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Speed Control of Vehicle Using Voice Commands

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Abstract—Speed control of vehicle using voice commands as the name says is a method for controlling the speed of a vehicle using the voice input. This indeed is another alternative to controlling the speed of a vehicle which replaces the mechanical interface between user and the acceleration system by an electronic interface between them.
The purpose is to bring in acceleration-by-voice or drive-by-voice into a vehicle. The control system intakes the voice input and then controls the speed of the vehicle depending upon the voice input. The system uses voice recognition which also provides an authentication as such to the user.
The system can provide great accuracy and efficiency using high precision voice recognition tools.
Keywords—Speed, throttle, microphone, microcontroller, motor, authenticated user, acceleration.

I. INTRODUCTION

An Embedded system is a computer system designed to do one or a few dedicated and/or specific functions often with real-time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts.

This project – "SPEED CONTROL OF VEHICLE USING VOICE COMMANDS" is an Embedded System since it includes a perfect share of hardware and an appreciable share of software as well. This system consists of Program source code, a microcontroller, voice sensor as user interface, power supply and other supporting electronic circuitry.

"SPEED CONTROL OF VEHICLE USING VOICE COMMANDS" is an innovative technology which will replace the mechanical part of the acceleration by the electronic control system through voice commands. It is a system which helps the people who are unable to handle the mechanical parts which requires the physical work. So, this system as it replaces the mechanical part would be helpful to such people.

This system takes the voice input from the authenticated user and then controls the speed in accordance with the user's demand. The speed is controlled by controlling the throttle present in the vehicle engine which in turn is controlled by the motor which is driven by driver circuit present in the control unit.

The system uses a voice recognition module which contains the microphone as the transducer and the ADC which converts the analog input to the digital form which is used by another control unit which produces a 4-bit output sequence for each of the voice input command given by the authenticated user.

The main controlling unit of the system embeds a microcontroller which takes the input from the voice recognition module and then drives the output via motor which in turn controls the speed corresponding to the voice input given by the authenticated user.

Thus, this system is an easy alternative to the present mechanism of speed control and brings in several advantages over the present mechanism. This voice controlled system can also be used to control many other applications.

II. SPEED CONTROL BASICS

In a gasoline internal combustion engine, the throttle is a valve that directly regulates the amount of air entering the engine, indirectly controlling the charge (fuel + air) burned on each cycle due to the fuel-injector or carburettor maintaining a relatively constant fuel/air ratio. In a motor vehicle the control used by the driver to regulate power is sometimes called the throttle pedal or accelerator. [1]

The throttle is typically a butterfly valve. In a fuel-injected engine, the throttle valve is placed on the entrance of the intake manifold, or housed in the throttle body. In a carburetted engine, it is found in the carburettor.

When a throttle is wide open, the intake manifold is usually at ambient atmospheric pressure. When the throttle is partially closed, a manifold vacuum develops as the intake drops below ambient pressure.

2.1 ACCELERATOR SYSTEM

Accelerator system provides the desired acceleration and speed according to the user's demand. The typical accelerator system used in motorcycle is as shown in the following figure:

Fig 2.1: View of the accelerator system used in motorcycles

Motorcycles use a throttle cable mechanism for propulsion. What is controlled by the throttle valve is essentially the volume of air and fuel entering the intake manifold.
As the accelerator is progressively squeezed, the throttle plate (butterfly valve) rotates within the throttle body, opening the throttle passage to allow more air to swoop into the intake manifold.

