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Design and Implementation of an Arduino-Based Accident Prevention System

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Abstract: *Road accidents are uncertain but whenever they occur causes damage, serious injuries and sometimes even death. These accidents are mostly caused due to delay of driver in hitting the brakes. Presently we are at the phase of effectively keeping away from mishaps as well as giving greatest security to the vehicle tenants and people on foot. Accidents occur due to three main reasons: first is front end collision that happens due to lack of knowledge of distance between two vehicles. Secondly due to engine overheating that may lead to fire in vehicle and thirdly due to over speeding. In this paper, the proposed system has an ultrasonic sensor for collision avoidance. Vehicle overheating may happen due to many reasons and one of the normal reasons is failure of cooling fan. Mostly, vehicle driver is ignorant about cooling fan malfunction and when malfunctioning is determined, it might be too delayed and cost a lot to fix the damage. Heat produced by engine need to be dissipated otherwise engine might be seriously damaged. With the help of the proposed system, vehicle driver is timely informed about cooling fan failure through an indicator that will illuminate with beep sound. In addition, to intimate driver about over speeding this system sends an alert message with beep sound.*

Keywords: *Accident prevention, temperature sensor, ultrasonic sensor, Arduino, speed sensor*

INTRODUCTION

According to the global road safety annual report, as many as 1.24 million people die each year in various road accidents occurring throughout the world. Apart from the above-mentioned death toll, almost 50 million people become victim of critical life-altering injuries. Collision avoidance system focuses on cutting edge thoughts, for example, pre-crash detecting[1]. A ultrasonic sensor is utilized to detect the article before the vehicle[2] and makes a motion to the microcontroller unit. In view of the sign got from ultrasonic sensor, the microcontroller unit conveys an alarm message to the driver so driver can make a vital move. A collision avoidance system, also known as a pre-crash system, may also be named forward collision warning system or collision mitigation system. This is an automobile safety system designed to prevent or reduce the severity of collision. Mostly, car drivers don't have the foggiest idea what has caused the vehicle to overheat abruptly in the center of the traffic jams or driving along the slopes. Sometimes car drivers stop at the side of the road and wait for the vehicle to cool down and check water level of the radiator water tank. After that, car drivers continue their drive without knowing in reality the cooling fan had failed. The engine may be critically damaged because overheating of engine and will cost a lot of money in fixing it. There are several factors which lead to vehicle overheating such as leakage in cooling system, leakage in water pump, radiator pipe breaking up, plugging or unclean radiator and overworking of engine. Hence, the engine overheating alert system helps to know the condition of the engine and also warn the driver when engine overheating occurs. As the number of vehicles on the roads is growing managing vehicle speed to avoid accidents is utmost important. On an average, one person dies by vehicle crash in every minute. Therefore, there is a need to provide an easy to use and more flexible road traffic management system for monitoring the speed of moving vehicles on the roads. Our main objective here is to design a system to supervise temperature of car engine, the speed of vehicle[3], obstacles along the path of car and also make out the chances of collision and give caution[10] to the driver.

COMPONENTS REQUIRED FOR SYSTEM DESIGN

The hardware part consists of:

1. Arduino UNO-Arduino microcontroller is an easy to use yet power full single board computer. The Arduino is open source Software. The board features an Atmel ATmega328

microcontroller operating at 5V with 2KB RAM and 32KB flash memory for storing programs and 1KB EEPROM for storing parameters.

2. Ultrasonic Sensor (HC-SR04)- The HC-SR04 Ultrasonic distance sensor comprises of two ultrasonic transducers. One goes about as a transmitter which changes electrical signal into 40 KHz ultrasonic sound pulses. The receiver receives these pulses and produces an output pulse whose width can be used to determine the distance the pulse has travelled. The sensor is small in size, simple to use and offers superb non-contact range detection between 2 cm to 400 cm with an accuracy of 3mm. The sensor operates on 5V supply.

3. Temperature Sensor (LM-35)- LM-35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade.

4. Potentiometer-A potentiometer is a three-terminal device with a sliding or rotating contact that forms an variable voltage divider.

5. Motor-DC motors are rotary electrical machines that convert electrical energy into mechanical energy (Rotation).

6. Motor Driver- L298N Motor Driver Module is a powerful motor driver module for driving DC and Stepper motors. This module comprises of an L298 motor driver IC and a 78M05 5V regulator.

7. Buzzer-A buzzer or beeper is an audio signaling device.

The software part consists of:

1. Arduino IDE-After successful completion of hardware connections, now it's time for programming the Arduino UNO.

DESIGN AND IMPLEMENTATION OF ACCIDENT PREVENTION SYSTEM

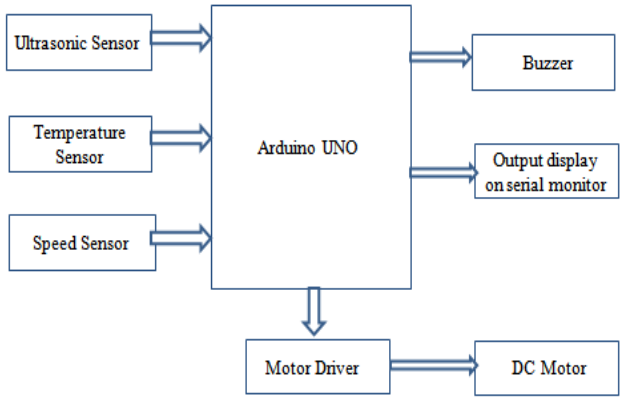

Figure 1: Block diagram of proposed system

Ultrasonic sensor, temperature sensor and speed sensor[4] provide inputs to microcontroller unit. If the input values exceed the threshold, warning signal/message is produced on the display of the vehicle and driver is intimated about the fault in the vehicle.

