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Implementation of Human Voice Controlled Robotic Car

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***Abstract*—This study's objective is to ascertain out more about asystem that recognizes human voice instructions to operate a voice controlled car. The a voice-controlled car is only an example of how to exert control over the movement of a basic robot using commonly used spoken instructions . An android app is utilised in this system to transmit human instructions to the microcontroller. The UART protocol may be used to connect a controller to a Bluetooth module. The android app receives the speech and the voice module processes it. After then, the voice is transformed to text. This text will be further processed by the microcontroller, which is going to take appropriate step taken to control the avoice control robotic car. The purpose of this system is to construct a robotic car that can be operated with a human voice for basic actions like going ahead and turning left or right. The ATmega Arduino board is the Hardware Development board utilised in this project. The programme is written in the Embedded C/C++ is used by the Arduino IDE. The hardware has been set up , and software has been ported. In general, utilising some form of module to recognise human speech costs much too much. We concluded that, indeed, there is a very basic and straightforward solution effective method for controlling robots using human voice after doing a large number of tests on the subject. This is a simple robotic application approach.**

Keywords: Voice, Arduino, Step-Motors, Smart Vehicle

I. Introduction

The goal of the VC Automobile system is to develop a voice-controlled car prototype utilising an Arduino UNO board. The concept might benefit physically

Challenged persons by allowing them to walk independently. It may be beneficial for physically handicapped persons who can tell the automobile to travel ahead, reverse, turn right, turn left, or stop, and the car will obey their commands. The voice will be used to direct the car's movement, and the robot will respond to

The controlling individuals by creating sounds of human voice in response to each spoken order. The prototype will be built around a microcontroller that will be linked to an Android phone through Bluetooth to listen to voice instructions The command given via voice , which may be provided in both English and Arabic, is translated to text by an Android app and sent to the microcontroller, which controls robot movement. After receiving the data, the robot responds to the instruction by moving in the correct direction in accordance with the spoken command. Ultrasonic sensors connected to the Arduino aid in the automated slowing or stopping of a vehicle in the event of a sudden obstruction detection, and after a wait, it aids in the obstacle avoidance. Along with sound, the technology will attempt to direct the car's movement by recognising hand gestures (if time permits). The hardware will be put together, and the programming will be done using the Arduino IDE, using block coding for moving the robot and Python for gesture detection. The the purpose of this article is to provide a comprehensive a summary of the VC Car Arduino system. It will describe the system's goal and characteristics, as well as the system's scope and limitations, as well as the system's software and hardware needs.

II. System Motivation and Problem Statement

Almost everyone in today's world suffers problems at some time, there will be trials and tribulations. On the other hand, there are barriers, might be more frequent and have a larger audience effect on individuals with disabilities Disabilities include blindness, impaired vision, leprosy-free, hearing impairment, locomotor disability, mental retardation, and mental sickness. They face obstacles such as those linked to attitude, communication, physical, social, and transportation, among others. This method focuses on the issues that particularly abled persons confront when they want to drive their car on their own but are unable to do so due to a natural reason. The focus in this suggested prototype is on voice control of the robot with automated braking, speed slowing, and automatic or manual obstacle avoidance (through voice command). Our team's "VC vehicle" prototype may be used to accomplish this aim using an Arduino Uno. We want to develop an Android application that will recognise voice commands and operate the robot to do a certain job in our system.

The capacity of a machine to recognise words from a spoken language is known as voice recognition or speech recognition. We are all familiar with well-known instances of such programmes on Android phones, such as Siri (iPhone), Google Assistant, and Alexa.

The voice will be used to direct the car's movement, and the robot will respond to the controlling individuals by creating sounds of human voice in response to each spoken order. The prototype will be built around a microcontroller that will be linked to an Android phone through Bluetooth to receive voice commands. The voice command, which may be provided in both English and Arabic, is translated to text by an Android app and sent to the microcontroller, which controls robot movement. Following receipt of the data, the robot responds to the order by moving in the correct direction in accordance with the spoken command. Ultrasonic sensors connected to the Arduino aid in the automated slowing or stopping of a vehicle in the event of a sudden obstruction detection, and after a wait, it aids in the obstacle avoidance. The ultrasonic sensor will serve as an obstacle detector, acting as a link between the Arduino microcontroller (or the CPU) and the immediate surroundings, finally causing the automobile to halt.

