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Vehicle Speed Control and Accident Avoidance System Based on Arm M4 Microprocessor

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***Abstract*— Now a day's road accident is one of the major concerns in our country. Reckless vehicle driving is the major reason behind those road accidents. Alarming rate of accidents and uncontrollable car in the road demand an automatic system that would guide drivers immediate in dangerous situation. When any obstacle (like human body, vehicle, and other object) comes in front of the vehicle, speed control of the vehicle is the viable solution to avoid accident. We propose a solution in our project to avoid road accidents and to control speed of vehicles. Front Ultra-sonic sensors of the vehicles detect obstacles, then Cortex ARM M4 process the information and passes signals to the wiper motor to brake the vehicle with the help of Arduino Uno. Furthermore, if any obstacle from the backside come closer to vehicles, immediately a buzzer will alert the driver.**

Keywords*— *safety, vehicle, accident, automatic system, ultrasonic sensor, obstacle, road accident, cortex, Arduino uno, arm m4, etc.

I. INTRODUCTION

From the evolution of mankind are racing for innovation and art in road system and vehicle to avoid unprecedented action that bring meaningful example in workplace for betterment of our life. Finding of new uses of technology in vehicles is increasing day by day. Some of well-known developing country already shown their capability over advancement of driverless car .Some of this can self-decision with precise time management. So on the basis of this it's paramount for the driver to interact with the system very quickly in an impromptu situation where vehicle are in close contact with other vehicle. To overcome such condition the existing state of art information technology like digital electronic system that transfer date in no second, making the design more simple is a huge contribution. This system significantly changing the relationship between conductor and the car providing a clear image of distance ratio though powerful driver-vehicle interface and information network. CAN protocol enhancing connection between driver and vehicle is serial communication protocol utilizing the time that bolster security. CAN that contain bit rate 1Mbit/sec bridge with various sensor and micro controller, buzzer ,while tiny distance is not possible to calculate with respect to the car, a raw signal is applied to start the sensors in a probable time to drive the buzzer system which is the embodiment of warning.

II. FOUNDATION OF THE STUDY

A. Historical background

Vehicle avoidance system first adopted by well-known manufacture company Cadillac in late 1950s, which developed a sample that detect obstacle come close to the car contain special sensor installed inside of "nose cones". CAN first invented by high profile vehicle network company Bosch in 1985. At that time wiring was used to send data from one point to another in individual vehicle. As days goes by new problem is created only because of using extensive arbitrary wiring in need of electronics in car. To mitigate the price of project they supersede the old system with CAN to maximize cost efficiency and simplicity.

B. Earlier research

Now a days, CAN, a serial high-integrity information networking device evolved in modern car industry. Followed by the year of 1995 a group of researchers at Hughes Research Laboratory in California proposed a theory funded by Delco electronics directed by physicist Ross D. the methods refer as a forearm that mainly performed by radar antenna can be found at Hughes Electronics not going in any advertisement strategy. But unfortunately, it was too exorbitant to build for every car. After then a new schematic data of radar antenna was proposed within a range of 77GHz. On the brink of nineteen century, Toyota first introduced cruise control by using laser technology. Various manufacture company instill habit of integrating CAN in their car since 1993.In 1994 a new level of enhance protocol established in CAN can be defined as a CAN open and Device Net. Now, this prototype is widely featured in modern car industry. Intel proposal of FULLCAN inhibit quality of CPU as fast as possible tied with various micro controller than another CAN like Basic CAN. In today's CAN devices developed with the combination of both CAN controller formed with few silicon where filter and data management showed vast success then previous Basic and

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Full CAN. To reduce time in software data transferring, researcher of Bosch implements new CAN FD to increase speed, came in public satisfaction at ham Bach castle conference in year 2012. Future application dependency come into more comfortable after introduction of motion sensor existed only because of CAN FD already popular in current CIA framed as SAE j1939.

