Study and Analysis of Intelligent Vehicle Control System

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Abstract – Modern Technology has an impact on vehicle control system for both safety and comfort. The various researches have been carried out in vehicle (Four wheel drive) control system. In this paper the result of research is compared, which can be useful for implementation of new design. New feature discussed here are digital speedometer, Z Axis control, Fuel level detection with corrosion free or without mechanical movement sensor, control on mortised window. Hardware of System included ARM controller having CAN port. Apart from hardware of system the software is in µcos-II operating system is also discussed here. This operating system enhances performance of control and simplifies the design and management software.

Keywords - *CAN Controller area network (CAN), Proximity infrared sensor (PIR), Real time operating system (RTOS).*

I. INTRODUCTION

Apart from basic features in existing system, proposed vehicle system gives various type of intelligence to assist driver. Existing system have Analog scale to measure parameter but here we can measure fuel level, speed of vehicle in digital scale. Z axis movement is required as safety control if vehicle lifted on crane. PIR sensor is used to detect human body interface for motorized mirror. Reed relay is used for speed measurement. This speed can be governed by central CPU.

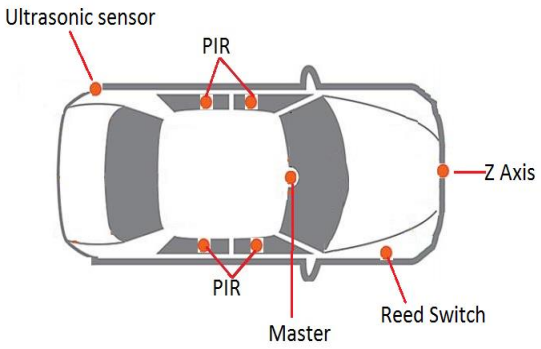

Fig 1: Vehicle with sensor network

II. LITERATURE REVIEW STAGE

Here different papers are studied and analyzed. Based on the approaches used by the different researchers, modifications are carried out to provide more reliability in the proposed system.

A. "Vehicle control system implementation Using CAN protocol" [1] By S. Vijayalakshmi.

Here Master slave communication is established using CAN bus interface. There are one Master and two slaves. The various sensor interfaced are IR (Infrared) based device for obstacle detection, Temperature measurement, Pressure measurement, Fuel level measurement, Impact detection. From the result it observed that Fuel level, Pressure level are shown by High, Low fashion. In case of accident the SMS is send to vehicle owner. In circuit diagram of this paper, provision is made for adding various sensors mentioned above. The circuit diagram describes that we can add any sensor with external signal conditioning and software driver.

B. "Design of the Smart Vehicle Control System based on ARM and µC/OS-II". [2] By Chunru Xiong and Jufang

Here the system is implemented using voice-driven principle, for improving the human interaction between machines and operators. The utilization of high-precision of ultrasonic sensors on obstacle avoidance robot provides a guarantee for safety .This system uses ARM7 controller with µC.OS-II as real time operating system which enhances the performance of control and simplifies the design and management of software. µC.OS-II's multitasking kernel ca can manage upto 64 task but here system includes total seven task. Voice recognition module processes five commands as forward, stop, backward, turn left, turn right order.

C. "Real Time Generator Fuel level Measurement Meter Embedded with Ultrasound Sensor and Data Acquisition System" [3]

This paper describes real time fuel level measurement from Generator tank using ultrasonic principle. This system stores data into data acquisition system. Here micro SD card is used to store fuel level along with time stamp of read , using RTC. The overall operation of system is controlled by PIC microcontrollers 18F4520.

D. "CAN based real time implementation in automobile using ARM" [4] By Mr. Vijay Bhamrae & Mar. Chirinjeevi.

The system uses two ARM controllers LPC2148, which are connected using CAN controller. The modules in this project are temperature sensor, humidity sensor, Pressure sensor to get the pressure, Buzzer to give alerts. The CAN transceiver is to establish communication between two ARM-7 LPC2148 ARM-7 LPC2148 Microcontrollers, LCD acts as a output device which displays parameters.

