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DRIVING CONTROL ISSUES AND REMEDIES FOR SMART CAR

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***Abstract*—** Smart cars are seductive because of their freedom of mobility, low impact on the terrain whilst furnishing a safer and smoother riding experience. To give the ultimate, driving control requires applicable systems and algorithms to optimize smart auto performance, maximize car stability and protection, minimize accident probability, and heighten driving comfort. Despite advancements in these areas, the consummation of optimal smart car still requires considerable trouble. In our design four driving control systems and algorithms for smart car is enforced, including the advanced driving adjunct system, perpetration of detectors, vehicle dynamics, and control algorithms. The main end of this project is to avoid the accident, crashes and provide the safe driving.

***Index Terms*—** Blind spot Detection, Pedestrian Detection, Lane Detection, Accident Indication.

1. INTRODUCTION

Cars are veritably important in present life because for over a hundred of times the cars have converted society by furnishing independence and freedom of mobility. Cars are a great way to get around. They're also a source of great comfort, allowing us to travel long distances in a short quantum of time. The topmost advantage of cars is that they can be used for numerous purposes, similar as transporting goods or people, and indeed performing medical procedures. With the advancement of wisdom and technology, especially the rapid-fire development of internet technology, communication technology and artificial intelligence technology in recent times, the period of smart auto technology has come. Still, the practical use of smart cars requires a long transition period. Despite the tremendous development of smart auto technology, there are still some issues that need to be addressed. The driving terrain has complexity and variability, which brings great challenges to driving opinions. In addition, the smart auto driving system is generally designed grounded on fixed rules that don't consider the drivers personalization of driving. This seriously hinders the development and practicality of smart auto driving technology.

2. PROBLEM STATEMENT

Blind spots are dangerous and can cause a collision because they obstruct our view of the road. This can result in an accident.

Pedestrian detection is problem of detecting the location of individuals who are walking on a particular indoor and outdoor environment.

If drivers don't make safe lane changes properly, it often leads to a car accident. When an accident has occurred and no peoples are around at that situation, will delay in the arrival of ambulance to the accident spot.

3. OBJECTIVES

The objective of the project is to:

- Assists the driver to avoid a collision by detecting vehicles in the blind spot area.
- By using advanced sensors, detect the pedestrians, if sensed it immediately applies the brake.
- The Lane Detection system has an objective to identify the lane marks. Its intent is to obtain secure environment and improved traffic surroundings.
- Using GSM technology, accidents will be indicated and it sends the message to the family member.

4. METHODOLOGY

4.1 BLIND SPOT DETECTION- A Collision Avoidance system is that a safety to the machine system to reduce the immense damage and to reduce the effect of the accident. It's also known as Pre-crash system; the system rather uses Ultrasonic detectors technology is being used as to apply the system. All the safety schemes can be put under the collision avoidance system. When the vehicle gets into the eyeless spot region, also the detector detects the handicap and the data is used to warn or manipulate the vehicle for the safety measure. The car being fixed with two lenses which is mounted to check the Blind Spot region for an impending collision. Once handicap detected its shoot to the processing unit and also advised the system. The system is assessed with Arduino Mega 2560 microcontroller board, once the handicap is detected, the data acquired by the detector is used to reuse the distance and also it's used to control the Dc motors connected to the individual wheels of the cars.

Working - Blind spot is a region surrounding the vehicle which cannot be observed properly by the driver if there is an obstacle like head rest, passenger height, window pillar etc. The vehicle is been fitted with two sensors to check the rear and the two side s of the automobile. When an obstacle is detected on the blind spot area, the distance of the obstacle is calculated and fed to the Arduino Mega to process the necessary action. The ultrasonic sensor provides 2cm - 400cm measurement range, the accuracy of ranging can reach to 3mm. The principle of the sensor is by the use of the IO trigger pin for a 10us high level signal. Then the module automatically transmits eight 40 kHz and when obstacle is detected, a pulse wave is transmitted back. If the signal return is received at the echo pin, through high level, the time of high output level is the duration from the ultrasonic to return.