C. Comparison with Traditional Method

In the past all vehicle is mainly controlled by driver in general way but with this system vehicle every movement is observed though ultrasonic sensor. A very little voltage is required to run the circuit is another choice for Production Company investing money and time for extra power in a car. It is certain However, there will be less manufacturing cost is an advantage for car industry. Furthermore, as most of the people wasting valuable time in traffic congestion and length of the roads are not so wide, road construction will no longer be necessary at all. Since in conventional vehicles sometime not possible to oversee and prototype need a little advances in busses, old vehicle won't be able to stand in roads anymore.

D. State of the art technology

Cortex ARM4 take massage from ultra-sensor that mainly work though CAN protocol to established a strong relation between obstacle and CAN and the distance of the object and vehicle speed measured though ARM4 showing signal in LCD display. Another unit connected to ARM4 calculate the distance to maintain speed of car using sensor. The more ability to sense the distance the more meticulous speed and break can be controlled. However, mostly observed by ultrasonic HC—SR04 sensor where one sensor is used in front another in rear of the bumper, although the destination of this project is not too mired in an accident as much as possible and to dictate the road by Artificial intelligence featured with two main parts. .One is transmitter another is receiver. Both are basically connected with CAN BUS to complete data transfer. A motor is also connected with infrared sensor additionally both of them consists of LCD display.

E. Objective of this work

Accident is the most common issue in today's world. For the growing necessity vehicle production going higher. In this project our goal is to build an embedded system using CAN protocol and Cortex ARM M4 microprocessor to avoid collusion in car.

Primary objectives:

- To design a CAN based accident avoidance system.
- To set up Ultrasonic sonar sensor in front and rear side of vehicle
- To implement control device like teensyduino3.2 Cortex ARM M4 microprocessor with many onboard interfaces like LCD. CAN controller serial port also needed.
- To drive the wiper motor controller.

Secondary Objectives:

- To communicate throughout the device therefore CAN controller was used to get the signal.
- To measure distance between two and weather the system status is showing in LCD.
- To install to warn the drivers come in consciousness.
- To debug teensyduino3.2 cortex ARM M4 has a capability of TTL language accessibility to send the signal in CAN.

F. Impact of project on society

The project can be a viable idea for a state. First of all, accident will be reduced annually in the same time vast majority of people will encourage to drive alone in road. As price of the device is very low anyone can afford it. Our government should lend hand to subsidiaries the project for the benefit of his people. Once the device installed in car will burnish its reputation around the globe.

III. Methodology

The prototype developed in this project, the speed controlling by a vehicle. There are different types of components are used in this project. The effective arrangement and execution of any gadget relies upon the best determination of electronic component and precise plan. Despite of having the same function of various circuits, we have to select the most efficient electronic components and circuits for the best operation considering the efficiency, gain, loss etc. So, in this chapter basically the electrical characteristics, each equipment are used in this project have been described.

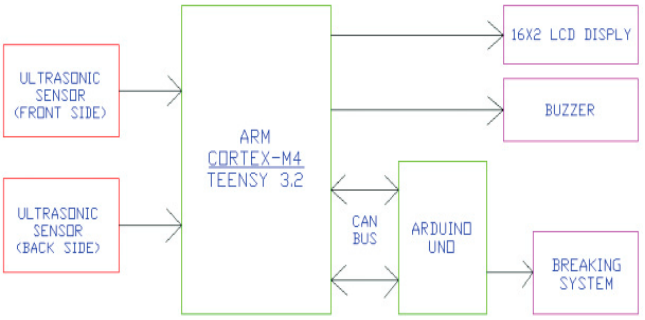

Fig. 1. Block diagram to represent overall system architecture

A. Process flow of breaking system

Vehicle speed control and accident avoid is main objective of this work. In flowchart how the braking system work and execute that has shown. In the chart, at first the coding has been inserted in the Arduino module to alert the system from a distance covered 4-6 meter by Ultrasonic sensor.

From the front and back side of the vehicle.