The automobile will go from one location to another based on the user's spoken commands in English or Arabic. The system will also attempt to construct a prototype for controlling the automobile using gestures. We used an Arduino Uno to do this.

Arduino is a free and open-source electronics platform that requires just a minimal amount of hardware and software to be up and running. Using an Arduino board, you can switch on an LED with the touch of your finger or the press of a button. starting a motor, or putting anything on the internet. To accomplish so, we usedWiring-based Arduino programming language and the Arduino Software (IDE) are both built on Processing.

III. Related Work

A voice-guided user companion robot has been proposed[1]. The companion robot receives instructions from the human voice through a smart phone. The individual-assisted robot is built on a tiny size controller-based stage and may be aware of its current location.

Prospective improvements are discussed, as well as their potential use in medical sectors and residences, among other domains. The effect of the distance between the mouth and the phone on the robot's display, Only a few of the topics that might be investigated further include the influence of noise on the voice to content alteration. The operational range of the model built is 90-100 metres. To recognise and help with action faults, the Robot Activity Support system (RAS) works with a smart framework for sensing conditions, item location and mapping, and communication amongst robots . It also displays the RAS framework's components and how they're employed is a testbed for smart homes. Whenever there is a time delay between sensors, databases, robot interfaces, and route structure modules that exceeds a few seconds, the notion of help is rendered obsolete temporal precision and is more likely to be forgotten or never be accurate again when assistance is enhanced. . [2] This has to be improved since the robot's walking speed is around 3/4 that of a human.

The likely results were created with the goal of creating a money-savvy robot that can operate with any kind of medical assistance. In this case, alleviating the load on workers necessitates an explanation for the personnel gap. The field is expected to have an accuracy of roughly 90% when the shield is set to Speaker Independent (SI). With the use of Quick2si programming, a sound-controlled system that may be used to repair speech flaws, this rate might be enhanced even further. Using an intelligent image processing framework, it may be possible to recognise an item just by its form, obviating the need to speak. The automatic arm may also be adjusted to move in any direction. [3]

Vocal-guided motors are made up of a multifunctional front camera that is encrypted by the user's voice instruction. The answer came from a faraway location (ZigBee). On the EasyVR voice acknowledgement mode, the directions anticipated to be utilised for control reasons are shown (GUI Programming). The throat amplifier is used for this. The devices' actions are controlled via eight channels. On the advanced signals based on the voice module, the directives were sent. The client disclosure is distinct and simple to VR. After synchronisation, the advanced signal is sent to the motor through the ZigBee transmitter mode, which the ZigBee module collector can read. This may then be sent on to the ATMEGA328 microcontrollers to dissect and provide a regular activity. [5] Phrasal directions like go right, back, and front are among the work's significant problems. This gadget has voice recognition, weak data transmission owing to ZigBee technology, extra equipment, and a high vulnerability to disturbance. The mechanical objective in this framework is made up of five degrees of chance, with the foundation properly on the motor [6]. This vehicle has four driving wheels, each of which is individually operated. The wheels are in charge of controlling the motor. The two buildings' equipment, programming, and utilisation are all included in their plan. The movement results were satisfactory, however due to the large number of engines crammed onto the automated arm, the weight conveyance limit will be limited by the engines' weight.

Automated motors are Android smartphone applications that may be used to do tasks that are located in another location. In android app control, the device direction is changed to the collector at the transiting end, especially for forward, backward, right or left movement while using the android app device to manage the robot's travel. The microcontroller interface has established a minimum of four engines as a desirable outcome (ATMEGA16). [7] Gripper

and arm advancement is the responsibility of two of them, while body advancement is the responsibility of the other two. Using android application transmitters, the remote controller is communicated to the microcontrollers, and a collector end Bluetooth device (AUBTM-20) is utilised to turn on the DC engines using engine drivers and integrated circuits. To carry out remote actions, a GUI (Graphical User Interface)-based touch screen activity is used.