III. PROPOSED SYSTEM

The generalised block diagram of proposed Vehicle system is as shown in figure below

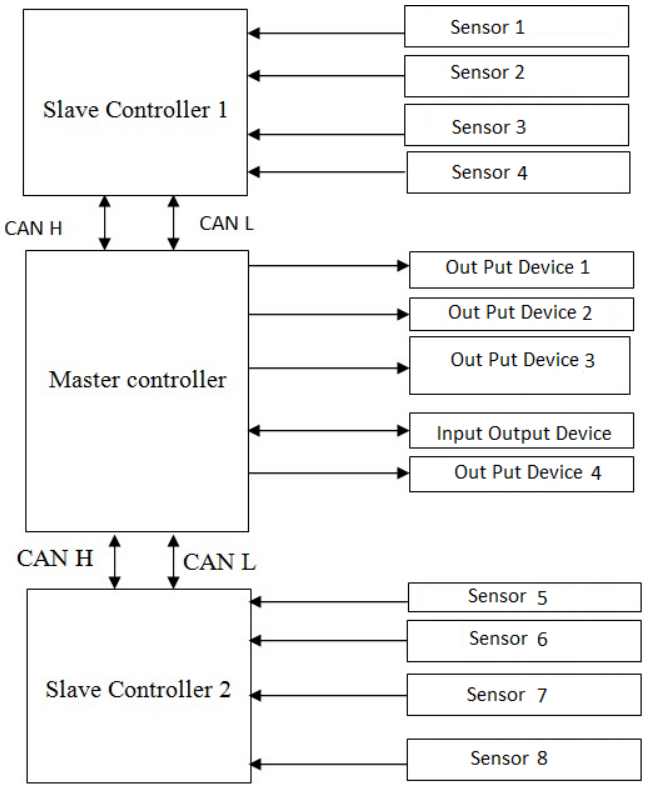

Fig 2: "System level block Diagram of vehicle control"

Proposed system consists of one master node and two slave nodes. ARM controller LPC2129 is proposed for this purpose. The communication between the Master and slave is based on CAN. Various type of sensor can be interfaced to the system .These sensor may include temperature sensor, Humidity sensor, Impact sensor, Pressure sensor. The input output device such as GSM modem can also possible to interface with system. By using CAN Slave controller, Master receives the data of vehicle like temperature, fuel level, and obstacles. As a scope of this paper new features that to be implemented are elaborated here. New features are Human body sense for motorized window & for auto air-conditioning control, Z axis measurement, Digital speedometer, Ultrasonic fuel level detection.

A. Human Body Sense

For Human body PIR (Proximity infrared sensor) HC-SR501 sensor can be used. This IC is having digital output, which gives high output when object is in 7 meter distance range. This sensor arrangement is required to detect human body in a window of vehicle. The angle of detection 120 degree and disctence covered upto 7 meter. Also same IC can be used to detect the movement of person to turn ON/OFF the air conditioning in vehicle.

Human Presence detected	TTL out put
Yes	3.3V
No	0V

IV. Z AXIS MEASUREMENT

Analog devices ADXL335 is used Z axis measurement. The ADXL335 is a small, thin, low power; complete 3-axis accelerometer with signal conditioned voltage outputs. This accelerometer can measure the static acceleration of gravity in tilt-sensing applications as well as dynamic acceleration resulting from motion, shock, or vibration.

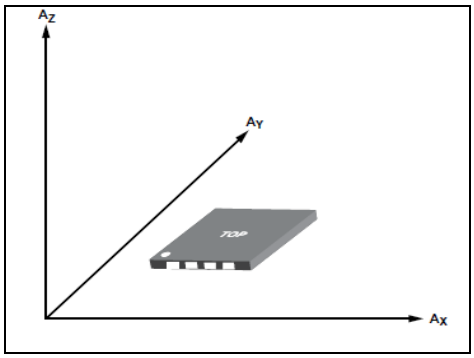

Fig 3: "ADXL335 three axis measurement"

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins.Capacitors must be added at these pins to implement low-pass filtering for antialiasing and noise reduction. The equation for the 3 dB bandwidth is

$F_{-3\ dB} = 1/(2\pi(32\ k\Omega) \times C(X, Y, Z))$ or

$F_{-3\ dB} = 5\ \mu F/C(X, Y, Z)$

V. DIGITAL SPEEDOMETER

Digital speedometer is incorporated in this project to assist the driver. Also in case of emergency we can send the speed of vehicle to remote location via SMS. For measuring speed

normally reed relay is used .Reed relay has many advantages over optical sensor. By providing speed on digital scale, we can assist the driver to make decision fast.
Calculations: Consider the four wheeler having radius of wheel is 40 cm.

