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Designing a Low Cost Autonomous Car for Collision Prevention with Vehicle Tracking and Intercommunication between Cars

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Abstract— This paper describes the design of a low budget autonomous vehicle using a modified with a GPS, ultrasonic sensors, intercommunication keys and various sensors to monitor the vehicle condition with obstacle avoidance and vehicle tracking system. The focus of the project was to determine how much capability could be achieved on a minimum budget. A budget shows that high performance can be readily achieved using low cost microcontroller and commercially available instrumentation. Since the system is battery operated, attention is given to power consumption. The largest challenge in developing low risk autonomous vehicles is keeping the cost down. Leveraging from low cost instrumentation developed for high volume consumer applications, inexpensive microcontrollers, ultrasonic sensors and a global positioning systems result in a low-cost autonomous vehicle that will navigate to a desired location with obstacle avoidance.
Index Terms—Component, formatting, style, styling, insert.

I. INTRODUCTION

Currently, vehicles are often equipped with active safety systems to reduce the risk of accidents, many of which occur in the urban environments. The most popular include Antilock Braking Systems (ABS), Traction Control and Stability Control. All these systems employ different types of sensors to constantly monitor the conditions of the vehicle, and respond in an emergency situation. [2] In this paper the use of ultrasonic sensors in safety systems for controlling the speed of a vehicle is proposed. An intelligent mechatronic system includes an ultrasonic wave emitter provided on the front portion of a car producing and emitting ultrasonic waves frontward in a predetermined distance [6]. An ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle. Then a microcontroller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purpose [3].

Autonomous vehicles are equipped with a variety of instrumentation and controls. One of the biggest challenges in developing low risk autonomous vehicles is keeping the cost down. Leveraging from low cost instrumentation developed for high volume consumer applications, inexpensive microcontrollers, ultrasonic sensors and a global positioning systems result in a low-cost autonomous vehicle that will detect the collision and control the speed of vehicle.[1] This paper describes the design of a low budget autonomous vehicle using a modified with a GPS, ultrasonic sensors, intercommunication keys and various sensors to monitor the vehicle condition with obstacle avoidance and vehicle tracking system. The focus of the project was to determine how much capability could be achieved on a minimal budget. A budget shows that high performance can be readily achieved using low cost processors and commercially available instrumentation. Since the system is battery operated, attention is given to power consumption [7].

II. RELEVANCE

Driving is a compulsory activity for most people. People use cars to move from one place to another. The number of vehicles is increasing day by day. It is produced tacked tightly and risk to accident. Nowadays, the numbers of accident is so high and uncertainly. Accidents occur frequently and cause worst damage, serious injury and death. These accidents are mostly caused by delay of the driver to hit the brake. This project is designed to develop a new system that can solve this problem where drivers may not brake manually but the vehicles can stop automatically due to obstacles [3].

The main target for this project is intercommunication between two cars, vehicle tracking monitoring and automatic braking system. In this project cars can run automatic braking due to obstacles when the sensor senses the obstacles. The braking circuit function is

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to brake the car automatically after received signal from the sensor and intercommunication facilities between two cars is also designed for emergency purpose [5].

The one of the most important objective of the projects is vehicle monitoring for various sensors and real time vehicle tracking using GPS. In this project vehicle will also sense the signal status and control the vehicle using signal status, if the signal status is green then vehicle will operate in normal mode, but red signal is detected the vehicle will be operate in automatic breaking mode[4].

III. LITERATURE REVIEW

The present invention relates generally to a collision avoidance control system which works to initiate collision avoidance action when the danger of possible collision with a target present ahead of a vehicle is encountered. Automotive collision monitor systems are known which work to estimate stopping distances of a system-equipped vehicle and a target preceding vehicle travelling ahead of the system equipped vehicle and locations of the system equipped vehicle and the target preceding vehicle after the elapse of a preset time to determine the danger of possible collision with the target preceding vehicle based on the stopping distances and the locations. For instance, Japanese Patent First Publication No. 08-132996 teaches such estimation of the stopping distances. Japanese Patent First Publication No. 05-181529 (corresponding to U.S. Pat. No. 5,473,538) teaches such estimation of locations of the system-equipped vehicle and the target preceding vehicle. It is, however, impossible for the above systems to determine the degree of deceleration to be produced in an automatic braking device of the system vehicle to avoid collision with the preceding vehicle based on the determination of the danger of possible collision. The systems, thus, need to perform an additional operation to determine a control variable to decelerate the system-equipped vehicle.

