Voice Recognition Vehicle Movement System

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***Abstract*—Cars are one of the types of transport that people use daily and automotive technology has advanced at an incredible rate. In this study, the researcher developed and tested an automotive innovation by utilizing smartphones, in which existing automotive features can be managed by voice commands. The implementation completed will be able to add another feature to the vehicle. Voice recognition is the procedure of consequently perceiving a certain statement talked by a specific speaker focused around individual data included in discourse waves. This paper tries to control a car with the voice of a human. Recognizing the presence of noise is an important pre-processing task in Voice Recognition systems. Sensitivity to speech fluctuation, a lack of recognition precision, and the inability to mimic are some of the main specialized barriers that prevent a wide range of speech-based recognition systems from being chosen. Voice recognition systems work sensibly well with a quiet condition however inadequately under loud conditions. As a result, the accuracy for the command by the user was around 88.57%. Other than that, the accent user that has been used for the trial was around 100% and for the range of Bluetooth to receive commands from user around 77%. For the percentage area, every time the user gives commands, and the ranges are 11.43% and 33% respectively.**

Keywords—Voice recognition; Automotive Technology; Vehicle System.

I. INTRODUCTION

Voice Recognition Vehicle System (VCVS) is a system that implements the voice recognition system using Bluetooth to move the vehicle. VCVS is a system that uses Bluetooth to receive a command from the user whether it wants the vehicle to move forward or reverse. This system also can be used from inside or outside the car as it is using the Bluetooth system to receive the voice data. By using this system, disabled people can drive the car without stepping on the gas pedal and it also will give warning to the people if the car to close to the rail guard or the wall during parking mode. To make this project feasible, there are several electrical components involved such as DC Motor, HC-05 Bluetooth module and LED. The goal of this project is to build a system that can be implemented into a vehicle system for disabled people that collect input from phones and move by itself.

Speaker identification and speaker verification are two types of voice recognition, sometimes known as speaker recognition. Speaker identification determines which person talks, whereas speaker verification determines whether a specific person speaks.[1] Voice recognition can be separated into text-dependent and text-independent technologies based on the voice of distinct materials. The speaker must pronounce the text in line with the contents of the text for the text-dependent voice recognition system to work. The sound profile model for each individual is precisely defined. To get a greater effect, people must also be identified by the contents of the text during recognition. Text-independent recognition systems do not require defined word contents, which is challenging to model, but are user-friendly and may be used in a wide range of situations.

Voiceprint recognition is a programme that recognises a speaker's voice and linguistic patterns based on physiological and behavioural features of the speaker's voice. Unlike speech recognition, voiceprint recognition is unaffected by the content of speech. Rather, the speaker is identified by analysing the unique qualities of his or her speech. The distinctive elements of voice samples will be extracted and transformed into digital symbols, which will then be saved as that person's character template. This template is kept on a computer, a smart card, or bar-coded cards. Inside the recognition system, user authentication is handled to determine whether the user is a match.

Voice recognition software decomposes a speech recording into individual sounds, analyses each sound, uses algorithms to determine the most likely word fit in that language, and then transcribes those sounds into text. Natural language processing (NLP) and deep learning neural networks are used in speech recognition software. “NLP is a method for computers to study, comprehend, and decode human language.” This means the software breaks down speech into bits it can recognize, converts it to a digital form, and evaluates the content sections. So, after the software makes assumptions about what the user is saying based on programming and speech patterns [2]. The software transcribes the dialogue into the text after estimating what the users most likely said. This all sounds simple enough, but the advances in technology mean these multiple, intricate processes are happening at lightning speed. Machines can transcribe human speech more accurately, correctly, and quickly than humans can.

The speech engine is the starting point for any speech recognition-based application. Consider the speech engine to be a keyboard substitute.[3] Speech engines come in a variety of shapes and sizes. Some just recognize commands and can work on a variety of platforms, including PDAs and PCs. Many are designed for telephonic applications like airline reservation systems and customer service answering systems. In medicine, the continuous speech recognition engine is employed for dictation solutions. This sort of speech recognition allows users to speak in their natural voice while also allowing voice control of a properly built program. This is one of the most advanced speech technologies available, as well as one of the most processor intensive.

II. RELATED WORKS

The first related projects are Intelligent Voice Control Lighting Device Based on Arduino Uno Microcontroller [4]. The concept to build the project using Arduino Uno, LED,

ASR M08-b module information, DS1302 Real-time clock module, OLED 12865 display module and steering engine.