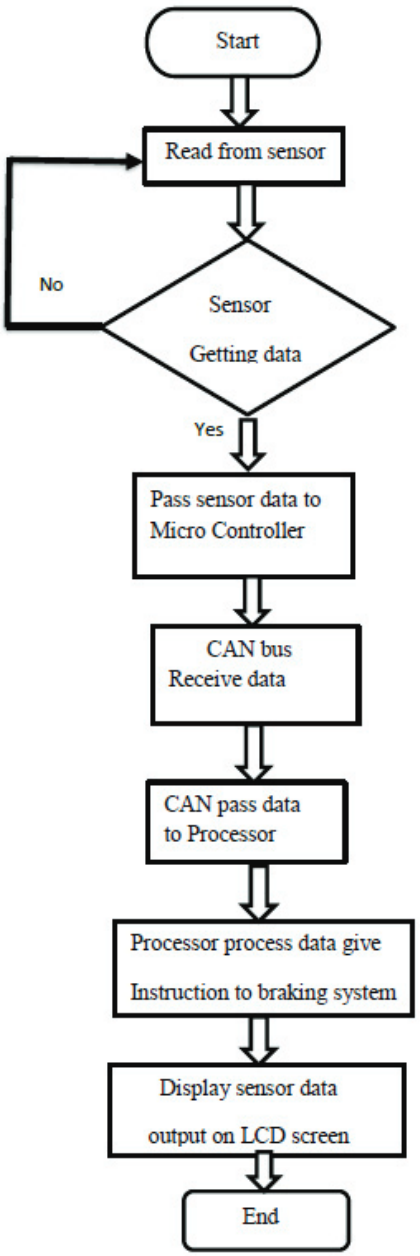

Fig. 2. Flowchart of total Process

Vehicle speed control and accident avoid is main objective of this work. In flowchart how the braking system work and execute that has shown. In the chart, at first the coding has been inserted in the Arduino module to alert the system from a distance covered 4-6 meter by Ultrasonic sensor

from the front and back side of the vehicle. If a person or object in the backside near about 4 meter the system will buzz and alert the driver. The ARM M4 Cortex Gen system has breeze connected with Arduino UNO. So, the input of the sensors has passed through the Arduino UNO and then to the CAN bus. The system will able to brake the Car instantly. Basically, Arduino UNO is slave device and ARM M4 processor is master device. Arduino UNO is controlling the braking system through the CAN bus. Arduino UNO has no CAN protocol but teensyduino has CAN protocol. There is a display connected with Arduino Mini so that it will display the Speed of the Car, distance of an object, battery power and other status. Here fig 2 show the process how it works properly.

The total control processing unit starts from the Arduino Mini. All the sensors have been connected to the Arduino. It controls the sensors such as Cortex ARM M4 processor, MCP 2515 CAN module, and display module. It takes input by distance coverage and pass the output the Arduino. The system is described that front and back side ultrasonic sensor will detect the object and output will pass to the ARM Cortex processor and from the processor the signal will be transferred to the Arduino mini and the car will stop. The distance will be shown in LCD Display. The backside system will alert by buzzing when an obstacle will be detected. Here the timing sensor will be worked. The RX and TX timing will be worked for the timing of brake the car and stoop it. The challenge is how much time the system is taking to stop the car in case of emergency. Finally, the CAN vehicle has structured successfully.

B. Working principle

ARM M4 is 32/16- bit Microprocessor, work in very little voltage and output performance is profound. It is created for people with ambitious and lack of money to spend and it is also useful in various needs such as multimedia, phone etc. 32-bit work in max clock. Need vary little voltage combined with 2 channels. 9 pin for punctuate in manufacture control as well as medical management and error correction. The flow chart of CAN control system shown above divided by receiver node and other transfer nodes. Sensor functioning the current situation of car and checked by it. IC we used in first part uses input of car present condition. In second part obstacles are thoroughly checked and warned afterward master controller receive data with high accuracy this is where vehicle condition simultaneously checked and finally a LCD display shows current status though a panel like front and back distance, current status of motor and buzzer signal. Those digital data receive installed stepper motor though Arduino that send a signal with respect with time to control the speed when an obstacle is close to the sensor. At the same time buzzer will start off when Two sensor in the back of a vehicle operating another trail which is to measure any obstacle come near to it. The whole operation happening simultaneously in a second.

