International Journal of Electrical and Electronic Engineering & Telecommunications

ISSN 2319 – 2518 www.ijeetc.com
Vol. 2, No. 3, July 2013

Research Paper

DRIFT AND FRONT LIGHTING SYSTEM IN SELF PROPELLED VEHICLES USING ELECTRONIC STABILITY CONTROL

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In this project we are going to design an embedded system for automotive in which the speed of the automotive is controlled automatically using microcontroller and CAN bus. This system is designed especially for preventing accidents in Hill stations due to over speed and improper front lighting of automotive. At present, automotives does not have proper braking mechanism which results in huge human loss in accidents. Due non-reliable braking of the automotive, the movement of automotive in hill stations especially in hair pin bend the automotive will lose its control due to over speed and also improper braking mechanism. This actually results in large number of automotive accidents in hill stations across Tamil Nadu and in India, which results in huge loss of lives. The automotive manufacturing companies often call its units back due to fault design mechanism which they realize only when their customers loss their lives. In this project we are going to design an embedded system for automotive system to control the braking mechanism and also control the front light with the steering in the automotive and the data communication from the steering to the motors in the vehicle is done through CAN bus. The front light mechanism is done through the steering angle movement that is when steering is done towards left side of the road the front light of the automotive shifts its direction towards left side. Lighting system is controlled with LDR sensor, the LDR operates in night time only because of its own property.

Keywords: PIC microcontroller (16f877A), CAN, SPI, ADC

INTRODUCTION

This project consists of PIC microcontroller which controls the braking and the front lighting mechanism, and the communication between the PIC microcontroller and the Front Lighting system is done with the help of CAN bus. The

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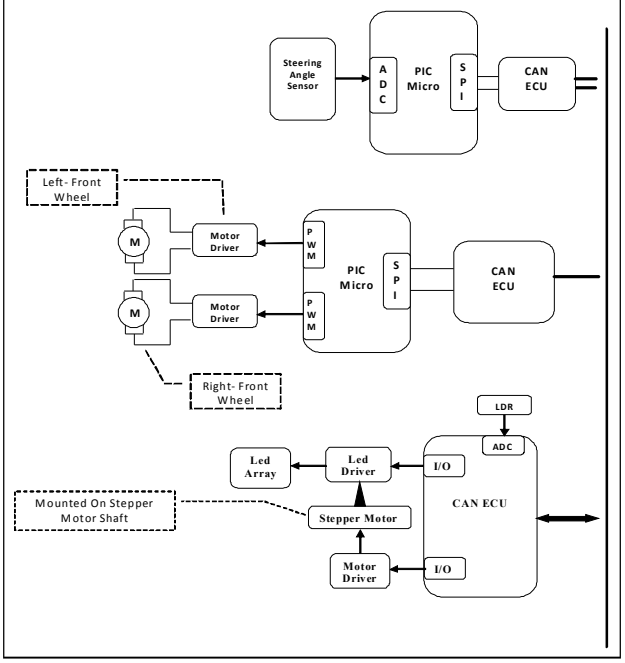
speed of the vehicle is controlled with the steering mechanism on steering angle parameter. If the steering angle is more than the actual value the microcontroller sends the data to braking section to apply the brake on the particular wheel and also simultaneously the front light of the automotive is also move accordingly to the steering movement. This results in the automatic speed control with the help of microcontroller and steering movement. This results in efficient braking and lighting mechanism.

