Controlling An Electric Car Starter System Through Voice

A.B. Muhammad Firdaus, R. Mohamed Yusof, A. Saharul, M.H. Nuraida

Abstract: These days, automotive has turned into a stand out amongst the most well-known modes of transportation on the grounds that a large number of Malaysians could bear to have an auto. There are numerous decisions of innovations in auto that have in the market. One of the engineering is voice controlled framework. 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 is to make an car controlled by voice of human. An essential pre-processing venture in Voice Recognition systems is to recognize the vicinity of noise. Sensitivity to speech variability, lacking recognition precision, and helplessness to mimic are among the principle specialized obstacles that keep the far reaching selection of speech-based recognition systems. Voice recognition systems work sensibly well with a quiet conditions however inadequately under loud conditions or in twisted channels. The key focus of the project is to control an electric car starter system.

Index Terms: Voice Recognition, discourse waves, speech variability, speech-based recognition systems, starter system.

I INTRODUCTION

Speech is the most common approach to convey for people While this has been valid since the beginning of human advancement, the innovation and across the board utilization of the phone, radio, and TV has given significantly further significance to speech correspondence and speech processing. The advances in computerized sign transforming innovation have driven the utilization of speech processing in various application regions like speech compression, enhancement, synthesis, and recognition [1]. Voice recognition is the methodology of taking the talked word as a data to a machine program. This procedure is critical to virtual reality in light of the fact that it gives a genuinely regular and instinctive method for controlling the recreation while permitting the user's hands to stay free. Voice recognition is "the innovation by which sounds, words or expressions talked by people are changed over into electrical signs, and these signs are changed into coding examples to which importance has been allocated" [2]. While the idea could all the more by and large is called "sound recognition". This extend concentrates on the human voice in light of the fact that regularly and most characteristically utilize our voices to impart our thoughts to others in our prompt surroundings. Voice control is coming to control car starter system. The procedure is perceives a certain expression talked by the user. The user will charge through receiver introduced in the car. The signal in analogue form will converted into digital form. The car is installed with controller and databases which comprise of vocabulary that make out of essential words utilized for charging the ignition system. . The controller will measure up the signal given by the user with databases that installed in the car [3].]. On the off chance that redress, the motor will begin.

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On the off chance that include is wrong, the ignition system won't working. The reason for this project is to make a security system for electric car. Security system that keep from the motor vehicle robbery. Motor vehicle robbery is the criminal demonstration of taking or attempting to steal a car. 55% of car burglary in Malaysia is utilizing hot-wiring method [4].The method is the procedure of 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 get signal from voice orders. This can counteract and make it hard to burglary to take the car. There are numerous process and examination include in this project. The main objective is to study the voltage output from the input signal of microphone. Second is to create controller circuit board for controlling the car ignition system. The last one is to design a programming for voice to control an ignition system. The scope of this project is to gather information of voltage signal from electret microphone. The signal will be amplified and be utilized by the controller. The voltage different from electret microphone will be analyzed to operate the DC motor. This project only focuses to control the starter system. The user or driver gives command to ON and OFF the DC motor. The commands to control another device in the car are excluded in this study.

II LITERATURE REVIEW

Literature review is one of the scope studies. It will give part to get the information about Voice Recognition and will offer thought to work the testing. From the early phase of the project, different literature studies have been carried out. Research journals, books, printed or online meeting article were the primary source in the project guides. At that point, the literature review segment fills in as reference, to give information and aide base on journal and other source in the media. Other than that, this part likewise some review of each one segment that utilized as a part of the project. All the part is depict in subtle elements focused around the finding during the completion of this project.

A. Voice Control

The idea of voice recognition began some place in 1940s, essentially the first discourse recognition project was showed up in 1952 at the bell labs, which were about recognition of a digit in a noise free environment [5]. Voice recognition is an

innovation that capable a computer to catch the words talked by a human with an assistance of microphone. These words are later on recognized by speech recognizer, and at last, framework yields the recognized words. The procedure of discourse recognition comprises of distinctive steps.