The automobile with voice-activated navigational systems. This voice is deemed transferred since the HC-05 Bluetooth IC is operating as a collector. The self-driving car could easily travel forward, backward, right, and left thanks to the engine. The voice channel is also used by this vehicle. Despite this, no one has been prevented from relocating as a result of the applications they submitted.

Moving robot frameworks from production lines to more wide situations, especially those involving human contact, presents significant hurdles for their control framework and human client interface. [9] As dictated by nature, robot experience, and system unpredictability, the robot design must be capable of operating under direct client control or gradually achieving self-sufficiency.

Additionally, it must do it safely and effectively, without demanding ongoing, particular consumer input, which may soon affect tyre consumers. Bajrang robotics' strategy for breaking down any barriers between client programming and self-ruling robot task learning [11]. We put client directions into a fortification learner at distinct levels of consideration to emphasise speedier approach acquiring as a solution to deal with diverse self-rule.

IV. System Scope and Limitations

Thousands of systems, ranging from basic domestic goods to major scientific equipment, have used Arduino as their brain throughout the years. Arduino is an easy-to-use platform for novices and highly configurable for expert users. It is compatible with Mac, Windows, and Linux operating systems. For physical computing, more microcontrollers and microcontroller platforms are available. Among others, the Parallax Basic Stamp, Netmedia's BX-24, Phidgets, and MIT's Handyboard all provide similar capabilities. All of these programmes condense the most challenging components of microcontroller programming into a logical package. Working with microcontrollers is also made simpler using Arduino, which has the following advantages:-

Arduino boards are quite inexpensive when compared to other types of microcontroller systems. You may build the smallest Arduino module by yourself or buy a pre-built one for less Rs. 300. You may use the Arduino IDE on a Windows, Macintosh OS X, or Linux computer. Microsoft Windows is the only operating system that most microcontroller systems can run on. Using the Arduino Integrated Development Environment (IDE) is as easy as pie for beginners as it is for advanced programmers and engineers. Arduino's software is available as open source, making it easy for talented programmers to expand upon it. C++ libraries may be used by people who want to learn more about the language, whereas AVR C can be used by those who want to learn more about the hardware. AVR-C code may be readily included into Arduino projects in the same way. Due to the Creative Commons licence, Arduino board designs may be freely modified and upgraded by qualified circuit designers. In order to better understand how it works and save money, even untrained users may construct a breadboard version of the module

Many businesses haven't heard of or aren't utilising the Arduino at this moment, but I expect that will change soon as companies recruit individuals who are knowledgeable with the platform. One of the most important things Arduino can accomplish for businesses is minimise the cost of prototyping, enabling organisations to iterate more often throughout development, resulting in better, more useful products.

It will enable companies to create products that are more readily upgradeable. It will lower the minimal volume required for a control and sensing system to be included with a product. The capacity to connect a large number of sensors and analyse the data might give us with previously inaccessible insights. With remote sensor networks, the Arduino will allow companies to perform things that aren't typically done today. This might result in whole new control systems for making buildings more pleasant, conserving energy, and lowering equipment maintenance costs.

The system's goal is to create a prototype for a voice-controlled automobile that can recognise gestures and navigate from one location to another. The ultrasonic sensor will serve as an obstacle detector, acting as a link between the Arduino microcontroller (or the CPU) and the immediate surroundings, ultimately causing the vehicle to slow down or stop completely. It would be a huge help in terms of ensuring the safety of those who drive it. The prototype must be used to construct the real-time model. Rather of opting for a real-time approach, we found that the expense of prototyping was manageable. We tested it initially since there are many opportunities for experiments with the prototype.