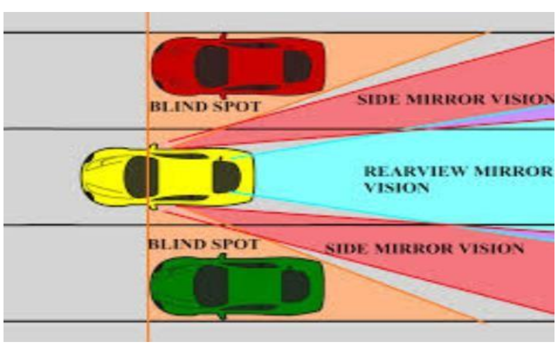

Fig. 4.1 Blind spot detection

4.2 PEDESTRIAN DETECTION- An essential and significant task in any intelligent video surveillance system, as it provides the fundamental information for semantic understanding of the video footages. It has an obvious extension to automotive operations due to the eventuality for perfecting safety systems. These systems are more effective at slower pets. Pedestrian Discovery may not always be suitable to help avoid a collision, but this point can help reduce the speed enough to make the impact more survivable. As exploration progresses, infrared technology is being added to improve performance.

Working- A pedestrian detection system uses advanced computer sensors around the vehicle to detect people within its proximity. With this information, the vehicle's on-board computer can alert the driver of any pedestrians or other moving objects, such as cyclists, that may be near the vehicle's intended path.

Cameras mounted behind the rear-view mirror and have become effective at detecting the more subtle movements of people.

Fig. 4.2 Pedestrian Detection

4.3 Lane Detection - Lane detection is used for localizing lane boundaries in the given road images, and can help to estimate the geometry of the road ahead. A significant amount of research has been carried out in the area of lane analysis.IR Proximity Sensor can be used for obstacle sensing, colour detection, fire detection, line sensing etc and also as an encoder sensor.

Working - The camera positioned at the front of the vehicle rear mirror. When travelling, the system monitors road markings and their position versus the car as well as the edge of the road or lane. The system is activated whenever the vehicle leaves its current lane unintentionally and stops the movement of car.

Fig. 4.3 Lane detection

4.4 Accident Indication – An accelerometer detector is used to detect the accident and also GPS will identify the accident and also GSM will establish the network connection and the communication will be transferred to the registered mobile number.

Working – The Arduino receives the equals from the GPS modem. Also it'll shoot this information to the GSM modem. The GSM modem is used to shoot this information via SMS. SMS will be transferred to the family member of the driver so that they can take immediate action to help the persons suffering due to this accident.

Fig. 4.4 Accident indication

5. HARDWARE AND SOFTWARE REQUIREMENTS

5.1 HARDWARE REQUIREMENTS:

A. Power Supply- A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

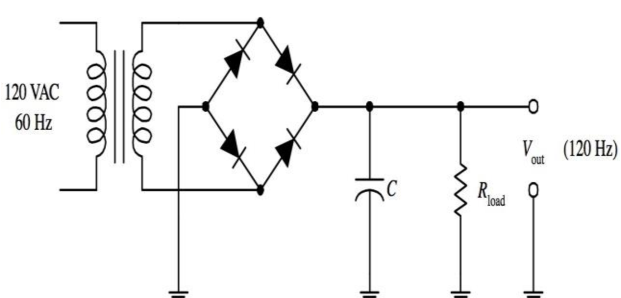

Fig. 5.1 (a) Circuit diagram of Power supply

All power supplies have a power input connection, which receives energy in the form of electric current from a source, and one or more power output connections that deliver current to the load. The source power may come from the electric power grid, such as an electrical outlet, energy storage devices such as batteries or fuel cells. The power supply which we are using consists of transformers which reduces alternating current to required voltage coming with the flow of power supply after reduction of voltage then we use a full wave bridge rectifier to convert AC to DC and then the DC current obtained is fed to the filters and then to the required voltage regulator and the to a load, the output of this power supply is obtained from the load and given to the components and the microcontroller. The function of a linear voltage regulator is to convert a varying DC voltage to a constant, often specific, lower DC voltage. In addition, they often provide a current limiting function to protect the power supply and load from overcurrent (excessive, potentially destructive current). A constant output voltage is required in many power supply applications, but the voltage provided by many energy sources will vary with changes in load impedance. Furthermore, when an unregulated DC power supply is the energy source, its output voltage will also vary with changing input voltage. To circumvent this, some power supplies use a linear voltage regulator to maintain the output voltage at a steady value, independent of fluctuations in input voltage and load impedance. Linear regulators can also reduce the magnitude of ripple and noise on the output voltage