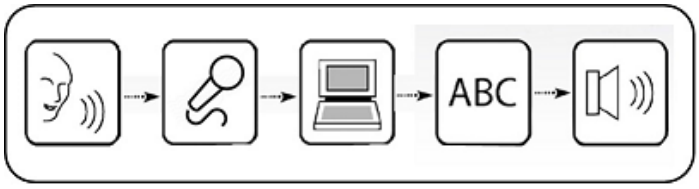

Fig. 1 *Voice recognition*

A perfect situation currently voice recognition is that, a voice recognition engine perceives all words articulated by a human but, basically the execution of a voice recognition engine relies on upon number of elements. Vocabularies, various users and noisy environment are the major factors that are considered in the depending elements for a voice recognition engine [6]. To perceive the voice orders effectively diverse parameters of discourse like pitch, sufficiency example or force/vitality can be utilized. To begin with the voice charges are brought with the assistance of a microphone that is specifically associated with PC. After it, the simple voice signals are tested and convert to digital signal. At that point, the device identifies and compares that specific command given by the operator and performs the task accordingly [7]. In the event that the command given by the operator does not match with any of the lexicon order then the device will not take action.

B. Electret Microphone

A quality microphone is critical part when using the speech recognition system. It permits the ambient noise to be minimized. An electret is a dielectric material that has been permanently electrically charged or captivated. A static charge is embedded in an electret by arrangement of the static charges in the material, much the way a magnet is made by adjusting the magnetic areas in a piece of iron [8].

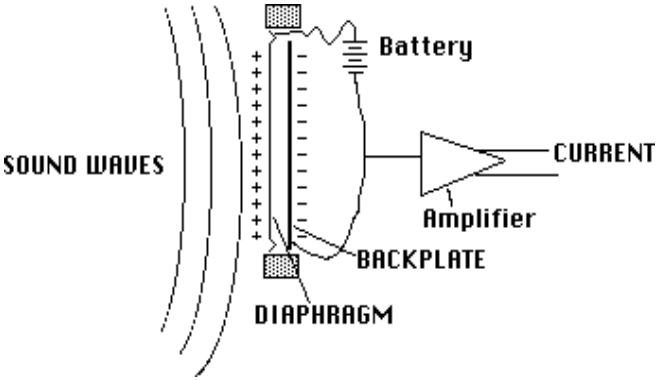

Fig. 2 *Condenser microphone*

The figure 2 demonstrated the fundamental process inside the condenser microphone. A microphone is an illustration of a transducer, a device that progressions information starting with one form to another. Sound data exists as examples of air pressure. The microphone changes this data into examples of electric current. In a condenser microphone, the diaphragm is mounted near to, however not touching, an unbending backplate. (The plate might possibly have holes in it.) A battery is joined with both pieces of metal, which creates an electrical potential, or charge, between them. This separation changes as the diaphragm moves in light of sound. The measure of current is basically corresponding to the displacement of the diaphragm, and is so small that it must be electrically amplified before it leaves the microphone. To be useful for recording or other electronic processes, the signal must be increased by a component of over a thousand.

C. Audio Amplifier

An electronic amplifier, or (casually) amp is an electronic device that builds the power of a signal. It does this by taking energy from a power supply and controlling the output to match the data signal shape but with bigger amplitude. Operational Amplifiers (Op amps) are one of the most widely used for analogue [9].

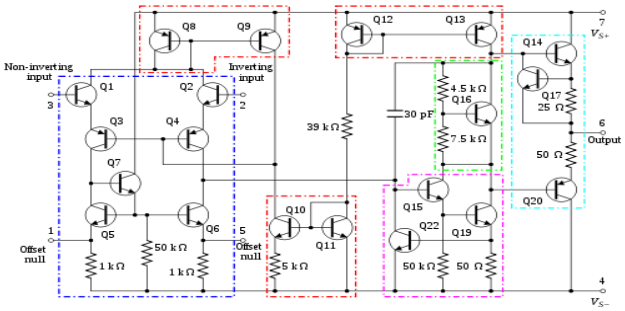

Fig. 3 *OP-amp LM741 circuit diagram*

The amplifier's differential inputs comprise of a non-inverting input (+) with voltage V+ and an inverting input (–) with voltage V−. Preferably the op-amp amplifies only the difference in voltage between the two, which is known the differential input voltage. (+) with voltage V+ and an inverting input (–) with voltage V−; ideally the op-amp amplifies only the difference in voltage between the two, which is called the differential input voltage.

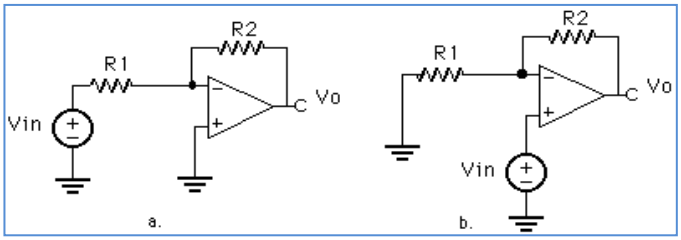

Fig. 4 *a) Inverting amplifier, b) non-inverting amplifier*

In the non-inverting amplifier on Fig 4.b, the presence of negative feedback via the voltage divider Rf, Rg determines the closed-loop gain ACL = Vout / Vin. Equilibrium will be created when Vout is simply sufficient to "reach around and pull" the inverting input to the same voltage as Vin. The voltage gain of the whole circuit is thus 1 + Rf/Rg [10].

