COLLISION WARNING SYSTEM USING CAN PROTOCOL

Dr. N. Sathish Kumar[1], K. Raj Prasanth[2], J. Shyam Sundar[3], G. Allen Wilson[4]

1 professor, Electronics and communication, Sri Ramakrishna Engineering college, Tamil Nadu, India
2 Student, Electronics and communication, Sri Ramakrishna Engineering College, Tamil Nadu, India
3 Student, Electronics and communication, Sri Ramakrishna Engineering College, Tamil Nadu, India
4 Student, Electronics and communication, Sri Ramakrishna Engineering College, Tamil Nadu, India

ABSTRACT

This paper deals with Collision warning systems that are used to improve safety and reduce accidents on the road. Most Accidents are caused by severe injury and death by delay to apply the brake pads. Light-based ranging Lidar sensor is placed front-end of the car to warn the driver in case of any pedestrian or vehicle is detected it applies the brake pad gradually during high-speed driving. The CAN protocol act as a communication transceiver that is interconnected with all the nodes for data transfer. CAN protocol is used to transmit and receive the data at a higher speed of 1Mbit/s to get a quick response. The higher priority identifier always wins bus access to transfer the data. Lidar sensor data is calibrated in distance (cm) used to give a warning signal during the collision scenario and output taken for applying the Brake Pad in a micro sec to reduce the latency delay. Output parameters are sensor input data and time taken to apply the brake to reduce the automatic emergency braking system latency to avoid a collision.

Keyword: *Collision warning systems, CAN protocol, reduce the latency, automatic emergency braking system similarity*

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1. INTRODUCTION

A Collision Avoidance System is also known as an advanced driver-assistance system designed to prevent or reduce the severity of a collision. In collision warning system monitors the distance between the vehicles to provide a warning to the driver if the vehicles get too close, potentially helping to avoid a crash. LIDAR sensors are used to detect an imminent crash. Rear-end Vehicle and Pedestrian are detected to avoid Collision to activate the vehicle braking system to decelerate the vehicle speed to avoid a collision. As considered in some research projects Collision avoidance system is the interaction between lidar and Breaking ECU through the high-level CAN Protocol. The CAN Transceiver is used to interconnect those CAN nodes with reliable communications among sensors ECU and Breaking ECU.STM32 is a Nucleo board, the STM32Cube software packages come with several development environments including IAR EWARM, Keil MDK-ARM, and GCC/LLVM-based IDEs. The main objective of this project is to avoid collision by sensing the fore coming vehicle through radar and immediately stopping the vehicle by applying brake pads.

2. LITERATURE SURVEY

2.1 Development of Autonomous Emergency Braking control system based on road friction

I-Chun Han discussed about the AEB is one of the important vehicle active safety functions to avoid or mitigate a collision. In general, the AEB system employs a Time-To-Collision to measure the potential danger of impact into obstacles. Time-To-Collision is the smaller threshold to activate the braking system. road condition is intricate and can change at any time. The estimated peak road friction is then used to obtain the braking threshold of TTC. Since road friction can be identified in real-time, the proposed AEB algorithm can adapt to different road surfaces. The simulation results show that the proposed control strategy has better performance than that of the conventional one.

2.2 Control system design for an Automatic Emergency Braking system in a sedan vehicle

O. Garcia-Bedoya discussed the Automatic Emergency Braking (AEB) system in vehicles is one of the technologies suggested by NHTSA to be included in vehicles by default. This article presents the dynamic model of the vehicle that should be considered to design control of the EAB system. After that, the design of a classic controller is presented, following some results of simulations, which let to identify variables to measure the comfort of automatic braking, and when and in which conditions the ABS systems act over the action of AEB.

2.3 Can-Based Accident-Avoidance System

Mayur Shinde discussed about Safety is generally the most significant property of automotive systems, and it is further improved by Advanced Driver Assistance Systems in modern automotive systems. To support advanced autonomous functions are connected. From the perspective of in-vehicle architecture communication. The Controller Area Network (CAN) protocol has been the focus of automotive security studies and has no direct support for security projection. A collision avoidance system is an arrangement of sensors, microcontrollers, and buzzers that are placed within a car to alert its driver of any dangers that may lie ahead on the road.