Figure 1: Block Diagram



SPECIFICATION

- The first module of the block diagram is the steering controller section, which contains STEERING ANGLE SENSOR, ADC, SPI, PIC MICROCONTROLLER (16F87XA) CAN ECU.
- This module is designed to control the steering by means of steering angle sensor from which we get analog signal and that signal is get converted to digital signal by Analog to Digital Converter (ADC) and feed to the PIC micro controller because it accepts only the digital signal.
- And from the PIC micro controller this digital signal is feed to CAN ECU through SPI.
- The second module of the block diagram is called as the DC motor section, which contains CAN ECU, SPI, PIC microcontroller, Pulse Width Modulation (PWM), motor and motor driver.
- The digital signal is received by CAN ECU from first module through CAN bus is transmitted to PIC micro controller by using SPI.
- In this section the speed of front two wheels of the vehicle are controlled by controlling the speed of motor (dc motor) that is done by pwm which receive input from PIC.
- Motor driver is used to provide the necessary power supply to drive the motor because the power supply which we get from PIC is only 5 v, which is not enough to drive the motor.
- The third module block diagram is called as the front lighting system which contains CAN ECU, ADC, LDR, Motor Driver, Stepper motor and LED arrays.
- This section receive the signal from steering angle section through CAN bus.
- As the steering angle changes its direction the front light system also change accordingly that is if the steering angle steer towards left the front light also shift towards left and vice versa.

- Lighting system is controlled with LDR sensor, the LDR operates in night time on.ly because of its own property.

Figure 2: Project Kit

Hardware Requirement

1. PIC microcontroller (16f877A)
2. CAN BUS
3. Power supply
4. Potentiometer
5. Dc motor
6. SPI
7. ADC

Description

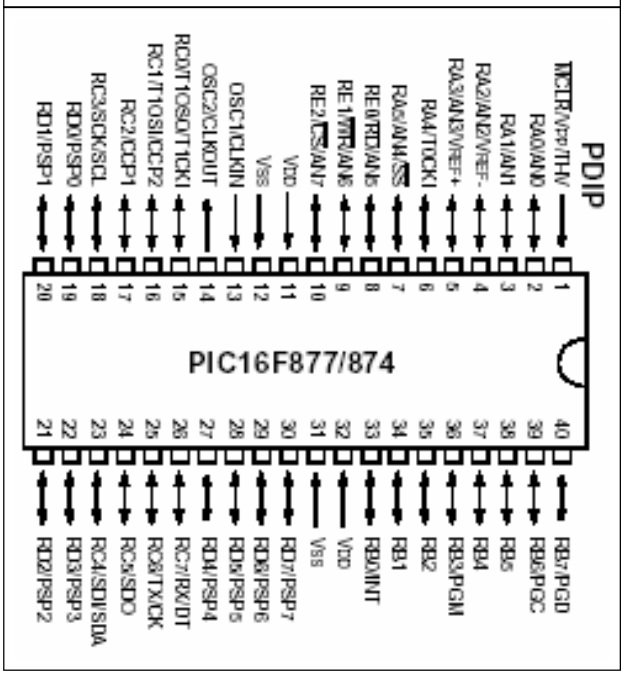
PIC Microcontroller (16f877A)

- High-performance RISC CPU
- Only 35 single word instructions
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
- Up to 8K x 14 words of FLASH Program Memory

  Up to 368 x 8 bytes of Data Memory (RAM)

  Up to 256 x 8 bytes of EEPROM data memory
- Interrupt capability (up to 14 sources)
- Eight level deep hardware stack

Figure 3: Pin Diagram

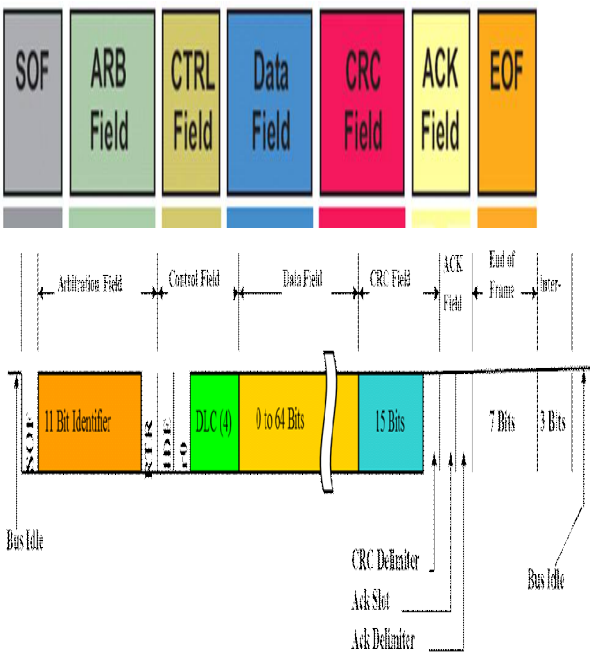


CAN Bus

Controller Area Network (CAN) was initially created by German automotive system supplier Robert Bosch in the mid-1980s for automotive applications as a method for enabling robust serial communication. The goal was to make automobiles more reliable, safe and fuel-efficient while decreasing wiring harness weight and complexity. Since its inception, the CAN protocol has gained widespread popularity in industrial automation and automotive/truck applications. Other markets where networked solutions can bring