III METHODOLOGY

Voice control system development is divides into four stages of method which is voltage regulator, sound detection, controller and starter.

A. System Phase Block Diagram

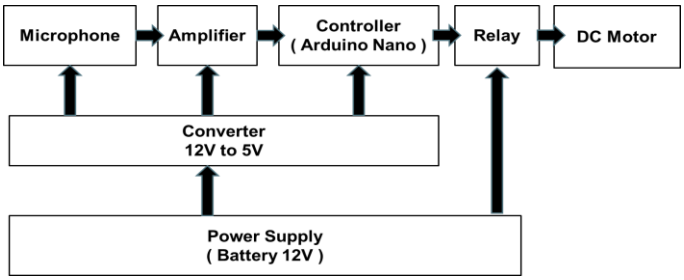

Fig. 5 *System phase block diagram*

B. System Phase Flow Chart

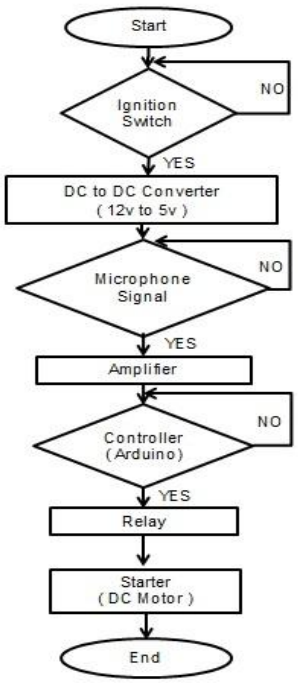

Fig. 6 *System phase Flow Chart*

C. Phase 1 : Voltage Regulator

A voltage regulator is designed to automatically maintain a constant voltage level. The LM7805 Voltage Regulator is a 3-terminal voltage regulator which can supply an output voltage 5V. It can supply more than 1.5A of load current to a load.

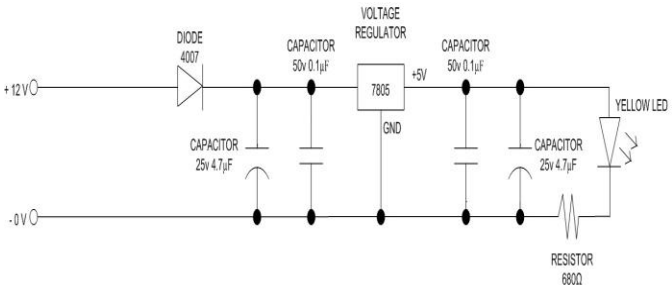

Fig. 7 *Voltage regulator circuit diagram*

D. Phase 2 : Sound Detection

A sound detector circuit is a circuit that can identify sound, for example, talking, applauding, or yelling. This project uses a microphone to be able to detect sound. . Be that as it may a microphone alone is inadequate for this circuit. This is on account of a microphone alone, without an amplifier, delivers little electrical signals. In this way, to have the capacity to discover a signal that is substantial enough, the signal needs to be amplified first to be usable by the controller. Along these lines, the signal from microphone must unite with an amplifier, have the signal increased, and afterwards join the amplified signal into the controller.

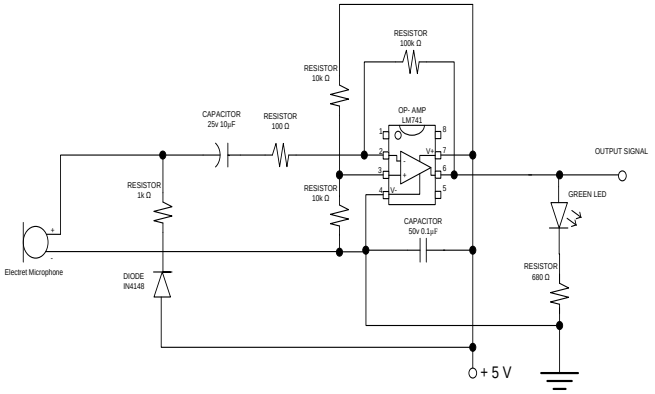

Fig. 8 *Sound Detection circuit diagram*

E. Phase 3 : Controller

Controller that utilized as a part of this project is Arduino nano. Arduino is an open-source hardware prototyping stage focused around adaptable, simple to-utilize equipment and programming. Arduino can sense nature by receiving input from an assortment of sensors and can influence its surroundings by controlling lights, motor, and different actuators. The microcontroller on the board is modified utilizing the Arduino programming language (focused around Wiring) and the Arduino advancement environment (focused around Processing).

