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DRIVER ASSISTANT OF ADVANCED ADAPTIVE CRUISE CONTROL USING CUSTOMIZED SCHEDULER

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Abstract: Currently most of the vehicles using preemptive scheduler based Real Time Operating system (RTOS) for the adaptive cruise control application. For low cost and highly predictable system can be implemented using Time triggered cooperative scheduler, instead of a full RTOS. RTOS require more computation time and large memory these are not present in most of the embedded systems. It is very complex and difficult to debug errors. One of the simplest methods is Time Triggered cooperative scheduler for the adaptive cruise control. It is most reliable and predictable.

Proposed adaptive cruise control is one of the main control parts in driver assistant system. The controller is placed in host vehicle. The minimum distance between host and front vehicle is maintained by using distance sensor by measuring the distance of front vehicle, speed sensor for getting speed of host vehicle and position sensor for getting the position of accelerator pedal .The controller vary the speed of the host vehicle so that to keep minimum distance.

The system is simulated using Keil IDE. The application tasks are scheduled by using efficient Time triggered cooperative scheduler .The scheduler is written in Embedded 'c' and simulated for the LPC2148 ARM 7 based microcontroller.

Key Words: *Real Time Operating System, Adaptive cruise control and Throttle position sensor.theory;*

1. INTRODUCTION

Traffic volume is on the rise everywhere in the world, the problem is the worst in metropolitan areas. More accidents, and more air pollution, will also result. Simply adding new roads is no longer a solution. Driver assistance applications aim to reduce workload on the driver either by presenting supporting information or by taking some part of the driving function, apart from this, aim is to reduce driver error by providing information about the task situation. The Adaptive cruise controls are aid the driver in keeping a safe distance between them. Thus assist the driver to slow down if the front vehicle is too close to an obstacle while moving forward and also assist the driver for applying brake in time so that vehicle can stop in a safe distance.

Providing automation in driving Vehicle enhance the performance .Many accidents are due to the stress on the driver, by taking part of the driving task as automation it leads to reduce pressure on the driver. The probability of vehicle accidents can be reduced with robust automated system.

The following figure1 gives the details of deaths due to accidents in the year 2012 in India

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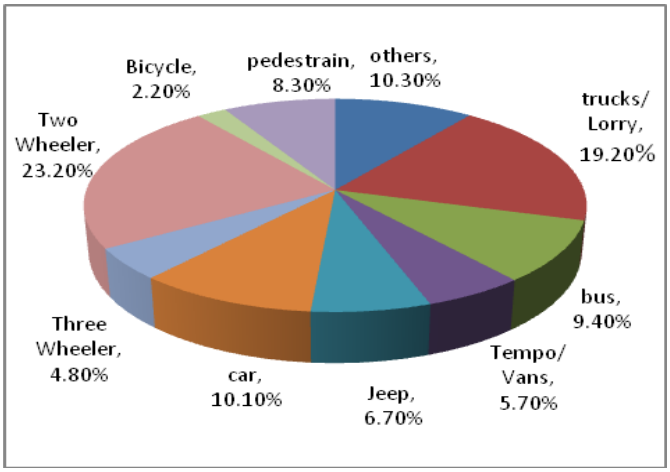

Fig1 In year 2012 deaths due to road accidents by different vehicles

Kamarudin Ambak, Riza Atiq, Rozmi Ismail Dagan[1].This paper reported that if driver has 500ms advance warning time around 60% front end collisions could be prevented, if he has one second extra warning time 90% of front end accidents can be reduced .In car driver warning system it first detect obstacle and then warns the driver about vehicle closeness to obstacle if driver is not control in time then auto control takes place. About 20% of accidents are due to driver with low level eyesight.

Vivek Agarwal, N.Venkatamurali and C Chandramouli [2]. Driver assistance system is also applied for parking system. Obstacle is detected using ultrasonic sensor, because of small range detectable more number of sensors are used ,microcontroller is used to control firing of sensors , each transducer will produce different number of pulses so that to reduce cross talk between sensors .

E. Anbarasi and N. Karthik [3]. TTC scheduler for every tick checks the task to be executed then execute the ready task this process continues. It does not have much RTOS overhead, also consume less memory

S. Kuankid, A. Aurasopon, W. Sa-Ngiamvi bool [4].The Time Triggered Cooperative scheduler is simple and useful for resource constrained embedded systems. TTC scheduler has the task jitter & task overruns problems, these drawbacks can be eliminated by sandwich delay method & TTC-MTI (Time Triggered Cooperative Multiple Timer Interrupt).Scheduler fragile due to task overload. Explained the schedulability test by two parameters such as cpu utilization U<1 and Tick<=$\sum$ WCET (i) + Overhead (Tick interrupt and Task interrupt). Here i=1 to n. It has been shown that there is a reduction in release jitter time and computation time compared to TTC dispatch scheduler.