2.2 THROTTLE BODY

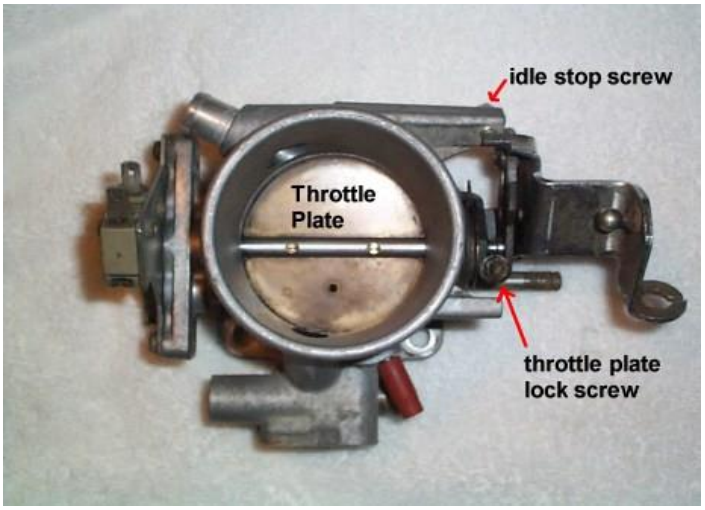

Fig 2.3: View of the throttle body

In fuel injected engines, the throttle body is the part of the air intake system that controls the amount of air flowing into the engine, in response to driver accelerator pedal input in the main. The throttle body is usually located between the air filter box and the intake manifold, and it is usually attached to, or near, the mass airflow sensor.
The largest piece inside the throttle body is the throttle plate, which is a butterfly valve that regulates the airflow. [2]

III. HARDWARE ARCHITECTURE OF THE SYSTEM

Fig 3.1 illustrates the block diagram of the automated ration distribution system. This block diagram consists of:

1. Control Unit: Microcontroller, Motor
2. User Interface Unit: Microphone
3. Sensor: Voice Sensor
4. Power Supply Unit
5. Indicator: LED's

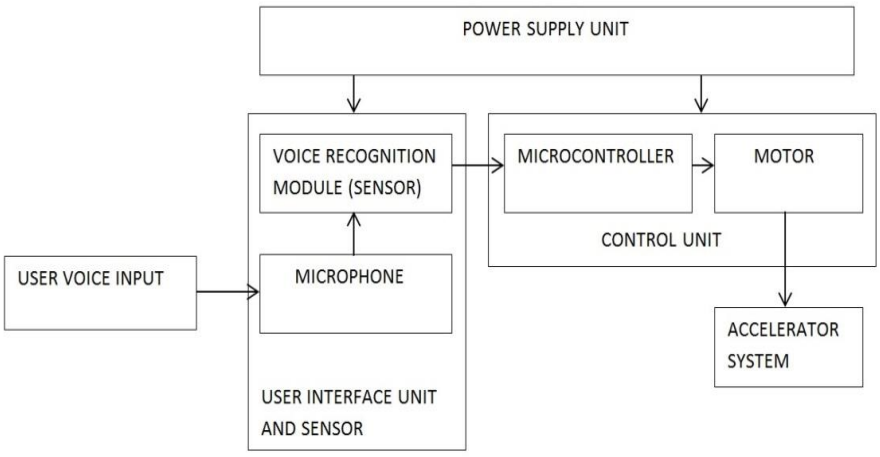

Fig 3.1: Block diagram of Voice Controlled Speed System

3.1 CONTROL UNIT

The control unit is the heart of an embedded system which controls the entire operation of the system. The control unit of this project consists of the microcontroller and the motor.

3.1.1 MICROCONTROLLER

The low-power Atmel 8-bit AVR RISC-based microcontroller combines 8KB of programmable flash memory, 1KB of SRAM, 512K EEPROM, and a 6 or 8 channel 10-bit A/D converter. The device supports throughput of 16 MIPS at 16 MHz and operates between 2.7-5.5 volts. [3]

3.1.2 DEVELOPMENT BOARD

AVR Development Board 118010 is especially designed for the students having interest in electronics, embedded system, robotics and industrial-automation. This board is made in such a way that it becomes easier for anybody to learn about AVR micro controllers. This board can also be used in various applications and engineering projects.

The development board contains the following components embedded into it: [5]

MICROCONTROLLER: It is a micro-computer chip which stores our programs executes them and takes necessary action. The chip used here is Atmel popular AVR micro controller.
L293DNE MOTOR DRIVER: This is basically a motor driver IC which takes input from microcontroller and is able to drive the DC and stepper motors by using separate power supply.
LED's Active high: RED LED1 – PORTB0 RED LED2 – PORTB1 RED LED3 – PORTB2 RED LED4 – PORTB3 ORANGE LS I- Logic Power ON indicator GREEN DS I- Driver Power ON indicator.
PB (PORTB): It is a general purpose I/O port. This port contains six pins that can be used as digital input and digital output. These pins are in the form, DATA-VCC-GROUND (denoted as D + - respectively on the board). The Data pins are towards the microcontroller. The VCC and Ground pins are provided with a 5V/1A power supply and or the supply to these pins can also be switched to external supply connected in DS pin through PTOG switch.