B. ARDUINO UNO- The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analogy input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analogy I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "Uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre-programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol, it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig. 5.1 (b) Arduino Uno

C. DC Motor- A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by induced magnetic fields due to flowing current in the coil. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

DC motors were the first form of motors widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

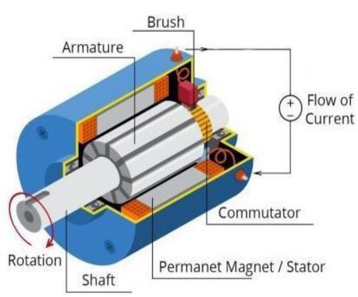

Fig. 5.1 (c) DC Motor

D. H Bridge motor An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards. The name is derived from its common schematic diagram representation, with four switching elements configured as the branches of a letter "H" and the load connected as the cross-bar.

Most DC-to-AC converters (power inverters), most AC/AC converters, the DC-to DC push–pull converter, isolated DC-to-DC converter most motor controllers, and many other kinds of power electronics use H bridges.

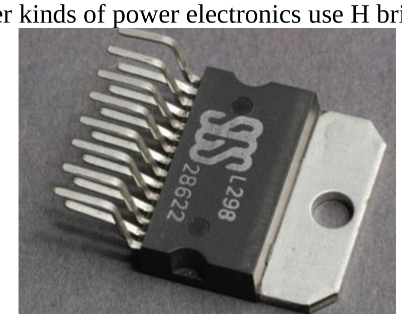

Fig. 5.1 (d) H Bridge IC

E. Ultrasonic Sensor- An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity.

Ultrasonic sensors can measure the distance to a wide range of objects regardless of shape, colour or surface texture. They are also able to measure an approaching or receding object. Most ultrasonic sensors are based on the principle of measuring the propagation time of sound between send and receive (proximity switch). The barrier principle determines the distance from the sensor to the reflector (retro-reflective sensor) or to an object (through beam sensor) in the measuring range.

Ultrasonic sensors are used in passenger cars to monitor the immediate surroundings of the vehicle and to measure distance to obstacles. They are often used in parking assist systems.

Fig. 5.1 (e) Ultrasonic sensor

F. Infrared Sensor An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm to 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

To detect the straight or curved lane you are driving in, Lane Keep Assist uses sensors. A forward-facing sensor is installed front of the rear view mirror, where it scans the road to detect the white or black lines of the lane.

Fig. 5.1 (f) Infrared Sensor

G.ADXL sensor The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. ADXL335 works on the principle of capacitive. ADXL335 is a capacitive accelerometer. It works on the principle that when the acceleration is applied to the sensor, the capacitance inside the sensor changes. This change in capacitance is then used to measure the acceleration of the object.

The accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration. It can be interface with 3.3V or 5V Microcontroller.

Accelerometer sensor can be used in a car application. By this sensor dangerous driving can be detected. With signals from an accelerometer, a severe collision is recognized and the vibration sensor will send a signal to microcontroller which in turn will activate GPSGSM module.

Fig. 5.1(g) ADXL Sensor

H. GSM- The Global System for Mobile Communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. GSM is also a trade mark owned by the GSM Association. GSM may also refer to the Full Rate voice codec.

The MS consists of the physical equipment, such as the radio transceiver, display and digital signal processors, and the SIM card. It provides the air interface to the user in GSM networks. As such, other services are also provided, which include − Voice teleservices and Data bearer services.

Fig. 5.1(h) GSM Module

5.2 SOFTWARE REQUIREMENTS

A. Arduino IDE - The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino programming language is based on C++, a widely used and well-known programming language.

B. Embedded C - Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.

Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all device working is based on microcontroller that are programmed by embedded C.