When it came to our first Arduino system, we chose the Arduino Uno board with Bluetooth connection since there are so many resources accessible on the internet. In addition to the limitations listed above, our robot will only respond to restricted orders in English and Arabic, such as going forward, backward, turning right, turning left, and stopping. If time allows, we'd want to integrate a moving automobile with unique motions as well.

V. Component Used

The following components were used to model and manufacture the VCRV, as well as to programme the Arduino and generate the software through the internet-based app creator.

Figure 1 depicts the Adruino UNO Board. Adruino UNO is an open source microcontroller board based on the Adruino.cc ATmega328p microprocessor. Six analogue pins and fourteen digital pins are available for programming through the Arduino IDE and a USB Type B connection. It may be powered by either a 12 volt or a mains voltage battery.

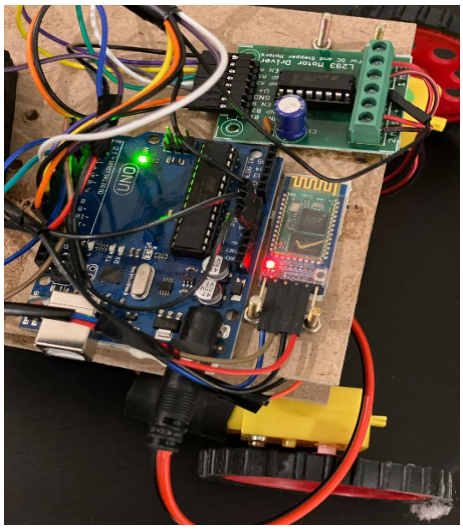

Fig. 1: Arduino UNO

Fig. 2: Gear Motor

A DC motor is a rotating electrical device that transforms direct current into mechanical energy. Along order to periodically reverse the direction of current flow in their route, all DC motors contain an internal mechanism that may either be electronic or electromechanical. Figure 2 shows a gear motor.

An inductive load may be driven by the L293 Driver, which can also accept conventional TTL logic levels. The L293 Driver is a twin bridge driver with high current and voltage. In each lower-level transistor, the emitters are linked to the matching external terminal, which may be utilised to connect an external sensing resistor. Figure 3 depicts the L293 Motor Driver in more detail as shown in Figure 3.

Fig. 3: L293 Motor

As seen in Figure 4, The HC05 is a straightforward Bluetooth serial port protocol module that enables the establishment of a wireless serial connection. It has a 12.7mm x 27mm footprint, which is rather tiny. This will streamline the whole design process.

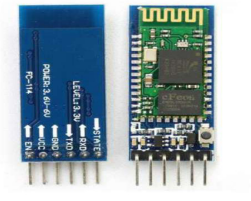

Fig. 4: HC05 Bluetooth Module

A chassis is the internal framework of an artificial item that facilitates its design and use of direct inclusion in abstracting services. The chassis is schematically shown in Figure 5 in VCRC.

A wheel is a robust and hard circular block that is put in an axil around which the wheel revolves when a moment is imparted by torque or gravity, resulting in one of the simplest machines. The wheel spinning on the horizontal axil allows huge loads to be transported when it is positioned beneath a load-bearing platform.

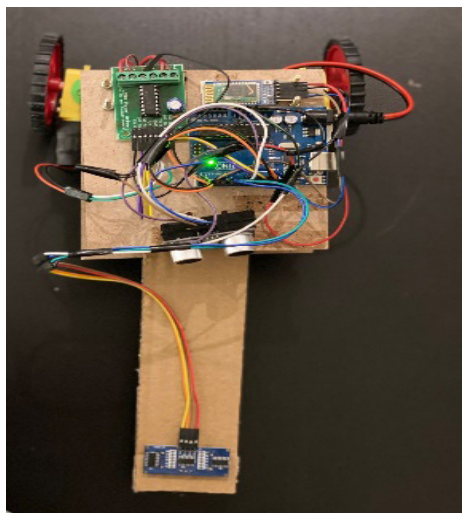

Fig. 5: Voice Controlled Robotic Car

The following is a block schematic of the voice-activated robotic vehicle. Figure 6 illustrates the circuit's connections.

