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Advanced Driver Assistance System with Location Identifier

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Abstract

The rules and regulations given by the government are violated by many peoples in many countries. Many car accidents occur due to the violation of the rules and regulations. In order to avoid the accidents, the driver assistance system (DAS) technology is used in the automobile industry. In the DAS, sensors are mounted on the front and side parts of the vehicle for sensing obstacles around the vehicle. Among these sensors, the ultra-sonic sensor and motion sensor is widely used in the DAS because it provides the obstacle information to the driver.

Keywords: RFID; Ultrasonic sensor; Motion sensor; Temperature sensor; embedded system.

1. Introduction

Nowadays road facilities are a major concern in the developed world. Serious accidents are associated with excessive road transportation and inappropriate speed. Driver Assistance Systems helps the driver in the driving process and it will increase the car safety and more generally road safety. In harsh driving situations, these systems warn and actively support the driver and, if necessary, it automatically takes decisions to avoid a vehicle collision.Using the RF communication, we are going to identify the locations like petrol station, hotels, etc., and also used to find the sign boards placed near the schools, hospitals, and the outputs will send to the driver. In embedded system part the various sensors are used to find the obstacles. If it detects means the alert will send to the driver. If the command received means the vehicle will automatically stop. When the vehicles enters into the RF region, it will automatically slow down the car speed, thus informs the location details using LCD display.

In our existing work, the sign boards which are used to avoid the accidents are not noticed by many drivers, so it is not an efficient to avoid the accidents. Some vehicle to vehicle accidents occurred near the traffic area as well as highway roads is due to the laziness of the driver. In order to overcome these problems we proposed a new system and it will assist the drive with a high degree of comfort.

2. System Architecture

The Driver assistance system adopts the PIC16F877A and the hardware architecture is shown in figure1. This system is initially used in cars, so the power supplied is vehicle supply system. Mostly in cars motor control system is operated by using a high voltage system and low power system for instrument and lighting. Thus the whole system adopts the supply of electricity from the car battery of 12V. The total work voltage of PIC16F877A and other external circuits is 5V. So it needs a voltage regulation chip LM7805. It will convert12V into 5V.

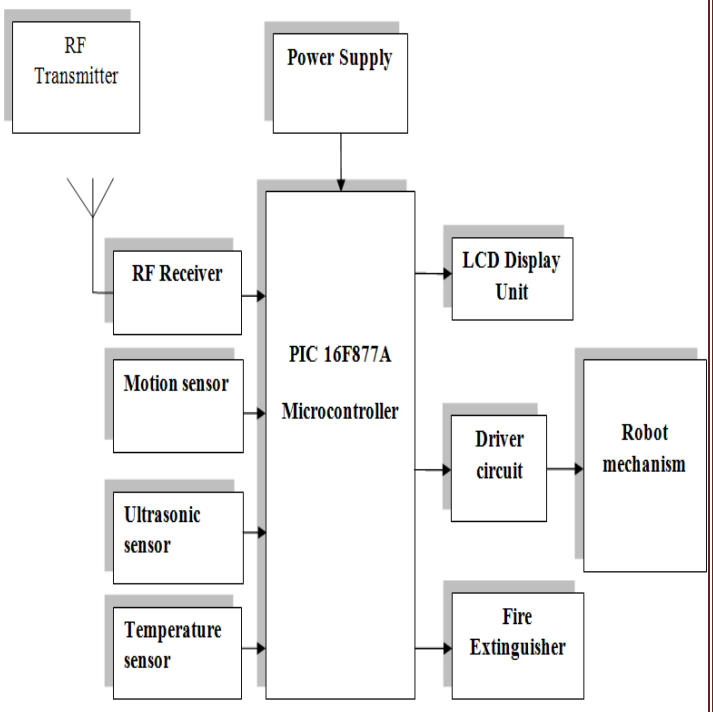


Fig1. Block Diagram representation of advanced DAS system

3. Hardware Design

3.1. Radio Frequency Identification:

The main idea offered by this paper is to use Radio Frequency Identification (RFID) technology to tag the warning signals where the road safety is much needed. The tag has a memory that stores additional data such as location details and an identification number. In RFID applications, the tags are attached or embedded into objects that are to be identified or tracked. RF signals might still be transmitted reliably. When the information is received from the zones, the vehicle's embedded unit automatically alert the driver, to reduce the vehicle's speed according to the speed range which is received from RF tag. Otherwise the embedded unit automatically reduces the speed. In tunnels or downtown areas GPS positioning might be unreliable, so the placement of RFID tags on that areas should provide an accurate vehicle localization.