3. METHODOLOGY

3.1 Overall Block Diagram:

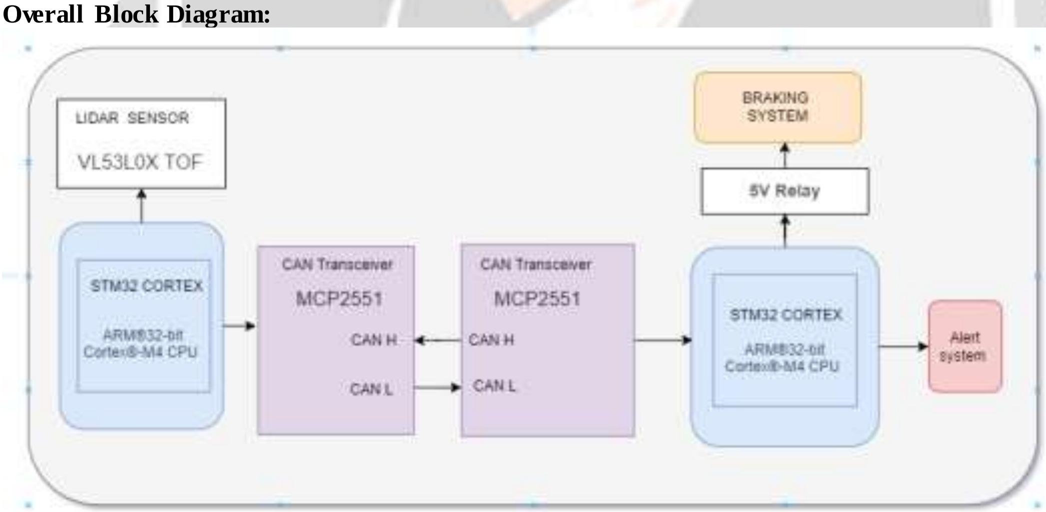

Figure 3.1 Block Diagram

Collision warning system the microcontroller unit forms the brain of all the control operations. In this block, the STM32F407VG development Board is access to all the sensors and actuators. The 16x2 LCD display is used in our project to display the overall functionality of the project and the status of the distance step by step. The objective of this project is to avoid collision by sensing the fore coming vehicle through radar and immediately stopping the vehicle by applying brake pads. Lidar sensor systems allow Pulse and reflection to mapping professionals to examine both natural and manmade environments with accuracy, precision, and flexibility. light detection and ranging system used to map and elevate models' information to assist in emergency response operations, and in many obstacles.VL53L0X is a laser-ranging module that provides curates distance measurement of the target reflectance range used as conventional data. It can measure up to 2m performance levels. MCP2551 CAN transceiver interfaces between a CAN protocol controller using the physical bus.

It can achieve Data transfer speeds up to 1 Mb/s in a CAN system device. It transfers sensors signal that can be communicated at high-speed to avoid a collision, CAN controller signals are transferred over the CAN High and CAN low buses. STM32Cube MCU Packages generic embedded software components required to develop an application on Arm Cortex STM32f407VG microcontrollers. STM32Cube initiative, this set of features is highly portable within all STM32 Series. Thus, in our project, the hardware we have used LIDAR, STM32F47VG NUCLEO, CAN transceiver, Relay, and LCD display are integrated with Software and algorithms to calculate to determine if there are any potential obstructions present. The simplest waring systems with beep sound at this point three level will hopefully it warn to drive away from the obstruction. In some cases, the driver's miss to control system may also pre-charge the brakes with an emergency brake assistance system. The braking system works when the sensor is detected by any pedestrian or vehicle in <1 meter and gradually applies the brake which may effectively reduce the severity of an accident.

3.2 Algorithms

Step 1: Initialize the System

Step 2: Get the Sensor Data

Step 3: If Sensed Data <15cm and >5cm go to Step 4, else go to Step 5

Step 4: Warning to the driver through the buzzer, go to Step 6

Step 5: Reduce speed and gradually activates the brakes.

Step 6: Continue with Step 2

3.3 Pseudo Code for Main File

LOOP

HCSR04_Read Data

HAL ADC Data Start(&hadc1)

if (HAL ADC Poll for Conversion (&hadc1, 10) ==HAL_OK)

Read The ADC Conversion Result & Map It to PWM Duty Cycle

Function to Add message for transition

HAL Delay For 500

HAL UART Transmit (&huart1, &a,1,100)

HAL Delay for 200

Print the Display the Distance

HAL Delay for 1000

This explains the Methodology and implementation code of the Vehicle collision avoidance system algorithm. Pin and Port configuration Method. Pseudo code for the main file for STM32F407VG Nucleo64 Development Boards.

4 RESULTS AND DISCUSSIONS

In this Forward collision avoidance system using CAN protocol connected between transceiver node1 and transceiver node 2 connected with CANH and CANL bus. These buses transfer data from the Sensor module to ECU. When any pedestrian or vehicle is detected in front of the vehicle sensor signal is processed and sent the signal to the Brake Module to warn the driver through Beep Sound and apply the automatic braking System gradually before the collision occurs. This will help to reduce and avoid the collision. Figure 5.1 given below, shows the flowchart of braking system.