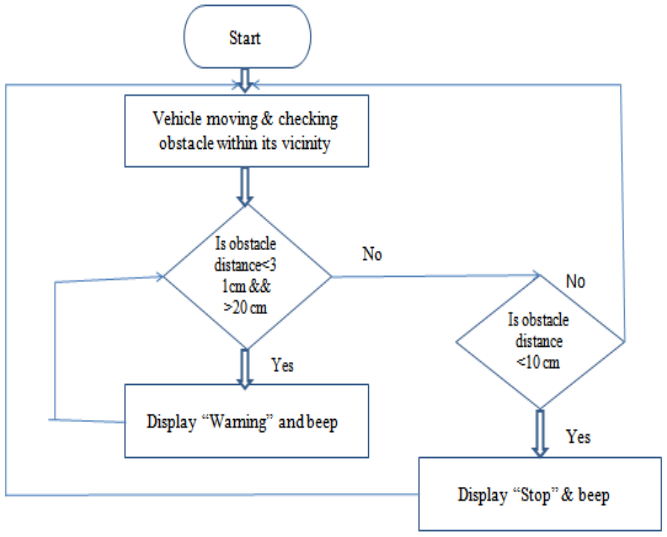

Figure 2: Flow diagram of vehicle collision avoidance system[6,8]

The ultrasonic sensor of the system measures the distance between the said vehicle and the vehicle in its vicinity. It the separation between the two vehicles is less than 31cm then the message "warning" is produced on the display unit and beep sound is also generated. If the separation become less than 10 cm then the message "stop" is displayed and beep sound is also generated.

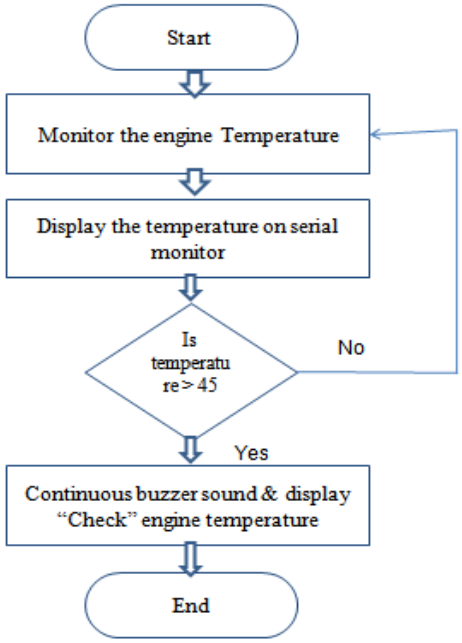

Figure 3: Flow diagram of engine overheating protection system[9]

LM-35 temperature sensor of the system measures the engine temperature. If it is more than 45 degree centigrade, buzzer rings continuously and message "check" is produced on the display unit.

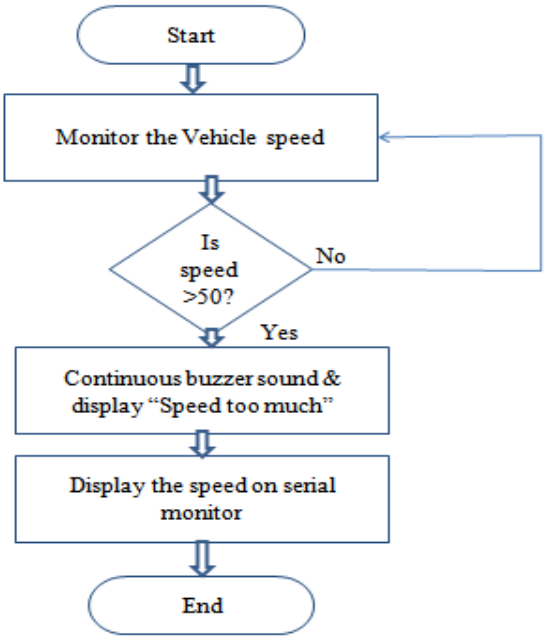

Figure 4: Flow diagram of vehicle over speeding detection system[5,7]

The system monitors the speed of the vehicle. If it is more than 50 kmph, message "speed too much" is produced on the display unit.

RESULT AND DISCUSSION

In collision detection check, the proposed system showed its competence to sense collisions and, consequently, give a caution. The engine overheating check confirmed the ability of the system to evaluate engine temperature and thereby taking suitable action i.e. displaying caution messages on serial monitor. The over speeding of vehicles can be checked by this system and speed is displayed on serial monitor and also beep sound is produced when speed of the vehicle goes beyond the threshold. The temperature, distance and speed sensors are used to collect vehicle data with Arduino UNO microcontroller.

CONCLUSION

In this system, the vehicle collision avoidance, engine overheating protection and vehicle speed detection system has been incorporated. The ultrasonic sensor is used to detect the vehicles in the vicinity and indication is given by buzzer so that accident can be avoided at a turning point. The engine overheating system monitors the temperature of the engine so that if temperature threshold is exceeded caution messages are displayed on the serial monitor. To minimize accidents due to over speeding, speed checker and alarming system is present.

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