3.2. Motion sensor:

With Motion sensor, even slight motions made by people will be detected easily. The Motion sensor used here is Passive infrared (PIR) shown in figure2.Since no energy is emitted from these sensors they are called passive sensors. PIR sensors are also called as pyro electric detectors. Thus the sensor is placed in the front

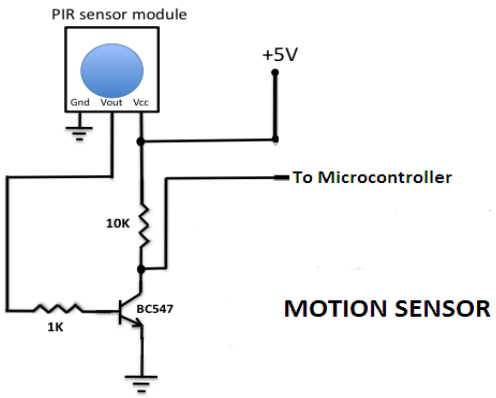


Fig2. Motion Sensor

portion of the vehicle and it will be active only when the vehicle exceeds the speed of 60km/hr. If it detects any movement which is closer and coming towards the vehicle means the system first alerts the driver or otherwise it automatically takes the decision to stop the vehicle using the ABS (Anti-lock Braking System) system. The sensor has fine motion detection capability with approximately 2 meter of sensor. Slight motion detection type sensor detects the movement of approximately 30cm.

3.3. Ultrasonic Sensor:

Ultrasonic sensors (also known as transceivers when they both send and receive) which compute attributes of a target by analysing the echoes from radio or sound waves respectively. This sensors generate high frequency sound waves and compute the echo signals which is received back by the sensor. These ultrasonic waves are produced by piezoelectric transducers. Sensor calculates the time intervals between the transmitted signal and received signal to determine the distance to an object. Thus the sensor is placed on the right and left side door in order to prevent the vehicle from sidewards collision.

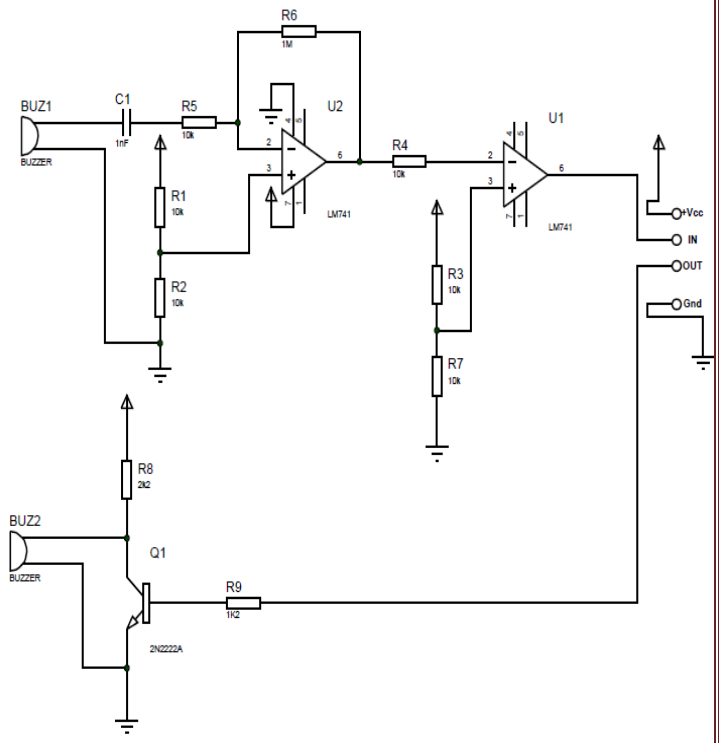


Fig3.Ultrasonic sensor

3.4. Temperature sensor:

The temperature sensor regularly monitors the temperature of engine as well as cabin and temperature values are sent to the microcontroller. If temperature of engine or cabin exceeds desire value then system alerts to driver and if any fire disaster happens means the embedded system automatically opens the fire extinguisher valve and saves the vehicle from fire. The LM35 Temperature sensors are more accurate than thermistors shown in figure4.