F. Phase 4 : Starter

The DC motor has been utilized to work the framework. An electric motor is an electric machine that changes over electrical energy into mechanical energy. In ordinary motoring mode, most electric motors work through the association between an electric motor's magnetic field and winding currents to generate force inside the motor.

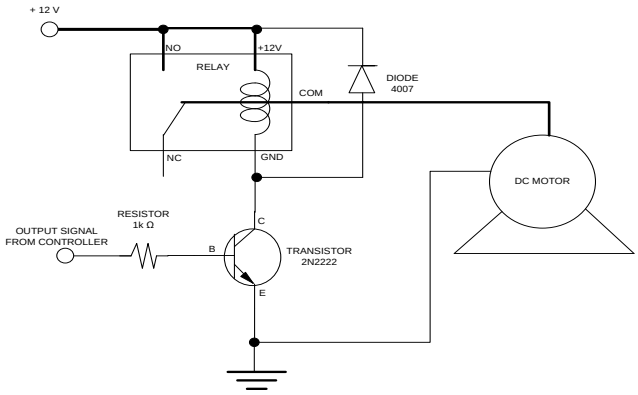

Fig. 9 *Starter circuit diagram*

IV Result & Discussion

A. Input Signal

The signal that used for this project is a human voice. These will be treated as inputs to the system and along will also see the frequency ranges of the inputs through waveforms. The presented waveform showed the impact of vocal effort level on the performance of voice detection. It will be considered as database for the system.

I. Input Signal for Turning ON the Motor

The figure 10 to figure 12 below showed the waveforms that have been recorded in difference environment with same command.

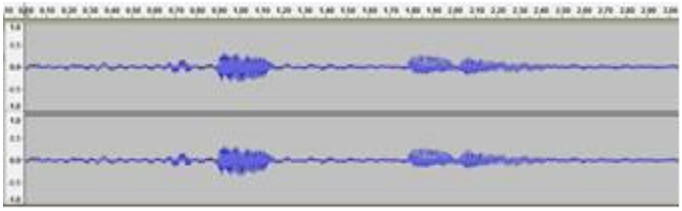

Fig. 10 *Command "Start Engine" in quiet environment*

At the figure above, there is big difference between the waveform of the voice and the environment. So, the system did not have problem to detect the user command. The error will be less and the system will run smoothly.

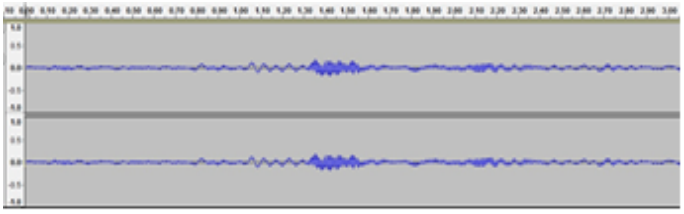

Fig. 11 *Command "Start Engine" in normal environment*

The figure 11 has shown the sample in normal environment where have little bit noise. From the waveform, the command only has small difference from the environment. So, the system has a problem to detect the command from the user. The user must speak little bit louder than normal to be recognized. It is because the microphone too sensitive to detect the sound and record the unnecessary sound. But the system still can detect the command and can be used to turn ON the motor.

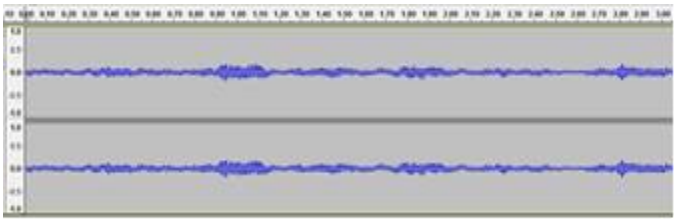

Fig. 12 *Command "Start Engine" in noisy environment*

The waveform of the command and the environment did not have much difference. It difficult to the system to detect or recognized the command by given by the user. Sometimes the system will turn on because of the noise make from the environment. So, the system is not recommended to be used in this environment.