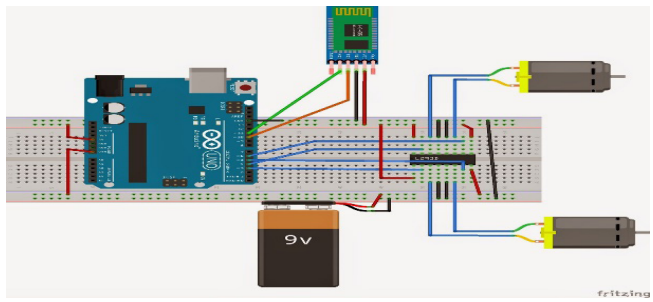

Fig. 6: Block Schematic of VCRC

MitAppInventor2 will be used to create an Android application for transmitting voice commands to the Arduino board. App Inventor enables you to develop Android applications using a web browser and either a connected phone or an emulator. The App Inventor servers maintain track of your systems and save your work as illustrated in Figure 7.

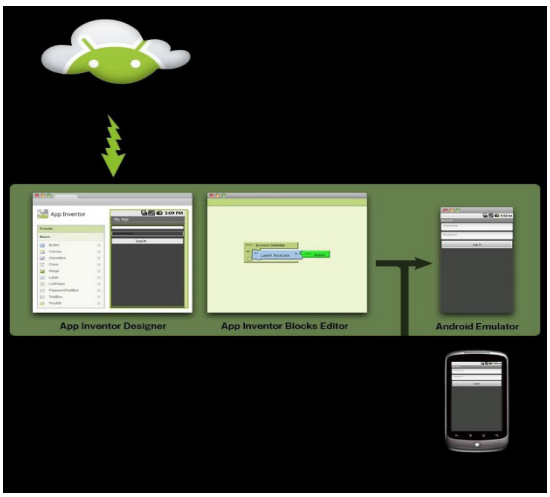

Fig. 7: Voice Controlled Robotic Car

VI. Funcationalinty

To achieve the objectives, the system will perform the following functions as illustrated in Figure 8. The user will provide the command using an Android application created with MIT AppInventor 2.

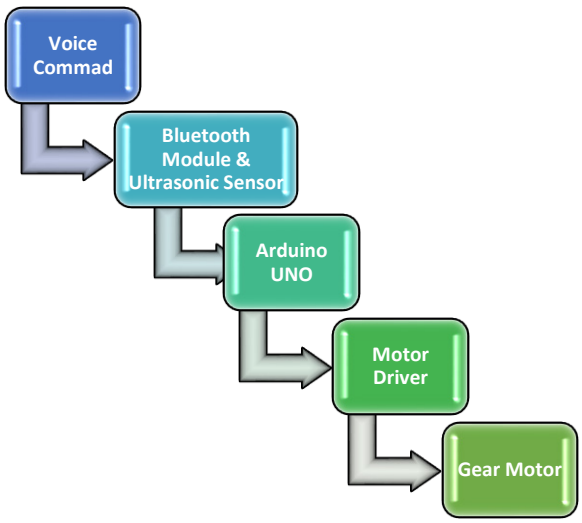

Fig. 8: Block Schematic of Process Flow

Through Bluetooth communication, the voice signal is analysed and delivered to the Arduino Uno board.

The instruction will be recognised by the Arduino board. The Arduino code will tell the Driver motor to turn the wheels in the right direction.

The ultrasonic sensor will detect the obstruction and transmit instructions to the controller's ports. The Arduino microcontroller will receive the instruction and gather data from the ultrasonic sensor to determine the obstacle's distance and regulate the speed.

The commands provided by the Android App are as follows:- Table 2.7: The commands provided by the Android App

Voice Command		Movement
English	Arabic	
Forward	امام	Move Forward
Backward	رجوع	Move Backward
Right	يمين	Move Right
Left	يسار	Move Left
Stop	قف	Car will Stop.