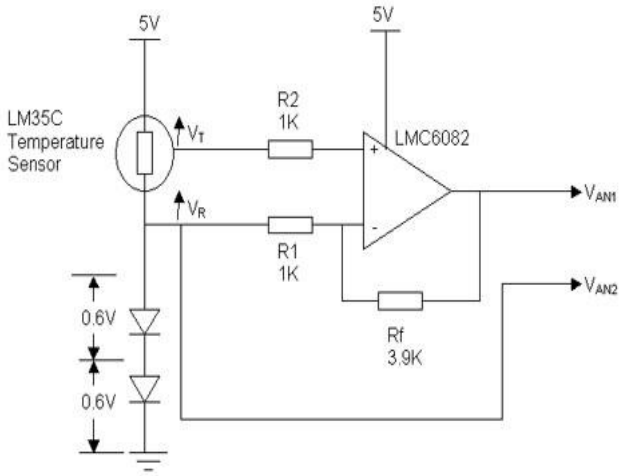


Fig4.Temperature Sensor

4. Working Module

The work of the Ultrasonic sensor is to detect obstacles in either side of the vehicles. It can detect obstacles up to 3m-4m of radius within the spherical curvature as shown in figure5. When an obstacle is detected in sides of the vehicle high frequency acoustic waves from either vehicle are emitted and these emitted waves produce an echo which is received by the vehicles as echo and reduces the speed of the vehicle. The acoustic waves produced in the sensor are of 4MHz.When any voltage applied to the ultrasonic sensor the size of the piezoelectric crystal changes which produces high frequency sound waves.

The speed of sound in air varies as a function of temperature is given as.

$$C(T) = 13{,}044\sqrt{(1+T/273)} \quad (1)$$

C (T) - speed of sound in temperature
T –Temperature of air in ° Celsius.

3.5. LCD Display Circuit:

The use of LCD display circuit is to display the location where the vehicle is exactly located, the system adopts SMC1602A LCD display. The LCD display unit has advantages such as lower power consumption, rich contents displayed, small volume, delicate and thin. The pin configuration is shown below and it is interfaced with PIC16F877A MCU.

Table1. LCD Pin configuration

PIN	SYMBOL	SIGNAL DESCRIPTION
1	VSS	GND
2	VDD	Power Supply
3	V0	Power Supply LCD Driver
4	RS	Register Select-LOW=Instruction, HIGH=Data
5	R/W	Read/Write LOW=MPU to LCM, HIGH=LCM to MPU
6	E	Enable R/W=LOW: Data are talking over at falling edge R/W=HIGH: Data can be read at E=1
7 to 14	DB0 to DB7	Data BUS-Software Selectable 4 or 8bit mode
15	BLK	Cathode of LED Unit
16	BLA	Anode of LED Unit

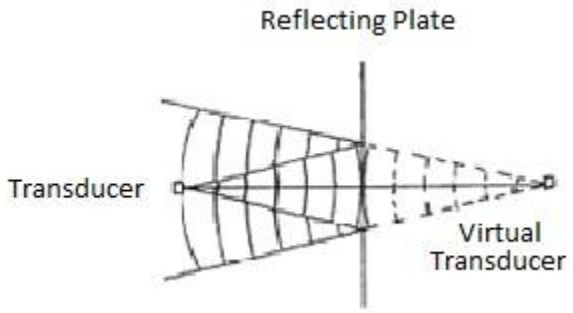


Fig5. Working of Ultrasonic Sensor

The Motion sensor is placed in front portion of the vehicle. The sensor detects disturbance in the infrared spectrum and detects the heat of a person or animal. The PIR sensor can detect levels of infrared radiation which is coming towards the sensor part. As the human body or any obstacle emits some hotter radiation which are more than the normally emitted radiations shown in figure6. Slow heat variations are detected by the sensors in the supervised area and in impact it reduces the speed of the vehicle as shown in figure7. The Motion sensors (PIR) have in fact a much wider range, between 8 to 12 micrometres. The heat transferred to sensor is by convection. The human's radiating energy in the infrared spectrum is 9 – 10 micrometres.