4.1 Flow Diagram of Braking System

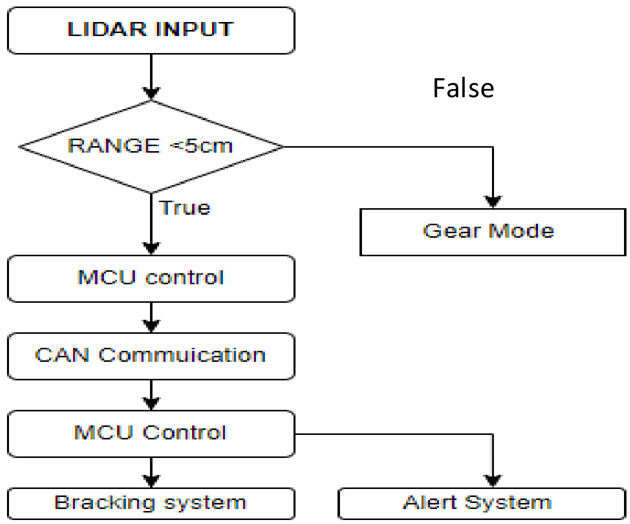

Fig 1: Flow Chart of Braking System

4.2 Hardware implementation output

Fig 2: Hardware Break Setup **Fig 3:** Lcd Display

The output of implemented in the Navigator using CAN Protocol. It shows the input distance in cm and the output measure time taken to apply the Brake Pad in Milli's second parameters. This terminal shows the latency of the CAN transceiver and the time taken to apply the Brake. Data Rate 1 Mb/s maximum. The CAN transceiver allows three modes of operation to be selected at High-Speed, Slope-Control, Standby

4.3 Time Taken to apply brake pad

S. No	Forward Range in Cm	Braking Time taken in (Sec)
1.	1.5	0.8
2.	2.3	1.09
3.	3.5	1.67
4.	4.8	1.8
5.	5	2.36
6.	6	2.5
7.	7	2.8
8.	30	0

Table 1: Time Taken to apply brake pad

4.4 Graph of Time Taken to brake

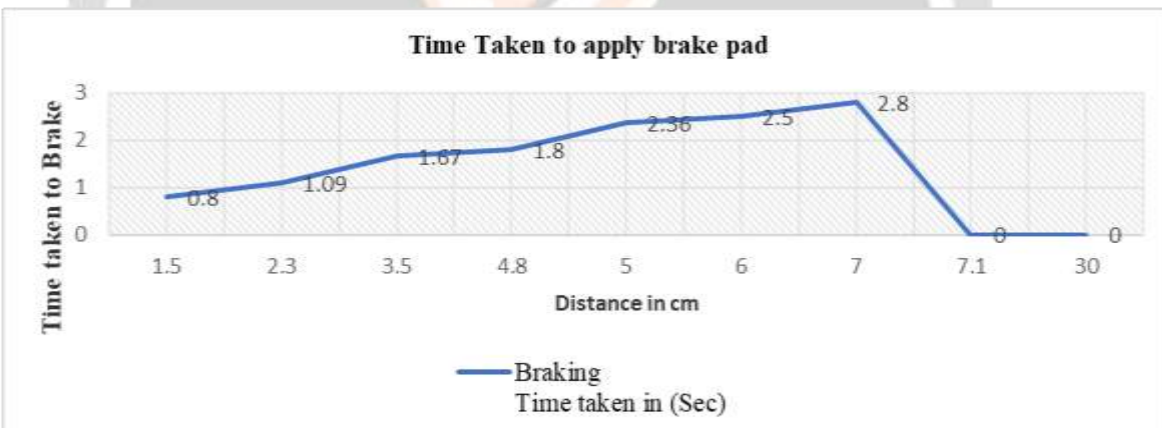

Chart 1: graph of Time Taken to brake

Table 5.1 shows the classified parameters of estimation time taken, latency accuracy, and test accuracy. As accuracy increases the sensitivity and specificity of the decreased latency. The experimental results of the working prototype model. This shows the experimental results at various stages of a prototype implementation. Based on the output, readings have been calibrated and the graph has been plotted.

5 CONCLUSION

In Collision avoidance systems used to reduce the road accidents. the lidar Sensor is mounted on vehicle the signals are transmitted through CAN protocol. Here there are two nodes connected using CAN protocol the Control Unit and the Engine Unit. Whenever the distance is measured using the LIDAR sensor the distance is displayed in node 1 and the data is transferred to node 2 When the distance measured is above the range of 30cm then there will be a continuous running of the motor and when the distance measured is below 30cm then there will be an emergency case then automatic vehicle control will take place and the motor stops running. This motor is controlled using the pulse width modulation technique and H-Bridge is connected and has external hardware for the rotation of the motor. In the future RADAR sensor can be implemented in all sides of the vehicle, and this is used to sense in all directions. The user can adjust the range at which the distance should be measured. This sensor can be used in two modes ON/OFF modes. In the case of driving on the highway then this sensor can be kept at ON and in case of traffic or during vehicle parking this sensor can be kept at OFF. Since the cost of the sensor is more when compared with the RADAR sensor. This sensor can be implemented in lower-end vehicles and avoid accidents and save the passenger's life.

6 REFERENCES

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