. Disadvantages:

- 1) GPRS
 - Speed is less.
 - It is less reliable.
 - Distance factor is a major issue.
- 2) BLUETOOTH
 - Less secure.
 - Range is very less (10-100m).
 - Battery use.

6. Future Scope

- 1) A Front Camera can be used for Lane Tracking purpose.
- 2) Long range IR sensors can be used in front to avoid vehicle collision.
- 3) A Camera can be used inside the car for vigilance purpose.

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