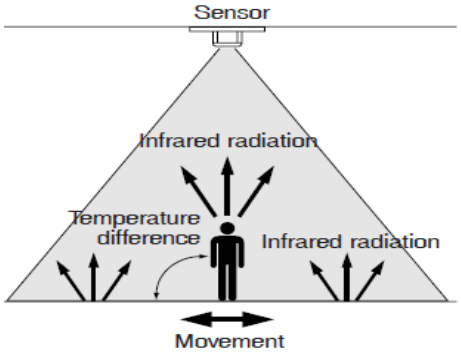


Fig6. Working of Motion sensor

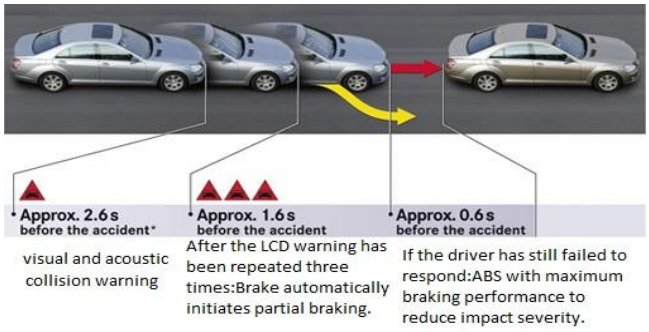


Fig7. Vehicle Collision Avoidance

The Temperature sensor monitors the temperature inside the vehicle. LM35 Temperature sensors are used here to record values. The LM35C is operated for -40° to +110°c range. The sensor uses plank law to measure temperatures. Thus the sensor contains a material that changes its resistance in accordance with the temperature value.

The change in the resistance is calculated. The output voltage is linearly proportional to centigrade temperature.The changes in the resistance values are measured by the voltage by increasing or decreasing. These output voltages values are converted to temperature using conversion factor given below.

Temperature (°C) = Vout * (100 °C/V) (2)

This obtained temperature value is checked with the threshold value (or) saturation value periodically and if the value gets deviated from the saturation value then the extinguisher valves automatically gets open to save the humans inside and prevents the vehicle from disaster as shown in figur8.

Fig8. Engine Fire Extinguisher

The Radio Frequency Identification (RFID) tags, this tag contain electronically stored information. These tags are placed in the road side sign boards i.e. the transmitter and the receiver is placed in the vehicles. The tags contain unique ID number and other additional data's. The passive type of Radio Frequency Identification is used here. The key use of Radio Frequency Identification tag is to reduce the speed of the vehicle. The Radio Frequency Identification consists of a transponder to store the processed information and contains modulating and demodulating circuit of radio frequency shown in figure9. It also contains an antenna for receiving and transmitting the signal. High frequency RFID systems (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) offer transmission ranges of more than 90 feet, and has limitations.

