CAN PROTOCOL BASED VEHICLE BRAKE CONTROL SYSTEM AT SLOPE

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Abstract – *Generally, there are two types of brake systems in vehicles. One is disc brake and the other one is box brake. Both the types of brakes in the vehicle are controlled using the CAN Protocol. When the vehicles are moving in slope, its brake system is controlled manually. This paper introduces a technique to control those vehicles moving in slope automatically with the help of CAN protocol. Here we are using tilt sensors to sense the inclination of the slope and fuzzy logic to control the break linearly.*

Key Words: Breaking System, CAN Protocol, PIC, Tilt Sensors, Fuzzy logic

1. INTRODUCTION

Driver and passenger safety is one of the important concerns in modern vehicles. With rapidly expanding automotive electronics, vehicles are undergoing dramatic changes in their capabilities and how they interact with the drivers. Steep slope accidents may be caused by a variety of factors, including driver error as well as poorly constructed roads. Due to the grade on a steep slope, vehicles may be more challenging to control as they gain momentum. Therefore increased number of accidents and vehicles on road, demands for an intelligent safety mechanism that helps the driver in handling immediate precarious situations.

This paper introduces a technique to control the vehicles moving in slope automatically with the help of an intelligent driver-vehicle interface through an intelligent information network using master-slave principle. Here a PIC-based data acquisition system is used that uses ADC to bring all control data from analog to digital format. Since the information systems in a vehicle are spread throughout the practical vehicle, a communication module that supports to implement a one-stop control of the vehicle through the master control of the digital driving system is used. The communication module used here is embedded networking by CAN (Controller Area Network). CAN is a serial communication protocol which supports real-time control with very high security. Its application ranges from high-speed networks to low-cost multiplex wiring.

2. LITERATURE REVIEW

Based on the requirements of the modern vehicle, in-vehicle Controller Area Network has been implemented. The benefits of CAN-based network over traditional point to point schemes will offer increased flexibility and expandability for future technology insertions. In [1] Ashwini.S.Shinde describes the ARM7 based design and implementation of CAN Bus prototype for vehicle automation. LIN protocol is used for controlling the LED lights of a car. Its hardware interface circuit mainly consists of MCO2515 standalone CAN-Controller, LPC2148 microcontroller based on 32-bit ARM7 and MCP2551 high speed CAN Transceiver. [2] uses an ARM based data acquisition system that uses ADC to convert the analog data's to digital and visualize it through the LCD. Communication module used here is CAN which has efficient data transfer. In this feedback of the vehicle conditions like vehicle speed, Engine temperature etc are taken and are controlled by the main controller. The whole unit is also equipped with GSM which communicates with the owner at times of emergency. A PIC-based data acquisition system is used in [3] that use ADC to bring all control data from analog to digital format and visualize through LCD. This paper presents the development of distance measurement using Ultrasonic Sensors which indicates the vehicle's position from obstacles. This project provides an intelligent break system using RFID module at automatic breaking system enabled vehicles. The vehicle control system is programmed using the embedded C in mikroelectronika for PIC and debugged with PROTEUS simulation. A driver vehicle interface for indicating various parameters of vehicle status like temperature, pressure, speed etc. is implemented in [4]. A microcontroller based data acquisition system is used that uses ADC to converts data from analog to digital format. The monitoring parameters in this paper are fuel level indication, parking assistance, cruise control, speed. For monitoring the above parameters, fuel oat sensor, IR, and ultrasonic sensors are used. The slave sends the data to the master, master reconfigures the data and sends it back to the slave and the results are visualized through the LCD. Then the simulation results are obtained using Kiel micro vision, Rtaw-sim v14.7, and Flash magic software.