This program design mainly adopts conditional statements, serial communication, protocol, and other statements. The program block diagram mainly consists of three parts. The first part is the main program for the lighting device to realize the main functions, namely the serial communication program between Arduino and the speech recognition module. The implementation principle is the speech recognition module will send fixed condition codes when it receives the set statement, and Arduino can recognize different statements by identifying these specific condition codes. The second part is the direct control of LED lights and steering gear after the data is recognized and processed by the single-chip microcomputer. The third part is the communication, processing, and display of the clock module, which needs to set the time parameters.

The second related project is Voice Controlled Home Automation Design [5]. The concept of this related project is showing the concept of using EasyVR shield with Arduino Uno and how the voice data work to make the equipment turn on and off by using voice. The main component for this project is Arduino Uno which acts as a microcontroller to control the EasyVR shield and ZigBee technology to receive the voice data and throat microphone to send the voice data to the microcontroller.

The method of Voice Controlled Home Automation Design by using a throat microphone, a set of voice commands has been defined in the voice recognition module. The designed home automation system works as follows. The voice recognition module converts voice commands into digital signals, and then these digital signals are transmitted to the home automation system via a ZigBee-based communications module. The receiver of the ZigBee communications module receives the commands given by the transmitter and sends them to the microcontroller. Finally, the microcontroller analyzes the commands and performs the expected operations. Arduino Uno has been used as the microcontroller and the EasyVR module has been used for voice recognition. The software of the home automation system has been developed in C using Arduino IDE.

The third related project is Controlling an Electric Car Starter System through Voice [6]. The concept is to make security for an electric car that can keep the vehicle from robbery. The main component for this project is using an electret microphone to send the voice data to the controller, the audio amplifier to amplify the data from the microphone to the controller which is Arduino Nano, and the relay will switch on the DC Motor.

The method of this project is bypassing a vehicle's ignition interlock and, in this way, beginning it without the key. Thus, this project is to create the circuit and associate between two wires (ignition key and coil). The circuit just can be ON and OFF by the controller which gets signals from voice orders. This can counteract and make it hard for burglary to take the car. There are numerous processes and examinations included in this project. The main objective is to study the voltage output from the input signal of the microphone. The second is to create a controller circuit board for controlling the car ignition system. The last one is to design programming for voice to control an ignition system. The scope of this project is to gather information on voltage signals from an electret microphone. The signal will be amplified and be utilized by the controller. The voltage different from the electret microphone will be analyzed to operate the DC motor. This project only focuses to control the starter system. The user or driver gives the command to ON and OFF the DC motor.

The third related project is Voice Recognition Based Wireless Home Automation System [7]. The concept of this project is to build an integrated system to facilitate elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands. The system contains 3 modules which are the handheld microphone module integrated with the RF module, the central controller module which acts as the controller and the appliance control modules that connect to the appliances.

The method of this project run when the automation centers on recognition of voice commands and uses low-power RF ZigBee wireless communication modules. The home automation system is intended to control all lights and electrical appliances in a home or office using voice commands. The system has been tested and verified. The verification tests included the voice recognition response test, indoor ZigBee communication test, and the compression and decompression tests of DPCM (Differential Pulse Code Modulation) speech signals.

The last related project is Smart Car: Digital Controlling System Using Android Smartwatch Voice Recognition [8]. The concept of this project is to build cars that can be controlled with a smartwatch through voice commands. The main component of this project is the relay channel where it can conduct the current electric that has higher voltage. Other than that, this project uses Bluetooth HC-05 use as a slave or master, Arduino Uno as a microcontroller and a smartwatch.

From the previous projects, this paper selection of the method of this project is the user connects the Arduino Uno with the smartwatch via HC-05 Bluetooth connection. Afterwards, the user opens the voice command application on the smartwatch and gives voice commands to turn on the machine, such as opening and locking doors, and raising/lowering the car window glass. Other than that, Arduino Uno R3 microcontroller that functions as the brain of the system, Bluetooth HC05 as a signal receiver from a smartwatch and LED as a notification sign, relay serves as a switch for connecting and disconnecting the switch car starter module to the battery in the car, push-button as a tool for turning off the electrical system in the car.

III. METHODOLOGY

A. Block Diagram

Fig. 1 depicts an Arduino Uno-based Voice Recognition Vehicles System block diagram. The major component used in this project is the Bluetooth model HC-05, which will receive signals or instructions from the user in the automobile to drive the vehicle. The vehicle will obey the user's commands, and each red, green, and yellow light will turn on and off according to the predetermined command.

The microcontroller used in the Voice Recognition Vehicle System (VSVR) is an Arduino Uno where it acts as a controller that will receive data and move the vehicle. after receiving instructions from the user.