Japanese Patent First Publication No. 11-066495 teaches a collision avoidance control system which uses an inter vehicle distance between the system-equipped vehicle and the target preceding vehicle, a relative speed between the system equipped vehicle and the target preceding vehicle, a minimum distance to be reserved between the system-equipped vehicle and the target preceding vehicle, acceleration of the target preceding vehicle, and a preset deceleration of the system-equipped vehicle to derive a quadratic function in terms of conditions required to avoid accidental collision with the target preceding vehicle and determines the possibility of the collision using a parabola, as represented by the quadratic function. Specifically, this system increases the preset deceleration of the system-equipped vehicle cyclically and determines the possibility of the collision based on the orientation of the parabola, an inclination of a straight segment of the parabola, coordinates of the straight segment of the parabola, and a predefined parabola determining equation in each cycle to bring a target deceleration used in deceleration control into agreement with a value of the preset deceleration when it is determined that there is almost no possibility of the collision.[1,2]

A collision avoidance control system comprising a travel control apparatus working to determine a target acceleration as functions of a distance to the target object and the relative speed and to decelerate or accelerate the system vehicle based on the target acceleration to control a travel condition of the system vehicle, and wherein the deceleration control activating threshold value is set greater than a maximum deceleration controllable by the travel control apparatus.

IV.BLOCK DIAGRAM

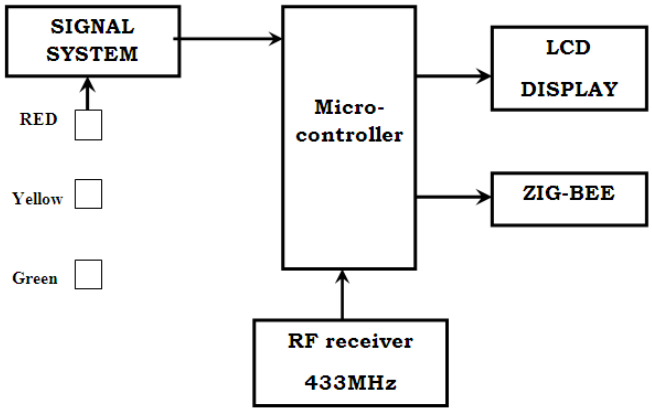

Fig. 1 Signal Unit

The proposed system will be designed to avoid a direct collision between two cars. For this system design the two car models that

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represent to cars. Here the car will be equipped with an ultrasonic sensor which will continuously track for any obstacles from the front side. If the obstacle / car are detected then the microcontroller will continuously compare the distance given by the ultrasonic sensor. If the next car is at a safe distance then the car will keep going at the same speed. If the distance keeps reducing indicating that the front car is coming closer to the current car then the microcontroller will start applying breaks until the distance is within safe parameters... This process will continue in a loop until the car comes to a Stop.