6. BLOCK DIAGRAM

6.1 Block diagram of the project

The proposed architecture for the hardware implementation of the studied control issues is showed in Fig 6.1. It consists of a number of sensors, power supply, motor and a control unit, which are used for the appropriate data transformations and controlling factor.

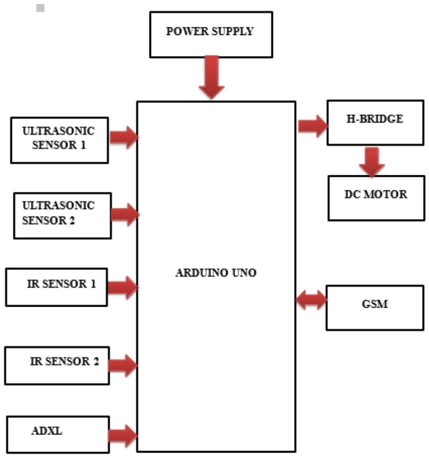

Fig. 6.1 Block Diagram

6.1.1 Block diagram for Blind Spot Detection

Fig. 6.1.1 Block diagram for Blind Spot Detection

Ultrasonic detectors emit sound swells. Their reflection is analysed for any shift in reflected swells grounded on object is detected in the eyeless spot. Ultrasonic detectors are cost effective and are dependable for operations.

6.1.2 Block diagram for Pedestrian Detection

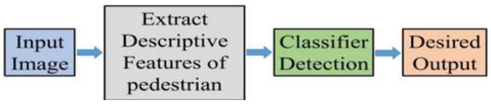

Fig. 6.1.2 Block diagram for Pedestrian Detection

A pedestrian detection system uses advanced computer sensors in front of the vehicle to detect people within its proximity. With this information, the vehicle's on-board computer can alert the driver of any pedestrians or other moving objects, such as cyclists, that may be near the vehicle's intended path and immediately stops the moving of car.

6.1.3 Block Diagram for Lane Detection

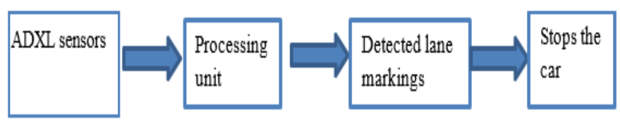

Fig. 6.1.3 Block diagram for Lane detection

Lane Detection is a computer vision task that involves relating the boundaries of driving lanes in a videotape or image of a road scene. The thing is to directly detect and track the lane markings in real- time, indeed in gruelling conditions similar as poor lighting, light, or complex road layouts.

6.1.4 Block Diagram for Accident Indication

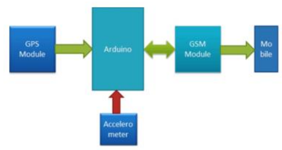

Fig. 6.1.4 Block diagram for accident indication

Now whenever there's an accident, the car gets cock and accelerometer changes his axis values. These values read by Arduino and checks if any change occurs in any axis. If any change occurs also Arduino reads equals by rooting string from GPS module data and shoot SMS to the predefined number.

7. ADVANTAGES AND DISADVANTAGES

7.1 Advantages

The part of driving control systems is to help deaths and injuries by reducing the number of car accidents and the serious impact of those that cannot be avoided. Essential safety-critical DCS applications include:

- Pedestrian detection/avoidance
- Lane departure warning/correction
- Traffic sign recognition
- Automatic emergency braking
- Blind spot detection

These lifesaving systems are key to the success of DCS applications. They incorporate the latest interface standards and run multiple vision-based algorithms to support real-time multimedia, vision processing, and sensor fusion subsystems.

Fig. 7.1 Advantages of Driving Control Systems in car

7.2 Disadvantages:

Drivers' overdependence on DCS is one factor that makes it risky for occupants as well as pedestrians. Additionally, they could disable their DCS functions because the technology might be problematic for drivers if it misinterprets what is happening outside the car. For instance, if DCS features wrongly detect that a car has passed another too closely, the systems may abruptly reduce or stop the car's speed, which might be hazardous.

Additionally, sudden highway turns make it difficult for the DCS system to identify an approaching vehicle or pedestrian. The DCS system requires appropriate marking and road signs so that the sensors can function effectively.