attractive benefits like medical equipment, test equipment and mobile machines are also starting to utilize the benefits of CAN. The goal of this application note is to explain some of the basics of CAN and show the benefits of choosing CAN for embedded systems networked applications.

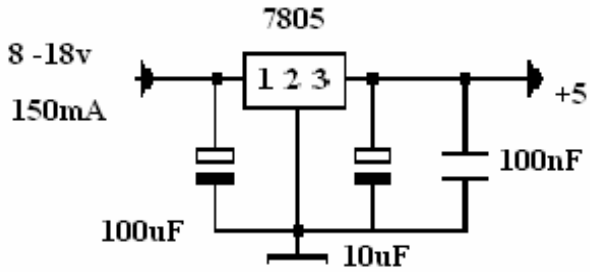
Figure 4: Frame Format



Power Supply

This circuit is a small +5 V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall transformers with variable output voltage are available from any electronics shop and supermarket. Those transformers are easily available, but usually their voltage regulation is very poor, which makes then not very usable for digital circuit experimenter unless a better regulation can be achieved in some way. The following circuit is the answer to the problem. This circuit can give +5 V output at about 150 mA current, but it can be increased to 1 A when good cooling is added to 7805 regulator chip. The circuit has over overload and terminal protection.

Figure 5: Power Supply



Potentiometer

A potentiometer (colloquially known as a “pot”) is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider. If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducer, for example, in a joy stick.

Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load (see infinite switch). Instead they are used to adjust the level of analog signals (e.g., volume controls on audio equipment), and as control inputs for electronic circuits. For example, a light dimmer uses a potentiometer to control the switching of a TRIAC and so indirectly control the brightness of lamps.

Dc Motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying

conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

SPI

Serial Peripheral Interface is a simple interface which enables to communicate microcontroller and peripheral chips or intercommunicate between two or more microcontrollers. SPI Bus uses synchronous protocol, where transmitting and receiving is guided by clock signal generated by master microcontroller. SPI interface allows connecting several SPI devices while master selects each of them with Chip Select (CS) signal – (Underline means that active is LOW). SPI bus consists of four signal wires:

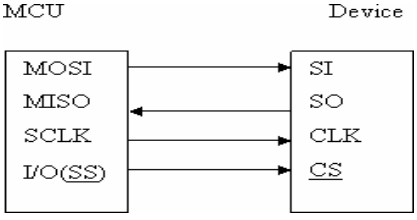
Master Out Slave In (MOSI),

Master In Slave Out (MISO),

Serial Clock (SCLK or SCK)

Chip Select (CS) for the peripheral

Figure 6: Data Transfer in SPI



ADC

An analog-to-digital converter is an electronic integrated circuit, which converts continuous signals to discrete digital numbers. The Analog-to-Digital (A/D) Converter module has five inputs for the 28-pin devices and eight for the 40/44-pin devices. The conversion of an analog input signal results in a corresponding 10-bit digital number. The A/D module has high and low-voltage reference input that is software selectable to some combination of VDD, VSS, RA2 or RA3. The A/D converter has a unique feature of being able to operate while the device is in Sleep mode. To operate in Sleep, the A/D clock must be derived from the A/D's internal RC oscillator.

Application

- This system is used in self propelled vehicle for automatic braking in blind curves.
- It is used for automatic lighting in the night time.
- As the vehicle turns in particular direction light/LED array turns accordingly.

CONCLUSION

According to the modular design by using pic microcontroller and CAN bus the project is done successfully. In this project it is having three modules named as firstly steering control module, secondly dc motor module and thirdly front lighting system. These three modules are communicated with the help of CAN bus.

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