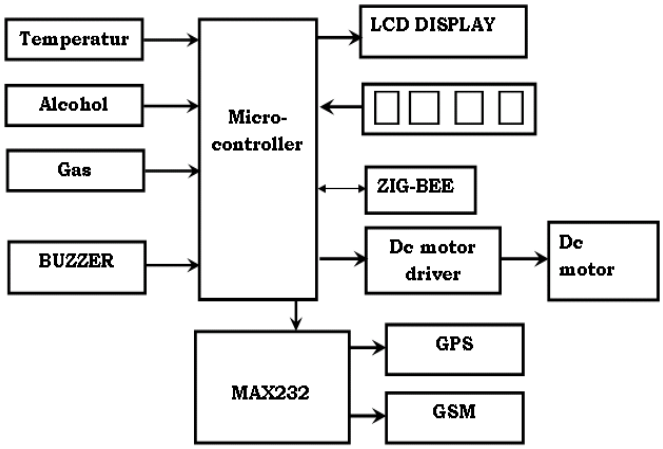

Fig. 2 Car 1 Unit

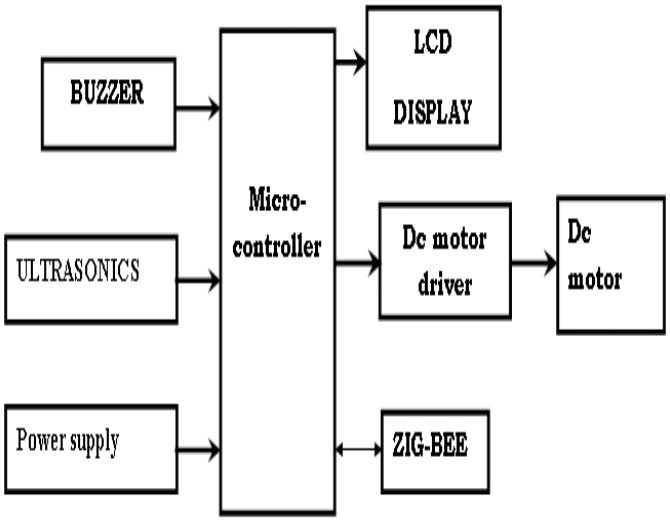

Fig. 3 Car 2 Unit

Safe distance is always maintained between the two cars and thus accident can be avoided. Also we are interfacing 3 IR sensors which are connected to the 3 sides of the car to detect any proximity to the car. The IR sensor will give a pulse to the microcontroller; the microcontroller will turn on the buzzer which will alert the driver in time to avoid the accident.

The proposed system will be make a DC motor based BUGGY. The microcontroller will increase and reduce DC speed control via Pulse width modulation. The microcontroller will increase or decrease the ON time and OFF time of the entire pulse time. If we decrease the ON time then the voltage applied to the DC motor will reduce and the speed of the DC motor will be reduced.

The proposed system will be designed in which the cars that are close by can communicate with each other on a RF link. The cars can communicate about the current speed. The speed of the car in front of the car is constantly monitoring the speed. If the speed decreases suddenly the car behind comes to know about it instantly and the breaks are applied avoiding a possible accident. The cars can also communicate about the traffic condition, Weather condition etc.

The proposed system also the car is able to communicate with the signalling unit which will provide the status of the signal to the

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car. The Car unit will then calculate the distance between the signal and the car itself and will reduce the speed accordingly which will improve the overall mileage of the car.

The proposed system will also monitor the car parameter using various sensors. Sensors are placed throughout a car that wirelessly sends data back to a central terminal

Data displayed on LCD

GSM is used to transmit Data to server unit

Visual Warnings will be given if a sensor detects something has fallen below the threshold.

Buzzers are used in a system to indicate or to grab the attention regarding an emergency situation occurred. Buzzer act as a panic horn which indicates the need of instant attention as the condition goes haywire.

The dc motor driver is capable of driving 2 dc motors at a time. In order to protect the dc motor from a back EMF generated by the dc motor while changing the direction of rotation, the dc motor driver have an internal protection suit, which also provide the back EMF protection suit by connecting 4 diode configurations across each dc motor.

LCD is used in a project to visualize the output of the application. The 16x2 LCD which indicates 16 columns and 2 rows. So, we write 16 characters in each line. So, total 32 characters will be display on 16x2 LCD.

Ultrasonic sensors are used to measure the distance. The ultrasonic sensor works on Doppler Effect. It consists of an ultrasonic transmitter and a receiver. The transmitter transmits the signal in one direction. This transmitted signal is then reflected back by the obstacle and received by the receiver. So the total time taken by the signal to get transmitted and to received back will be used to calculate the distance between the ultrasonic sensor and the obstacle.

The proposed system will add an application that is four Emergency keys. If any key will be pressed then by the use of zigbee transmission the messages will be passed to the near vehicles.

The GPS unit sends the co-ordinates to the microcontroller which stores these co-ordinates in its ram location. Also various other parameters are also stored in microcontroller. Then after a specific time microcontroller sends this data to the base unit (surveillance unit) with the help of on board GSM modem with help of AT.

The base unit after receiving the co-ordinates displays them on the visual basic software on board the pc. The position of the vehicle is then displayed on the Google map of VB software. Thus the owner can not only track the vehicle but also know the reasons of accident by analyzing various parameters of engine such as temperature, fuel level, speed etc.

V. OBJECTIVES

A. Design the Low Cost Autonomous Vehicle

By using microcontrollers, ultrasonic sensors and a global positioning systems result in a low-cost autonomous vehicle that will navigate to a desired location with obstacle avoidance.

B. Monitor the Vehicle

The one of the most important objective of the project is vehicle monitoring for various sensors and real time vehicle tracking using GPS. Vehicle will also sense the signal status and control the vehicle using signal status, if the signal status is green then vehicle will operate in normal mode, but red signal is detected the vehicle will be operate in automatic breaking mode.