Mouaaz Nahas, Ricardo Bautista-Quintero [5].In various Time Triggered cooperative scheduler address one of the problems such Task jitter, Power consumption, Task overruns while designing TTC scheduler .This paper address the task jitter and overrun both problems at a time and measure the WCET of each task while executing.

Ayman K. Gendy and Michael J. Pont [6].The auto scheduler code is generated using the parameters of task order ,tick interval ,offset value of each task then checks schedulability using the TTC scheduler and TTH scheduler. If it is not schedulable then it generates possible schedulable tasks.

Qiang Huang, Xiaofeng, Liang, Weittua Xu [7] .This paper presents Time Triggered scheduler is predictable but drawback is less responsive. Sinewos is new scheduler; it is a combination of time triggered and event triggered. It is more predictable and high efficient, this new kernel is implemented with Adaptive cruise control on lpc2129 using simulator.

Michael short, Michael J Pont & Jiazhong Fang [8] Tested preemption method on vehicle using cruise control but he found that there is a negative impact on the performance.

The rest of the paper is organized as follows. Proposed hardware and software algorithms are explained in section II. results are shown in section III. Conclusion is in IV.

2. PROPOSED ALGORITHM

The proposed prototype for driver assistant system consists of hardware and software.

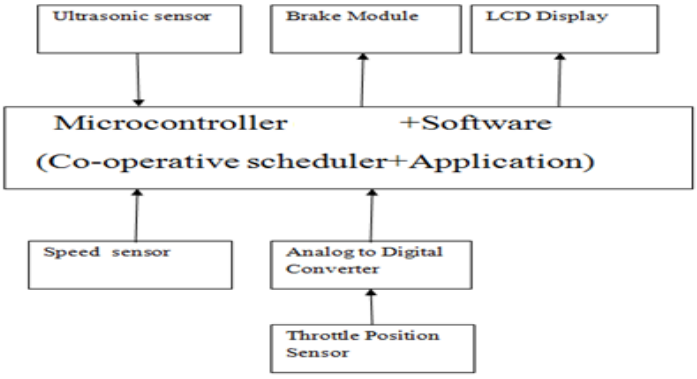

Fig 2 Block diagram of Adaptive cruise control

The block diagram consists of ultrasonic sensor, speedometer, throttle position sensor, ADC and LCD display unit and software consists of scheduler and Application program.

2.1. Hardware Module:

The hardware system consists of an ultrasonic sensor for measuring the distance of the front vehicle. Throttle position sensor for measuring the throttle valve position, the valve position is in the form of voltage and is converted to digital data using ADC. The speed sensor measure the speed of the vehicle in Rotation per minute (RPM), The Auto brake module is to stop the vehicle in critical situation and LCD display unit is used for displaying all the information.
Ultrasonic sensor: It is a wireless distance measuring module It is used to measure the distance of the obstacle using ultrasonic waves.TS601 is one of the example of 3-pin ultrasonic sensor. It finds the distance of front vehicle by sending more number of pulse signals and receive the reflected by object. Maximum and Minimum measurable range is .03 to 3 meters. Rated working voltage is 5 VDC; Frequency of sensor is 40 KHz

Ultrasonic sensor consists of 3 terminal 1-signal ,2-Vdd and Vss .First trigger the ultrasonic sensor by applying pulse then sensor sends signal of 40KHz of 8 pulses after that sensor receiver become high ,it remains high till it receive reflected signal from object when it receive reflected signal then its input signal become low. The duration of the input is high it corresponds to the distance of the object.
The following equation 1.1 is used to calculate the front vehicle distance in meter.

$S = VT3/2$ …… (1.1)
V=Velocity of light in m/s, S=distance in meter
T3=Pulse width duration.

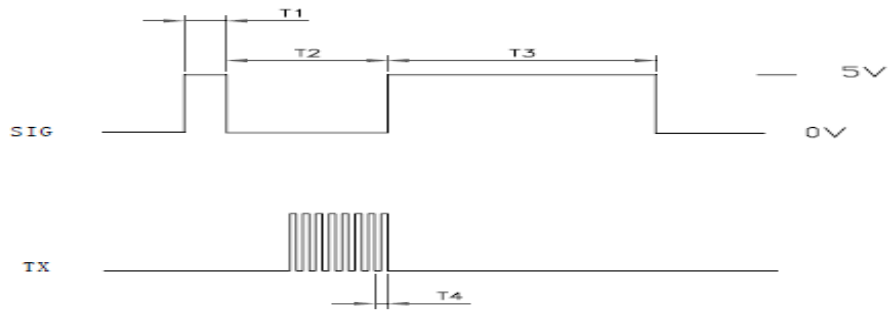

Fig3. Timing diagram ultrasonic sensor

T1is greater than 5 microsecond,T2 is 200 microsecond,T3 is 0to 19.5 millisecond and T4 is 25 microsecond