Another obstacle to implementing DCS is the expense of insurance and maintenance. DCS equipped automobiles are significantly more expensive to repair, which drives up insurance costs. Additionally, specialized personnel with the necessary system knowledge are required to fix DCS-equipped automobiles.

8. RESULTS

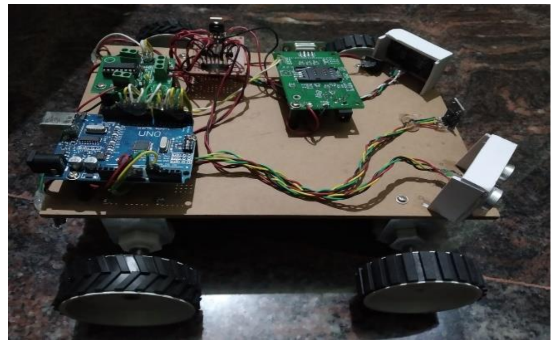

Fig. 8.1 Top view of the model

Fig. 8.2 Side view of model

8.1 Results in Blind spot detection

The outgrowth from this test shows a good performance of the ultrasonic detector in determining the distance of detected obstacles. Blind- spot monitoring is a accessible point set up in numerous new cars. While there’s still no relief for turning your head to check your eyeless spot, this type of monitoring system can help keep an eye on those spots that are hard to see with your glasses.

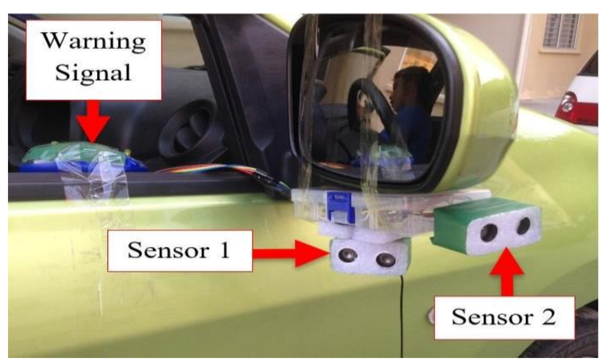

Fig. 8.3 Blind spot installation for on-road testing

8.2 Results in Pedestrian detection

Fig. 8.4 Output of the Pedestrian detection

These systems cover a vehicle's surroundings and should allow the driver and car to reply. Camera looks for people in the path of the car that may cross in front of the vehicle. Also, ABS automatically apply brakes when a driver doesn't reply in time.

8.3 Results in Line detection

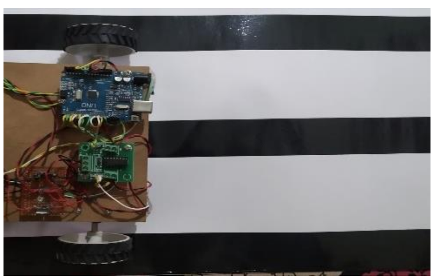

Fig. 8.5 Output of the Lane detection

The final result of the lane detection is shown. It outputs the area inside the detected lane marking in white colour to generate the driveable trajectory to send the control commends to the actuator.

8.4 Results in Accident indication

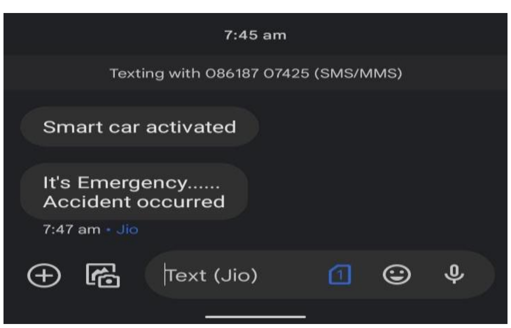

Fig. 8. 6 Output of the Accident indication

The detector connected to the car gets actuated in the case of any accident. Announcement dispatches will be transferred to the family members through the Global System for Mobile Communication GSM.

CONCLUSION AND FUTURE SCOPE:

Control methodologies for improving the performances of smart cars, have been actively developed and implemented.

Furthermore, one of the most notable areas of growth in the transportation business is road safety. As a result, automakers are developing a variety of driver aid technologies to make driving easier, reduce driver stress, and reduce the severity of accidents.

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