II. Input Signal for Turning OFF the Motor

There are other samples for OFF command that have been recorded and analyzed. The figure 13 to figure 15 below showed the waveform of the sample for 3 second.

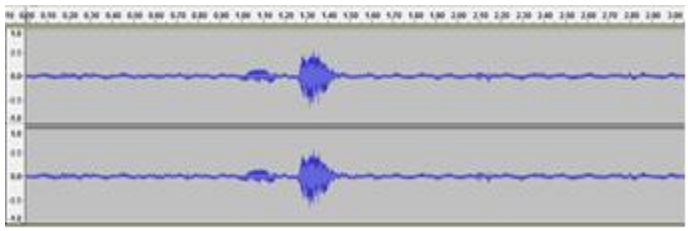

Fig. 13 *Command "Stop" in quiet environment*

From the figure above, the command can easily be recognized in this environment. It did not have major problem compare to other environment. The system can nicely been run in this situation.

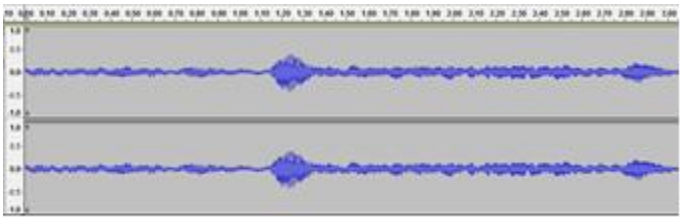

Fig. 14 *Command "Stop" in normal environment*

In the normal environment, this command can perform well but less sensitive due to the unwanted noise. It can be seen in figure 14. The waveform of the sample is little bit difference compare to the sample that has been recorded in quiet environment.

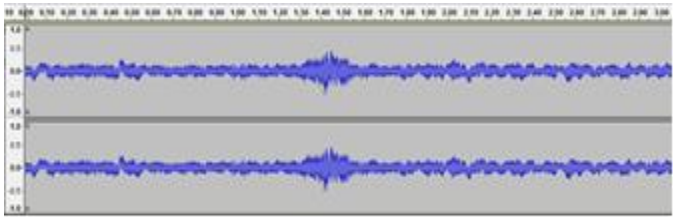

Fig. 15 *Command "Stop" in noisy environment*

For this environment, the sample given and environment is almost same frequency. The figure 15 has shown the waveform. It is hard to the system to recognize the command. It is a same situation as a sample in figure 12. The command is not clear and difficult to detect because of surrounding environment that effect the input signal.

B. Analogue to Digital Converter

The important element of this system is to convert the input signal from analogue signal to digital signal. So that it can be

used by the controller. The equation can be given as in (1). This mathematical equation is to calculate the resolution of the sound level using voltages that have been measured.

$$\frac{Resolution\ of\ ADC}{Voltage,\ VDD} = \frac{ADC\ Reading}{Voltage\ Measured} \quad (1)$$

Since the system use Arduino nano as the controller, the ADC on the microcontroller converts a range of 0v to 5v to a 10-bit number. The calculation can be show as :

Resolution of ADC = 10 bit
= 2^{10}
= 1024

The analogRead() on the Arduino is always reading a non-zero value even no noise in the microphone. So, the silent ADC of this range is not 0, it is around 532 which corresponds to a voltage of around 2.6 V. The ADC range to turn On and OFF the starter system is 900 and 655 (Table 1).

***TABLE 1**: ADC CONVERTER*

No.	Voltage Measured, (V)	Sound Level (ADC Reading)
1	2.0	409.20
2	2.2	450.12
3	2.4	491.04
4	2.6	531.96
5	2.8	572.88
6	3.0	613.80
7	3.2	654.72
8	3.4	695.64
9	3.6	736.56
10	3.8	777.48
11	4.0	818.40
12	4.2	859.32
13	4.4	900.24
14	4.6	941.16
15	4.8	982.08
16	5.0	1023.00

Unfortunately, this system has some issue on account of a few reasons. The foundation noise from the microphone and user's surroundings here and there causes the recognizer to hear an alternate vector and is not consistent. Each time a user talks a word it sounds diverse. Users don't create precisely the same sound.

V CONCLUSION

This project is to analyze the voltage of the microphone and develop a prototype of the voice controlling device in the car system. The system can turn ON and OFF using difference level of voltage that came from microphone. However, this system has a limitation and only record 3 seconds of the data sound. Further studies must be carried out concentrating on voice recognition to enhancing the interface system. The set-up for keeping up these ecological conditions will be an one-time venture for any genuine application..

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