Circumference of wheel = 2 * π * r
(Where r is radius in cm)
= 2 * 3.14 * 40
= 251.32 cm or 2.5132 meter

Speed: Let's consider that, in one second the vehicle covers 2.512 meter i.e. one complete revolution Therefor speed in Km/hour:

Speed = N * 2.512 * 3600 /1000
(Where N is number of revolution per second)
= N * 9.0432

Here 9.0432 is a constant value.

Distence : To cover 100 meter the wheel is required to update approximately 39.49 revolution i.e (100 /2.532) The microcontroller take care counting revolution, speed calculation , conversion and display of result.

VI. FUEL LEVEL DETECTION

For Fuel level ultrasonic sensor HC-SR04 is used. From level of fuel and mileage of vehicle per liter, we can calculate how much distance that vehicle can travelled. Principle of ultrasonic sensor is shown below

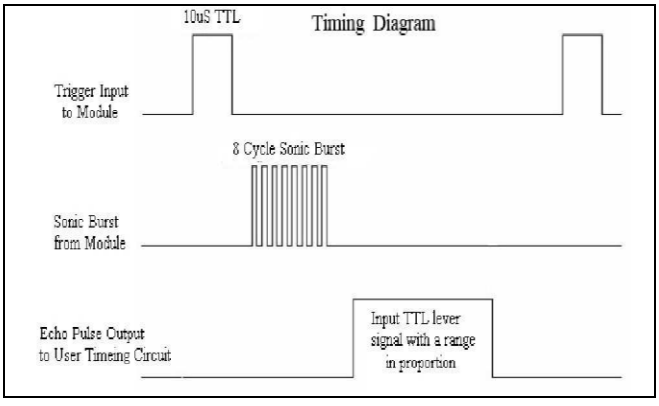

Fig 4: "Tx and Rx wave form of HC-Hr 04"

Distance can be calculated as time between sending trigger and receiving echo.

Distance: microsecond / 58 Unit: centimeter.

VII. SOFTWARE FLOW CHART FOR VEHICLE CONTROL USING MC/OS-II

µC/OS-II is real time operating system (RTOS) having Primitive, multitasking kernel, source code portability. The various tasks are executed on their time stamp. The generalised software flowchart is as shown below

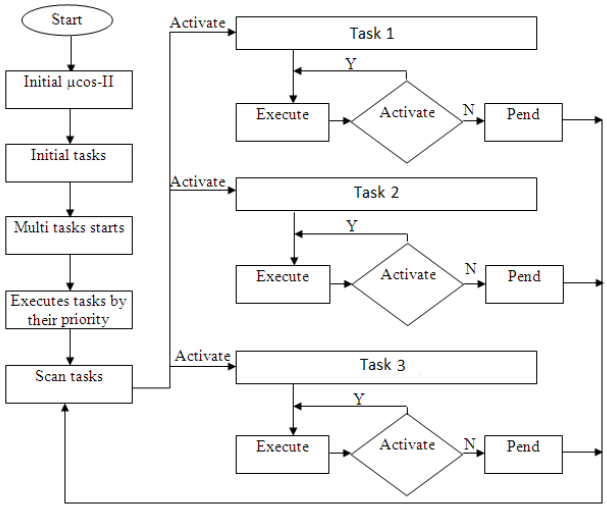

Fig 5: "Software Flow chart"

VIII. CONCLUSION

The prescribed paper gives, use of modern technology for resolving the vehicle related problem thus it will make safety and comfort drive. ARM based design and MC/OS-II operating system will make the design development fast. Because of modular structure we can plug or remove the sensor without much effort.

IX. REFERENCES

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