3. PROPOSED SYSTEM

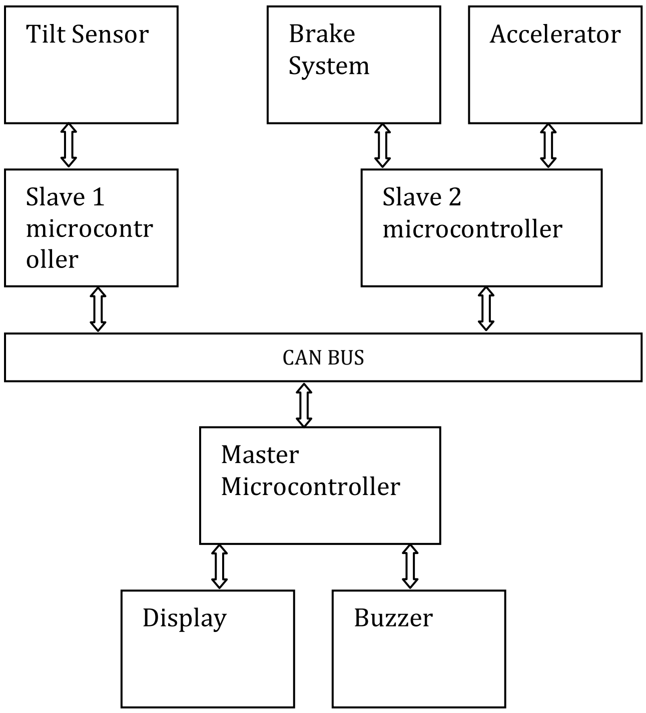

Fig-1: Block diagram of the proposed system

Can Bus

The Controller Area Network, also known as CAN Bus is a vehicle bus standard designed to allow electronic control units and devices to communicate with each other in applications without a host computer. As an alternative to conventional multi-wire looms, CAN Bus allows various electronic components in the vehicle to communicate with each other on a single or dual- wire network data bus up to 1Mb/s.

Wiring of the electronics within the vehicle is drastically reduced due to the introduction of CAN Bus. By connecting all the modules in a vehicle to one central line, the control system is simplified and more regulated. This design allows any connected module to alert the main controller to an event as it occurs and make the rest of the system to act accordingly.

If one module of the CAN Bus fails, it doesn't necessarily cause the failure of other modules. If the two systems are not directly connected with each other, the healthy modules will continue to function perfectly without being affected by the bad module.

PIC 18 F Family

The PIC18 microcontroller family comes in 18- to 80-pin packages that are both socket and software upwardly compatible with the PIC16 family. The PIC18 family includes all the popular peripherals, such as MSSP, ESCI, CCP, flexible 8- and 16-bit timers, PSP, 10-bit ADC, WDT, POR and CAN 2.0B Active for the maximum flexible solution. Most PIC18 devices will provide FLASH program memory in sizes from 8 to 128 Kbytes and data RAM from 256 to 4 Kbytes; operating from 2.0 to 5.5 volts, at speeds from DC to 40 MHz. Optimized for high-level languages like ANSI C, the PIC18 family offers a highly flexible solution for complex embedded applications with special microcontroller features like Power-on Reset (POR), Power-up Timer (PWRT) and Oscillator Start-up Timer (OST) , Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation, Programmable code protection.

Tilt Sensors

Tilt sensors are devices that produce an electrical signal that varies with an angular movement. These sensors are used to measure slope and tilt within a limited range of motion. Tilt sensors consist of rolling balls and conducting plates beneath them. When the sensor gets power, the rolling ball comes beneath and the connection is established between the two terminals and current flows between them. When the sensor is tilted, the rolling ball doesn't fall to the bottom and the current will not flow between the terminals

4. IMPLEMENTATION OF VEHICLE BRAKE CONTROL AT SLOPE

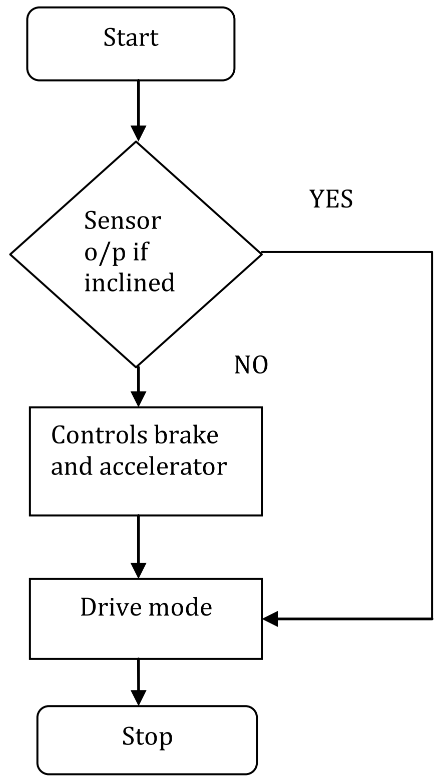

Fig-2: Flow chart

The main aim of this work is to control the vehicle while moving in slope. When the vehicle is moving in slope, the correct amount of acceleration and brake has to be applied to it in order to make the vehicle to move forward otherwise it will move in reverse direction. To avoid moving in the reverse direction, we are using tilt sensor which will sense and give the inclination of the road. According to the inclination information obtained from the sensor our control unit will send the command to acceleration and brake unit to make both in the correct proportion such that the vehicle moves forward.