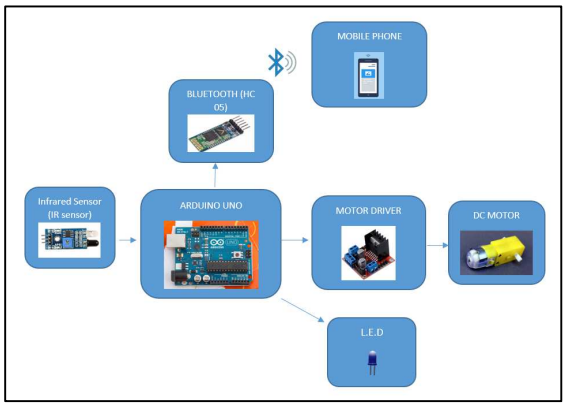

Fig. 1. Block Diagram of VRVS

B. Flowchart

Fig. 2 shows the flow chart for the VRVS project. VRVS systems require a combination of car bias and voice systems used in the car industry. This system is combined with a Bluetooth module where it functions as a receiver and transmitter. it will receive instructions from the user. upon completion of all elements for the Voice Recognition Vehicle System. The system can be continued for complete testing and installation.

First, users need a voice command that can be found in the play store for their phone or android player that is in the user's car and connect with the Bluetooth module. Next, the Bluetooth transmitter will detect the Bluetooth module that has been connected to the vehicle system. when the user has connected with Bluetooth, the user has been able to make commands to voice commands and Bluetooth will send the signal to Arduino Uno that has been obtained to be processed.

Next, after the user connects to the Bluetooth module, the system will be ready to receive instructions. when the user gives directions to VRVS with the command 'on', it will turn on the vehicle system such as turning on the car engine and equipment in the car. it also turns on the green LED light for a few seconds to indicate the system has pounds working.

Moreover, when the user gives a command to the Voice Recognition Vehicles System which is the 'forward' command, it will turn on the green LED light and move the vehicle tires forward. in addition, when the user changes the command to the 'reverse' command it will move the vehicle backwards and the red LED light will light up. next, if the user gives a 'turn left' command, the microcontroller will give a command to the system to make the vehicle turn left and turn on the yellow LED light.

This yellow LED light will also come on when the 'turn right' command and the system will turn the tire to turn right. for the 'stop' command, it will stop the vehicle and the red LED will flash twice. after the user stops and wants to turn off the system, with the 'off' command it will turn off the vehicle system.

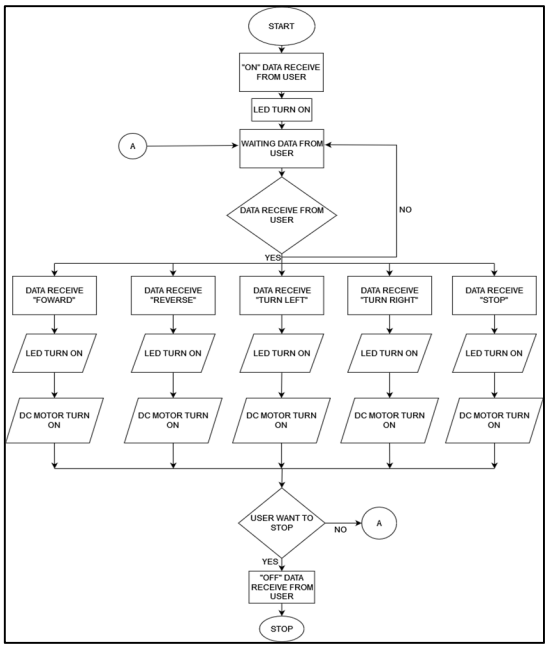

Fig. 2. Flowchart of Voice Recognition Vehicle System

C. Circuit Diagram

In-state of designing the circuit diagram, the programs that were used to draw the circuit for the Voice Recognition Vehicle System is proteus software that was shown in Fig. 3 below. There is one part were used for the input part and the other 3 part were used for the output connected to Arduino Uno. For the input part, there is a Bluetooth module [9] that are connected directly to pin 0 and pin 1 as receiving and transmitting from device to car system.

Next for the output port, the motor for this project was connected to Arduino using pin 2 until pin 12. For pin 2 until pin 5 were used to connect the motor through the motor driver. The motor driver that is used for Voice Recognition Vehicle System is motor driver L298N and this project use 2 motor drivers to control 4 motors.

This motor driver [10] can connect 2 motors to its port. Port that connected directly to Arduino[11] are pin IN1 to IN4 respectively to pin 2 to pin 5 at Arduino and pin 6 to pin 9 for other 2 motors. IN1 and IN2 were used to control 1 motor and the other IN3 and IN4 controlled the other one. To turn on the motor driver it used external batteries which is 12V batteries and for the ground, it connected with a battery negative terminal and Arduino ground pins. For the LED port, the connection pins are from pin 10 until pin 12. Red LED connected to pin 10, yellow LED connect to pin 11 and green LED connect to pin 12. It will turn on and off according to the command that the user transmits.