C. Collision Detection and Accident Avoidance With Vehicle Tracking

Cars can run automatic 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. If the car speed decreases then breaks will be applied to avoid the possible accident.

D. Intercommunication Between Two Vehicles

The system in which the cars that are close will communicate with each other on a RF link. The cars will communicate about the current speed. The cars can also communicate about the traffic condition, Weather condition etc.

E. Vehicle Tracking Using Google Map

The system tracks the vehicle and real time accident monitoring on PC (VB software) using Google map.

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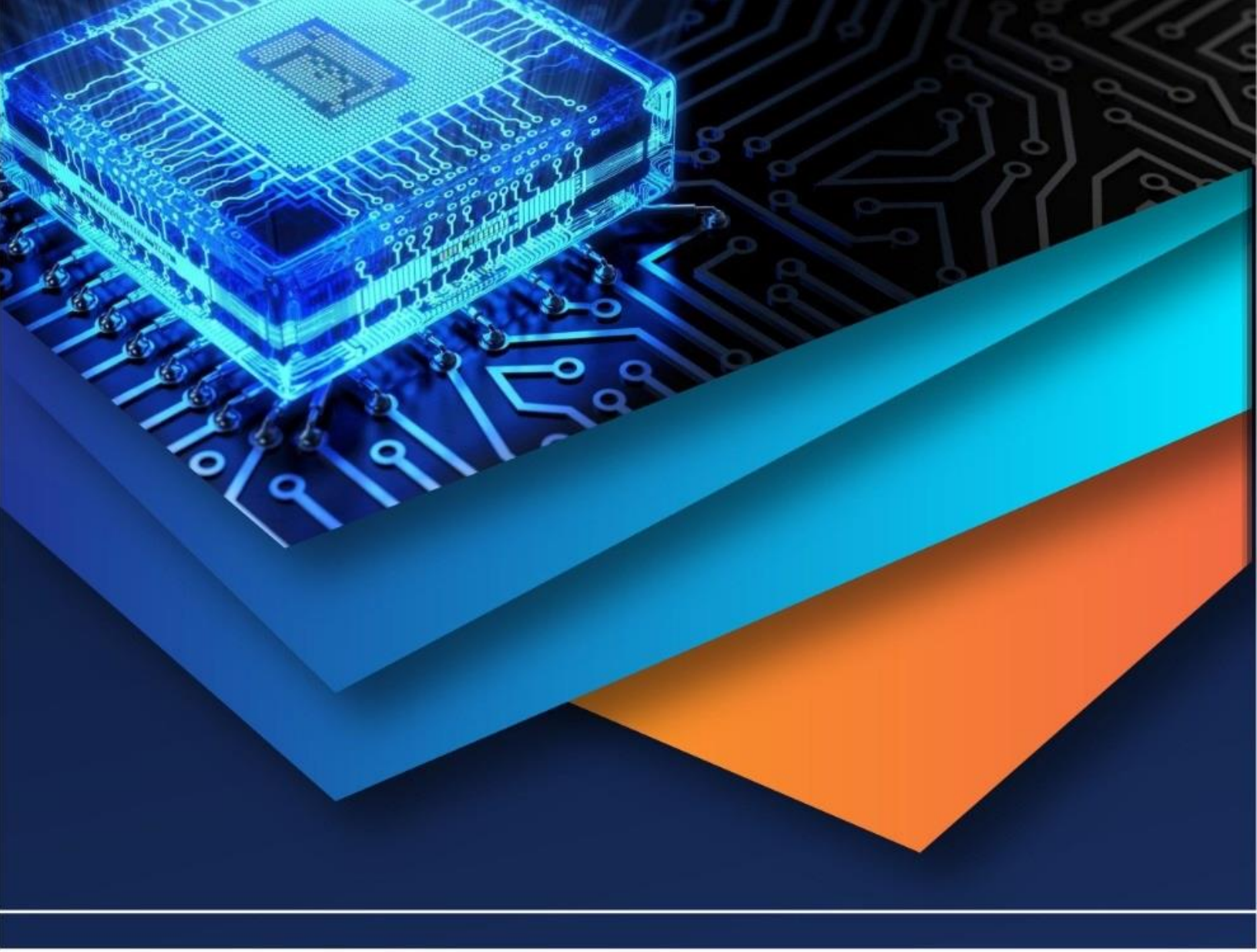

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