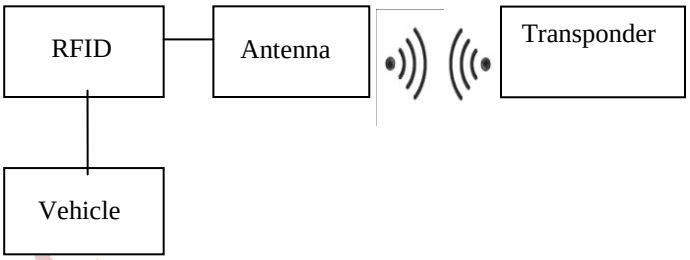


Fig9. RFID Transmission

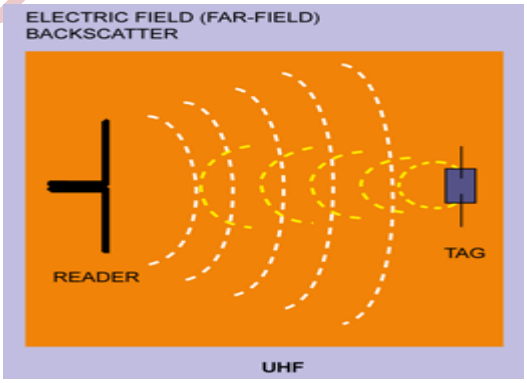


Fig10. Radio Frequency Identification

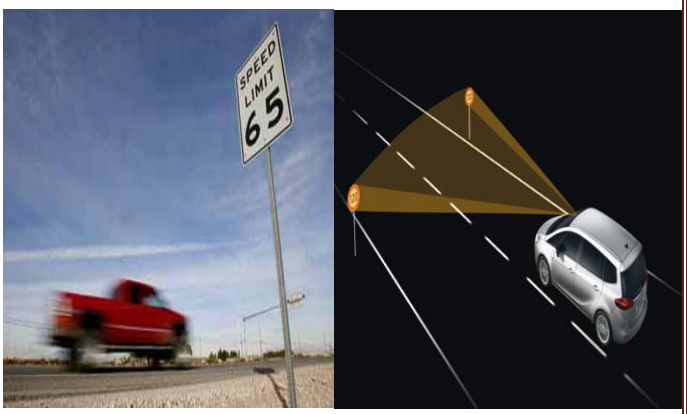
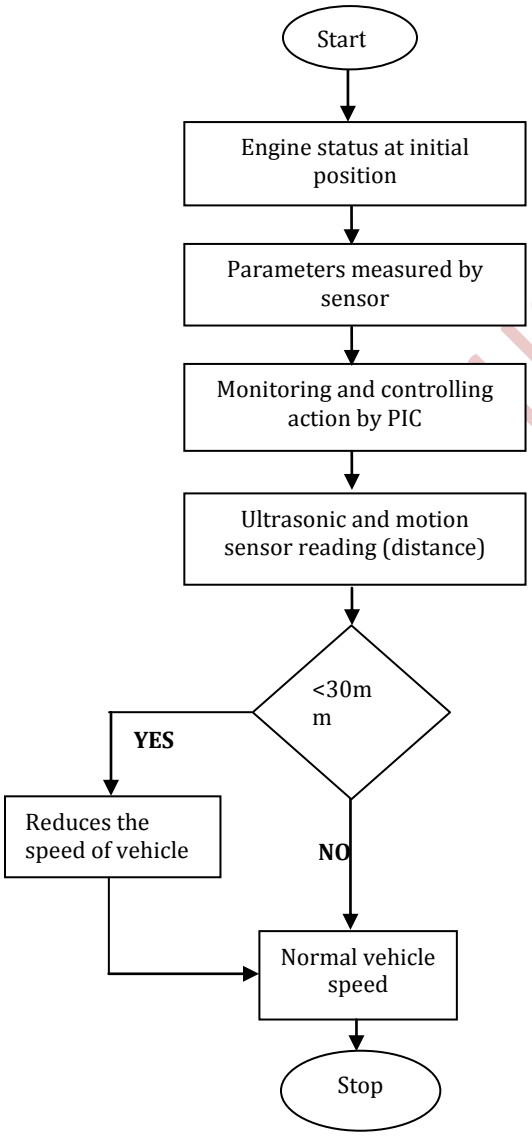


Fig11. Speed Limit Sign Boards

When a vehicle enters the school or any other safety regions where these tags are placed it automatically reduces the speed of the vehicle .The signal transmitted from the tags in the sign boards are received by the vehicle and displayed in the LCD screen as shown in figure11. If it is not noticed by the driver then the vehicle automatically travels in the speed limit coded in the Radio Frequency Identification tags. The maximum range with low frequencies (LF) is 50 cm, with high frequencies (HF) 1 m, with ultra-high frequencies (UHF) 7 m shown in figure10, and with micro-wave frequencies more than 10 m. These above frequency values given are the distance within which the vehicle speed is controlled. By using this we can avoid many accidents which are happening around schools, hospital and pedestrian regions.

5. Flow chart



6. Future Scope

In Future, Radio Frequency Identification tags will find their own space in our environment. Nowadays the vehicle traffic and usage becomes very high. The future scope of our system is to avoid the vehicle accidents, fire accidents and to identify the position the vehicles. In the next phase of our project we have planned to implement it in the real world entity. We use pneumatic cylinders interfaced with embedded part to reduce the speed of the vehicle. The drivers will be assisted more than today's trend in their comfortable journey. In this system further we can add a voice alarm to get the driver attention and make the drive faster and safer. The system can also be enhanced with active type radio Frequency Identification tags to increase the coverage area of the communication range. Narrow range of sensors can be replaced by wide range of sensors with low frequency.

7. Conclusion

This system is very easy to implement on current system with low cost and durable, ensures maximum safety to passengers and public. The DAS system is further enhanced by automatic speed control when the vehicles get any hazard signal from outside environment and uses sensor information to avoid potential accidents. The automatic fire extinguisher also improves the vehicle safety from fire accidents and the whole DAS system will assists the driver with a high degree of comfort. From this system the driver gets all information's around the vehicle without distracting his/her attention.

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