C. Application of vehicle speed control using CAN protocol

Many integrated circuits are used nowadays for several applications in type of vehicle.

- 32bit and 16-bit microprocessor help for real multiple applications.
- CAN communicate in order to connect to ECUs.
- Digital and analog can at the function same time in sensor.
- For GPU status update.
- Wide range signal intercommunication in GSM modem.
- Break controlling.

D. Physical output

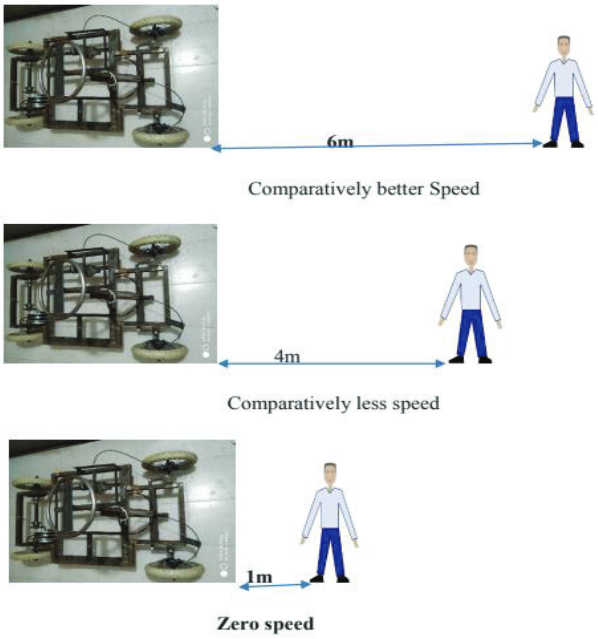

Fig. 3. Speed control of proposed model

In this system speed of vehicle varies for three different distance which is sensed by front ultrasonic sonar sensor. As we know, speed=distance/time. After sensing the position CAN bus get the decision from cortex ARM M4 processor to decrease the speed. Speed is control by wiper motor. In our system another important feature is buzzer. When back sonar finds an obstacle in back of the vehicle instantly alarm is sound.

E. Critical design review

One of the major challenges in our system was sonar that not working properly and coverage area of sonar was small. Apart from that hard-braking system is used. Motor controller passed weak signal to communicate with the CAN bus. The ARDUINO Mini is the one of the parts of this project. The ARDUINO do not response always properly due to the lake of supplied power and complexity of circuitry and connections. The main controller circuit was designed by VERO board was made manually thus the connectors were not precise. It is hard to differentiate actually where the problem is when taking data due to lose connection sometimes.

F. Finalized Version of CAN system Vehicle

Fig. 4. CAN control vehicle

After combining all the equipment properly, the CAN system vehicle operation has done. And now it's ready to work. The coding part has input to the microcontroller and its working properly. The body frame can load a person. In figure the final model of different view of CAN vehicle has shown. After completion the car, it has tested whether it's every equipment, screws and system has totally set up or not. Then turned on the car and it has tested vastly to check the system working or not. So, it can detect an object and can stop the car. Moreover, it alerts by buzzing if it detects an object from backside of the car.

IV. Result Analysis

Over the duration of the research, the design of the vehicle speed control went through multiple revisions being subjected to change which finally led to the latest design with the state-of-art technology. One of our main targets of the project was to make a device which avoid the accident by controlling the speed of vehicle. This was done by CAN protocol and varying the speed of vehicle.