PC (PORTC): It is a general purpose I/O port. This port contains six pins that can be used as digital input, output and ADC. These pins are in the form, DATA-VCC-GROUND (denoted as D + - respectively on the board). The VCC and Ground pins are provided with a 5V/1A power supply.
PC (PORTC): It is a general purpose I/O port. This port contains eight pins that can be used as digital input and output.
MOTOR DRIVER CONNECTIONS: The motor drivers are used to run the DC motors or stepper motors that may be connected to the board according to the data from the microcontroller. The motor driver's link with micro controller is shown below:
M0 - PortB0 M1 - PortB1 M2 - PortB2 M3 - PortB3 M4 - PortD4 M5 - PortD5 M6 - PortD6 M7 - PortD7

3.2 USER INTERFACE UNIT

This unit provides the user the interface to the controlling unit. This unit is the one which is seen by the user and is used to control the system.

3.2.1 MICROPHONE

A microphone, colloquially mic or mike is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. Microphones are used in many applications such as telephones, hearing aids, public address systems for concert halls and public events, motion picture production, live and recorded audio engineering, two-way radios, megaphones, radio and television broadcasting, and in computers for recording voice, speech recognition, VoIP, and for non-acoustic purposes such as ultrasonic checking or knock sensors.

3.3 SENSOR – VOICE RECOGNITION MODULE

The voice recognition module is the voice recognition sensor which takes the voice as the input and then produces a corresponding 4-bit output for each of the spoken command.

Fig 3.3: Voice recognition module

Key Features

1) 12VDC / 2Amp (Don't Give AC Power Supply).

2) Analog Interface: 3.5mm mono-channel microphone connector.

3) TRAIN1 Switch for Record First Group.

4) TRAIN2 Switch for Record Second Group.

5) Each Group Store 7 Voice Commands.

6) Load1 Switch For Load The First Group To Voice Recognizer.

7) Load2 Switch For Load The Second Group To Voice Recognizer.

8) PB2, PB3, PB4, PB5 Pins are 4bit Data Output.

3.4 POWER SUPPLY UNIT

The project requires power supplies to three different components within the entire system:
1) The voice recognition kit requires a DC power supply of 12V, 2A (max).
2) The development board requires DC power supply of 5V, 1A (max).
3) The DC motor requires a DC power supply of 9V provided by the general purpose battery.

3.5 INDICATOR LED'S

The indicators used include the Light Emitting Diodes (LED's) which indicate the voice input received from the authenticated user. The pattern in which the LED's glow indicate the which voice input has been received from the authenticated user.

IV. SOFTWARE ARCHITECTURE OF THE SYSTEM

The software architecture of the system defines the software part of the system which actually controls the system internally by running a program code embedded into the system.The software architecture is defined by the flowchart and the algorithm of the embedded program code. The program code is written in Embedded C language using the compiling software known as the AVR Studio 4.0. The Embedded C program editor known as the Programmer's notepad is also used to write the code for the system operation.