VII. Result & Discussion

The microphone on an Android smartphone is used to recognise human speech. Android and Artificial Intelligence technologies are utilised to analyse and transform this voice to English and Arabic words. Speech recognition is a multidisciplinary field of study within computational linguistics that examines techniques and technology enabling computers to recognise and convert spoken language to text. Additionally to automated speech recognition (ASR), it is referred to as computer voice recognition and speech to text (STT). It is a fusion of languages, computer science, and electrical engineering, among other disciplines. Speech recognition technology has a long history, with several waves of significant improvements throughout the years. In recent years, advances in deep learning and big data have boosted the sector's overall performance. The benefits are shown not only by the increasing number of academic papers in the subject, but also by the widespread industrial use of a range of deep learning algorithms in the design and implementation of voice recognition systems across the globe. The result analysis of the number of instruction guven in English and Arabic given and successfully executed asre illustrated in Figure 9 and 10.

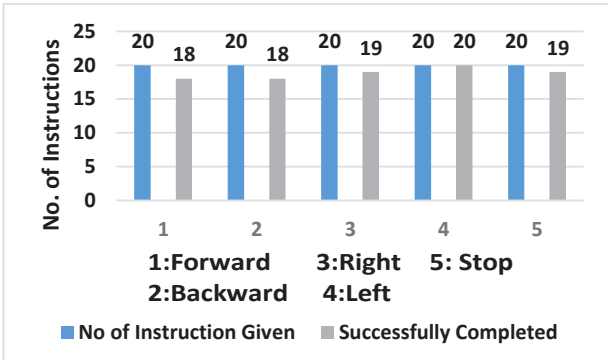

Fig. 9: Number Of Instruction Executed in English

The system was completed in accordance with the requirements and specifications. The voice may be used to

control simple motions. The suggested method is based on a Voice Controlled Robotic Vehicle that allows the robot to be controlled via voice instructions received through an Android application.

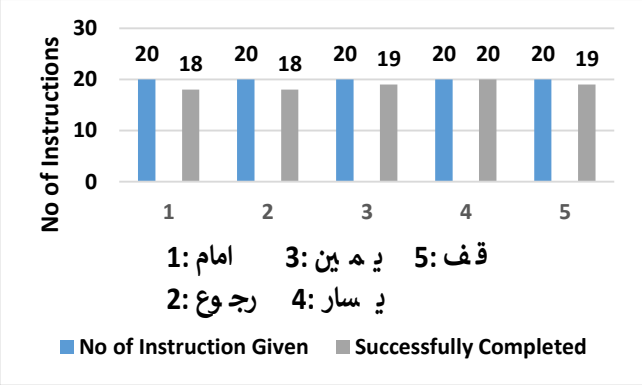

Fig. 10: Number Of Instruction Executed in Arabic

The person who is controlling the system gives vocal instructions to operate the Voice Controlled Vehicle. These voice instructions must be given through an Android application installed on the user's smartphone. The android app recognises speech and then transmits a command to the voice-controlled robot vehicle, which responds to the order. The instructions are decoded by the vehicle's CPU, which then sends the proper command to the vehicle's motors.

VIII. Conclusion

The "Voice Controlled Robotic Vehicle" technology offers a wide range of uses, both now and in the future. In the future, improvements may be added to the system to make it more effective. The system has a broad range of uses, including military, home security, rescue operations, industry, and medical support. Using the given resources, we were able to create a rudimentary model of a voice-controlled robotic car. Because this technology is simple to apply, the robot contributes to the well-being of humans. . The Voice Controlled Robotic Vehicle is beneficial for monitoring and assisting disabled persons. It is simple to use since it operates with basic voice commands. It is beneficial in locations where people are unable to reach. Because of its modest size, we can utilise this robot to spy on people. It has the potential to be utilised for surveillance. For security purposes, we can include a web cam into this robot. The speech recognition software is very sensitive to background noise and has a high accuracy for identifying a spoken command.

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