The threshold level is set for acceleration. If manual acceleration is below the threshold level, then the control unit controls the acceleration and break automatically. CAN Protocol is used here so that single master can provide information to multiple slaves. Fuzzy logic is used to control the break linearly according to the sensor output. If the road is flat our system goes to inactive state and it is activated only in the slopes.

5. RESULT

This work is done using PROTEUS Simulator. When the vehicle is on the flat road, the system will be inactive. When the vehicle is on a slope, the sensor will be activated and the accelerator and the brakes are controlled and the driver is alerted. The results are shown below.

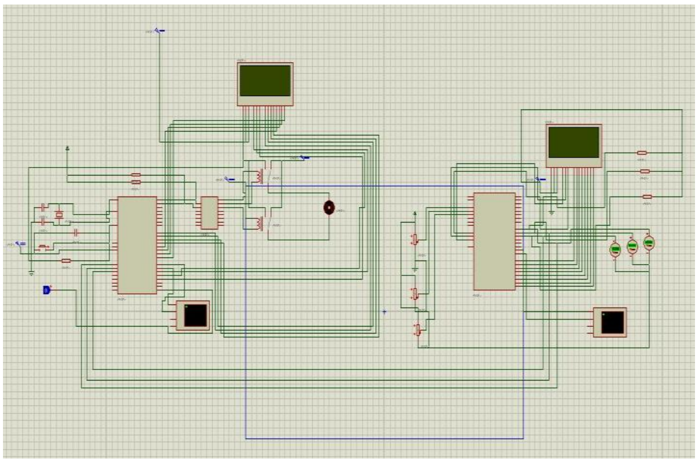

Fig-3 Brake control system inactive

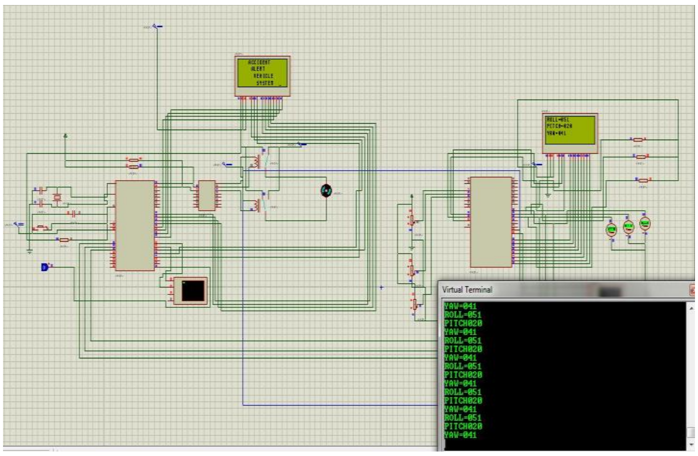

Fig-4 Sensor output low

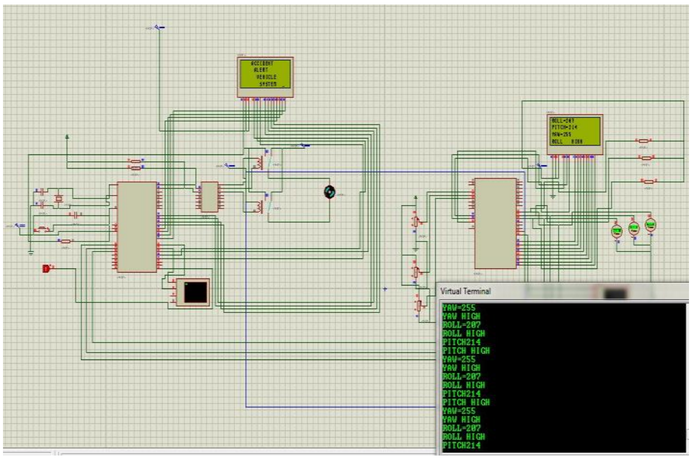

Fig-5 Break active and alert driver

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