IV. Result and Discussion

A. Voice Recognition Vehicle System Analysis

In data analysis, estimation of the project was done at an open space area located at Tasik Shah Alam, Selangor by using a small car model. For this data analysis, data was taken for each analysis to obtain the exact amount of command that Bluetooth module speech can detect and the range of the Bluetooth module to receive the commands. This allows the model to freely move to receive the commands to be recorded in the final analysis. The accurate transmit commands and time is important for this project.

Firstly, analysis is done to get the accurate commands that transmit from device to system to identify how accurate the device detect the users' commands. To get the accuracy of the device, each commands accuracy is obtained by asking 10 users to use the device. This allows the model that has been used to move according to the commands. Next, analysis for the users' accents. For this analysis, users' just need to repeat the commands. This analysis is to obtain the accuracy of voice commands using users' accents.

Finally, the analysis is continued on the Bluetooth device. Data is taken for the range of the Bluetooth device to transmit the signal from the user to the system in all directions. For this analysis, data were taken for several different times where 2-meter, 4-meter, 6-meter, 8-meter, 10 meters. Table III were used to obtain the range of the command against the VRVS system.

TABLE I. Accuracy of Users' Commands to the System

Commands	User's Commands									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
On	/	/	/	/	/	/	/	/	/	/
Off	/	/	/	/	/	/	/	/	/	/
Turn left	/	/	/	X	/	/	/	/	X	/
Turn right	/	/	/	/	/	/	X	/	X	/
Reverse	/	X	/	/	/	/	X	/	/	/
Stop	/	/	/	/	/	/	/	/	/	/
Forward	/	X	X	/	/	/	/	/	/	/

Based on Table I above, shows the data obtained from the accuracy that users give to the system. The specification provided by the supplier shows that the voice Bluetooth application can detect the commands that have been used for the project about 88.57%. Through the analysis made, the commands transmitted by the user can be detected with high accuracy.

Table II shows the data obtained from the users' accents against the system receiver. Through this analysis, data were obtained by using the voice Bluetooth application to transmit the data to the system in this case. The data obtained show that the system can detect the users' accents but need to try several time for a few users.

TABLE II. Users' Accents Transmit Signals to the System

Commands	User Accent
	Malay
On	/
Off	/
Turn left	/
Turn right	/
Reverse	/
Stop	/
Forward	/

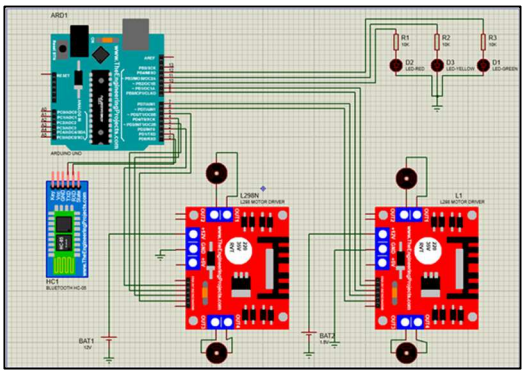

Fig. 3. Circuit diagram of Voice Recognition Vehicle System

Based on Table III below, shows the data obtained from the analysis for the range of the Bluetooth application to the system. Throughout the spec provided by the supplier for the Bluetooth module, the Bluetooth module can receive the signal in the range of 10 meters. Through the analysis made, the Bluetooth module was tested at the range of 2,4,6,8 and 10 meters to show how far can it receive the signal.

TABLE III. Range of Bluetooth Module to Receive Data

Commands	Range of Bluetooth module				
	2	*4*	*6*	*8*	*10*
On	/	/	/	/	/
Off	/	/	/	/	/
Turn left	/	/	/	/	X
Turn right	/	/	/	/	/
Reverse	/	/	/	X	/
Stop	/	/	/	/	X

V. Conclusion and Recommendation

In this paper, the method used is a simple technique by simply using Bluetooth module, Bluetooth transmitter application and Arduino Uno as a processor that directly gives a signal on the system. This system gives a solution for the disabled user to drive the vehicles or car without any difficulties. Hence with the Bluetooth system, it can directly command the system by the user as it is convenient for the user to go to the desired places. Furthermore, this system can be used by the car manufacturing industry to improve people life in Malaysia. This system can make the country develop more to smart country. In addition, it also can upgrade into putting the system into the normal car. In the future, the system can be upgraded by synchronizing it with an autopilot system like tesla model cars and can increase the production of friendly user systems for disabled users.

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