4.1 FLOWCHART

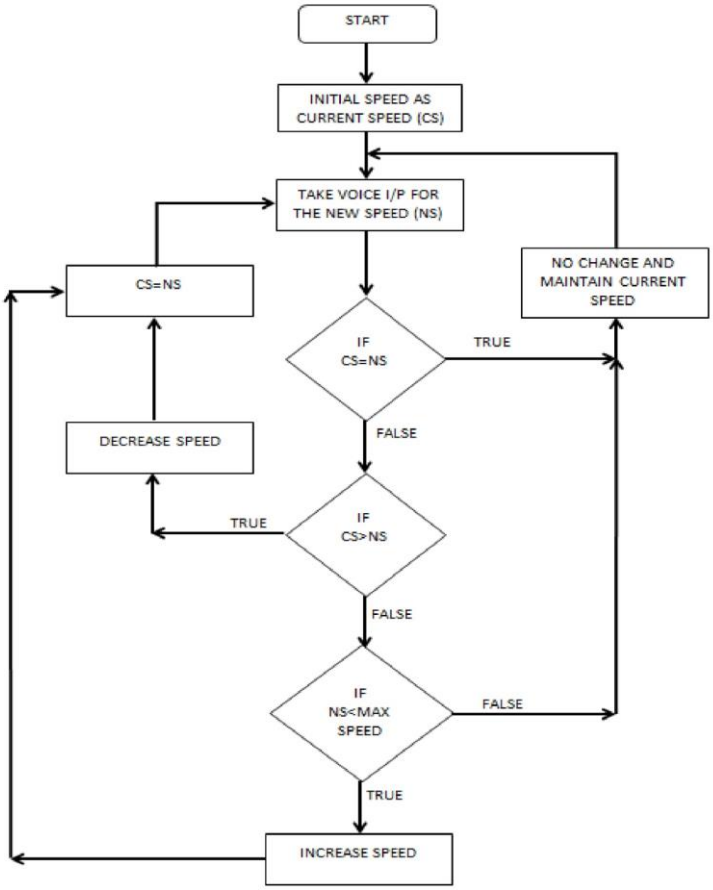

Fig 4.1: Flowchart of the voice controlled speed system

4.2 ALGORITHM

STEP 1: Start.
STEP 2: Set CURRENT SPEED to zero.
STEP 3: Take the VOICE INPUT from the user.
STEP 4: Check the INPUT to be equal to the PRESENT SPEED.
STEP 5: If condition is TRUE don't change the speed and go to STEP 3.
STEP 6: If condition is FALSE check for PRESENT SPEED to be greater than NEW INPUT.
STEP 7: If condition is TRUE then check whether NEW INPUT SPEED is less than the MAXIMUM SPEED.
STEP 8: If TRUE then don't change the speed and go to STEP 3.
STEP 9: If FALSE increase the speed.
STEP 10: Set CURRENT SPEED to be equal to NEW INPUT SPEED.
STEP 11: Jump to Step3.

V. METHODOLOGY

The system is first trained so that the commands for the voice of a particular user are loaded in the system. This provides a kind of authentication to that particular user as all other voice inputs of a different user won't be recognized by the voice recognition module.

After the system is trained with a particular voice then that user is then allowed to speak the commands stored earlier during the training process. Once the command is received by the system the system checks to see whether the input command is to increase the speed or to decrease the speed. After performing the check the motor rotates in the required direction and thus the system produces the desired output in order to deliver the speed demanded by the user.
In case if the user gives the voice input same as that of corresponding to the current speed then the system just maintains the current speed without any change.

VI. RESULT

The results after implementing the project are at two different stages:

1) Voice Recognition Module

The voice input from the user is taken by the voice recognition module and is converted into a digital form after processing. Thus, several different bit sequences are obtained corresponding to each voice command given by the user.

2) Throttle

Depending on the voice input the position of the throttle plate is controlled by the motor so that the required amount of air and fuel flows through the throttle body and the desired speed is obtained.
The success rate of the project heavily depends upon the interference caused by the noise around the system. The system is less likely to produce correct results in presence of noise around the system. The success rate of the project can be increased by using advanced voice or speech processing techniques so that even in presence of the noise the system produces correct results by suppressing the noise.
Success rate is also dependent upon the consistency in human voice i.e. the pitch of the human voice may change and this may result in a situation wherein the same human voice may not be recognized by the system even after training the system with the same human voice. This problem can also be solved by using advanced voice or speech processing techniques to compromise for the change in the pitch of the human voice.

VII. CONCLUSION

This system discovers a new way of controlling the speed of a vehicle. Its as if the user is communicating with the vehicle and asking it to increase or decrease the speed according to the user's wish. Thus, this project can also be known as "Drive-by-Voice" or "Accelerate-by-Voice".The major concern with this system is that the noise present around the system as the voice recognition module is also able to hear the background noise in addition to the voice commands.But, this concern can be eliminated by using highly accurate and highly precise voice recognition module wherein very complex voice processing is done so that the voice is accurately processed eliminating the background noise.

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