A. Power distrubution

Device Name	Quantity	Rated I	Rated V	Power (W)
1. Motor Movement	1	10.45A	24V	250W
2. Motor Barking	1	4.3A	12V	51.6W
3. Tennsyduino Power	1	250mA	3.3V	0.825W
4. Sonar Sensor	3	15mA	5V	0.23W
5. Can (Controller)	1	1mA	5V	0.005W
6. Buzzer	1	3mA	5V	0.014W
7. Arduino Uno	1	45mA	5V	0.23W
8. Display	1	1A	5V	5W
9. Arduino Mini	1	0.023mA	5V	0.0012W
Total power required=**308W (+20%) =368w**				

V. Summary of Findings

Implementation designing demonstration CAN communication protocol is conducted by both hardware and Software. Simulation was done by CAN communication using MATLAB. In suggested design we used ARM4 (TX). The sensor receiving rate with respect to distance. CAN protocols sending data with the help of Cortex ARM M4. Any sorts of obstacle near the vehicle via ultrasonic sensors will show distance in display before the break start to work.

VI. Novelty of the Project

The break of the vehicle has to be work very quickly that will keep passenger in safe our brake system and sensor is the key section to control the vehicle. In the past vehicle has been designed with traditional braking system today function is completely altered by stepper motor if any other vehicle nearby and is increasing acceleration. The stepper motor started to drive the break until the car gone or avoiding programmed distance. The signal we are getting from ARM4 is programmed accurately and as small as possible to cut the

cost of the system. A highly apt power adapter is used to ensure any kinds of accident. Sensors are installed are highly adaptive and measure any obstacle effectively. A special buzzer will alarm just at a time before rare face-off. To drive the motor, we used 12v battery instead of lead acid battery to minimize any trouble.

VII. Project sustainability

Traffic is a kind of problem we had to face every day from office to school and we become scapegoat to road accident. there are several ways to resolve this issue whereas controlling speed and to let the break work automatically with the help of embedded system and ultrasonic sensor. This is mainly because so that the driver can't drive aggressively while in road .one of the advantages of this system is with compact control. Even if the drivers are careless with controlling car in traffic. Vehicles will go further with respect to the distance. unlike other car this system has a duality. It can control simultaneously with warning send from the sensor. How-ever is not pricy and consume less power that is what we for a green environment. To boost out economy one can manufacture the embedded system for commercialization. Meanwhile instead of spending money in developing system for avoiding accidents this system scrupulously bring safety.

VIII. Limitation of the work

The ultrasonic sensor is key part to sense object in the past we used infrared waves to find object driven by 5v dv power supply. Any disruption of power is failure of system. sometime ultrasonic sensor unable to achieve exact value caused by Arduino mini malfunction. In high speed vehicle break has to be pressed harder for more effectiveness. over current supply can cut the circuit because analog pin miss calculation of voltage.

IX. Recommandation for future devlopment

The embedded system has been built with the help transmitter receiver and sender unit where to prevent the clash between two vehicles. When the car come nearby obstacle. sensor will assist car in specific distance. In future we can replace this sensor with laser sensor to get more precise controlling and overcome other errors. For time limitation we are unable to reach our destination. Our main focus for future would be to use GSM and GPS using android phone. Weather the driver is addicted or not can sensed and send though SMS for better patrolling. On the one hand to reduce collusion and find the reason behind accident image processing will be a fruitful action.

X. Conclusion

In real world scenario accident avoidance technique is proposed for maximum security and safety where the driver some time unaware of propelling. working on this connection enable us to assay higher level of programming in car. The Result proved desired output and ensuring safety of public such as passengers. The system can work smoothly in high curve and old bridge.in heavy traffic zone, hospital, school, U-turn, highway vehicles are capable of controlling automatically with the help embedded system. Any of the car passing from behind in high speed easily be detected and warned. Research have made it possible to develop vehicle automation, with diverse solutions. Some of the issues has been resolved with better algorithms and brand-new sensors. Nevertheless, verse research in machine should be accelerate as it necessary for the road automation specially to mitigate crash troubles. Finally, govt should legislate concerning not only crash free character of the vehicle, but also positivism and principal a car sustains.

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