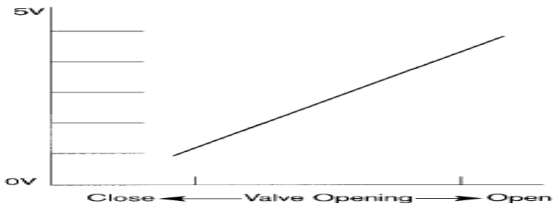

Fig4.TPS position with voltage

Throttle Position Sensor (TPS): It is used to know the position of the throttle. It gives analog output voltage corresponding to the throttle position, if throttle is open then output voltage is maximum and if throttle is close then output voltage is minimum, this analog voltage is converted to digital by using Analog to digital converter

Speed of DC motor: Infrared (IR) sensor is used detect rotation of the motor. For every rotation a pulse is generated, this pulse is counted by counter. The counting is done till 200ms, this result is multiplied by 5 and 60 .The final result is in RPM.
Analog to Digital converter (ADC): most of the parameter in real world is in analog and physical. These parameters are converted digital using analog to digital converter.
Displays: LCD display is used to display alphanumeric characters. It consumes less power and its low cost. It consists of two lines, each line display 16 character.

2.3. Software Implementation

Consists of cooperative Single interrupt scheduler and Application program.
Cooperative scheduler: consists of initialization of Timer program for tick time generation. All the six application tasks are initialized then start the scheduler. It schedules the application tasks according to their timings. The application function consists of six tasks as given below.
Task1: Detect the distance of the front vehicle
using ultrasonic sensor
Task2: Auto brake
Task3: The speed of the host vehicle in RPM
Task4: measure the throttle position.
Task5: Maintain the inter car distance.

Task6: Display all the parameters on LCD.

2.4. Algorithm for ACC

i) Initialize the Timer0 for tick generation
ii) All six tasks are initialized
iii) Start the Timer0
iv) Infinite loop
v) For every tick, update the count if any of the tasks is ready
then execute go to step iv
vi) Repeat the steps v to vi

2.5. Flow Chart

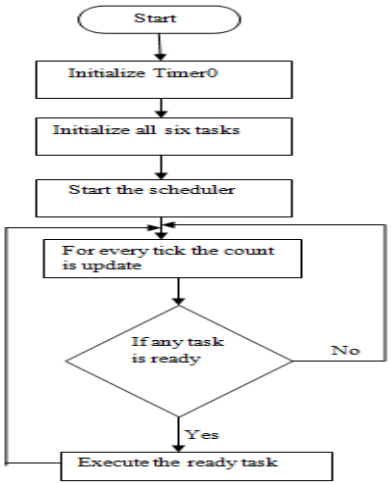

Fig5.Flow chart

3 SIMULATION RESULTS:

Scheduler program and application tasks are combined, compiled and executed. The application tasks are executed according to their timing mentioned.

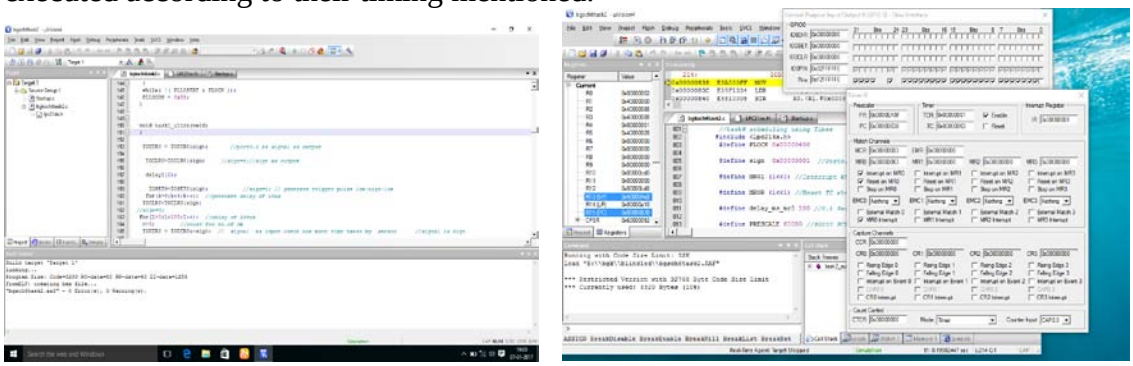

Fig 6. Simulation of ACC

Advanced adaptive cruise control is used maintain the minimum distance between two vehicles and also auto stop if the driver is not applied brake in critical situation.

CONCLUSION

Application tasks are scheduled in time using cooperative scheduler on 32-bit microcontroller. This project is simulated on 32-bit controller .For future Multi sensors are used for single parameter and Hardware is implemented

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