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Design and testing of solar charged voice recognized Arduino car

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ABSTRACT

This research study is an advent of voice recognition technology has ushered in a new era of human-machine interaction, enabling seamless and intuitive control of various devices and applications. In this research paper, we present a novel application of voice recognition technology in the realm of robotics - a Voice-Activated Arduino Car Control System. This system combines the power of Arduino microcontrollers, voice recognition software, and motor control mechanisms to create a versatile and user-friendly platform for controlling a robotic car using voice commands. The primary objective of this research is to design and implement a voice-activated control system that enhances the accessibility and usability of robotic cars. To achieve this, we have developed a comprehensive system architecture comprising hardware and software components. The hardware includes an Arduino microcontroller, motor drivers, sensors, and a microphone, while the software incorporates a voice recognition algorithm and the solar panel is used to recharge the battery which is user friendly.

Keywords – *Voice control, Automated car, Human-machine interaction, Solar charged.*

1. INTRODUCTION

In an age where technology continually strives to make human-machine interaction more seamless and intuitive, voice recognition technology has emerged as a transformative force[1]. Its applications extend far beyond virtual assistants on our smartphones; it has made significant inroads into the realm of robotics. In this context, we introduce the Voice-Activated Arduino Car, a remarkable fusion of advanced hardware and cutting-edge software that allows us to control a robotic vehicle simply by using the power of our voice.

The concept of autonomous vehicles has long been a hallmark of technological innovation. However, what sets the Voice-Activated Arduino Car apart is its ability to transform any ordinary vehicle into a smart, responsive machine that obeys vocal commands[3]. By leveraging the capabilities of Arduino microcontrollers, voice recognition software, and precision motor control, this system ushers in a new era of user-friendly and accessible robotics.

The allure of this innovation lies not only in its technological prowess but also in its potential for diverse applications. From educational tools to assistive devices for those with mobility challenges, and even as a stepping stone to fully autonomous vehicles, the Voice-Activated Arduino Car promises to disrupt and revolutionize how we interact with and control robotic systems.

In this paper, we delve into the intricacies of this groundbreaking technology. We explore the hardware and software components that make it possible, dissect the voice recognition algorithms[4] that enable it to understand and respond to our commands, and

investigate its real-world performance. Through rigorous experimentation and analysis, we aim to provide a comprehensive understanding of the Voice-Activated Arduino Car[5] and its potential impact on the world of robotics and beyond.

2. LITERATURE REVIEW

Alice Joseline and Mrs.S.Benila . (2018)
This paper introduced the voice recognition concept for easy identification and assembly of parts for auto motives of a car. Voice recognition, also known as speech recognition or automatic speech recognition (ASR), is a technology that enables a system to interpret and understand spoken language. It involves the conversion of spoken words into text or commands, allowing computers or devices to respond to verbal instructions. The primary goal of voice recognition is to accurately and efficiently transcribe spoken language into a format that can be processed and understood by machines.

Prof. Bhuvaneshwari Jolad, Mohnish Arora, Rohan Ganu and Chetan Bhatia. (2018)

This paper deals about the control of vehicle movement (car) by using voice command. Vehicle movement by using voice commands refers to the capability of controlling the motion of a car or any other vehicle through spoken instructions or commands. This typically involves integrating a voice recognition system with the vehicle's control system, allowing users to give verbal commands to control the vehicle's direction, speed, and other movements.

Ashish Jha . (2019)
This paper deals with the Arduino Programming and embedding the mechanical and electronics systems. Arduino programming refers to the process of writing code for Arduino microcontrollers to control electronic devices or systems. Arduino is an open-source platform that provides a simple and accessible way for both beginners and experienced developers to create interactive projects. Arduino boards are equipped with input and output pins, and users can write programs (sketches) using the Arduino programming language, which is based on C/C++.

3. DESIGN

3.1 Block diagram

The block diagram of a voice-recognized Arduino car illustrates the interconnected components and functionalities that enable the vehicle to respond to voice commands. At the core of the system is the Processing Unit, comprising the Arduino Board and Microcontroller, responsible for receiving and processing voice signals. The Voice Input block includes a Microphone capturing user voice commands and a Voice Processing Unit converting the analog signals into digital data. The Control Unit interprets the recognized voice commands, sending signals to the Motor Control for vehicle movement and managing interactions with sensors for obstacle detection through the Sensor Interface. Communication is facilitated by a Wireless Module, allowing connectivity with external devices such as a smartphone via a dedicated app. A Feedback Mechanism provides real-time information to the user through an LED Display, indicating the car's status, and Voice Output, delivering audio feedback for acknowledged commands. Power is supplied by a Battery, and obstacle detection is enhanced by Ultrasonic Sensors. This comprehensive block diagram outlines the key components, their interactions, and the flow of information within the voice-controlled Arduino car[6] system. The front view and top view of the vehicle is shown in the figure 3.1.1 and 3.1.2.

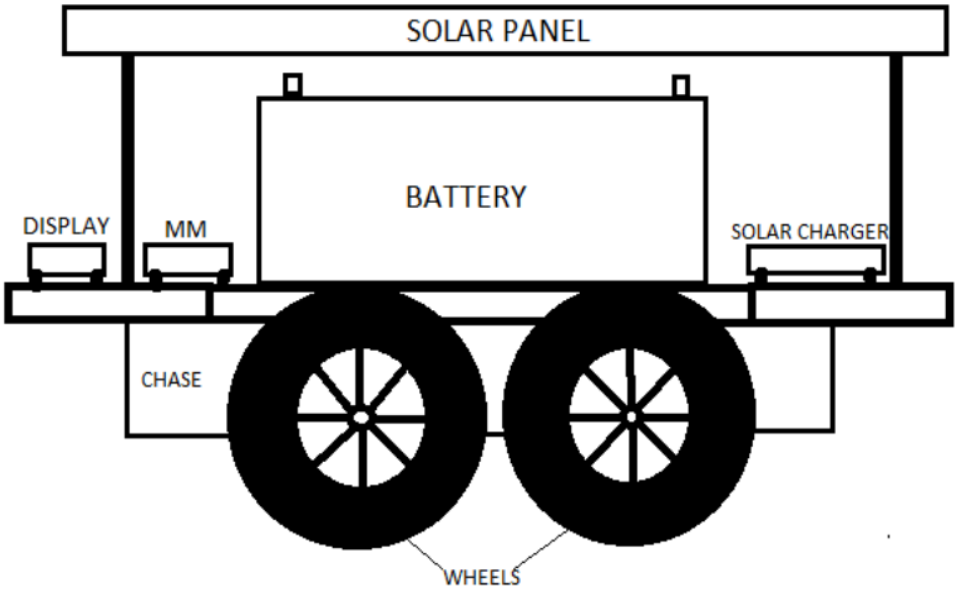

Fig.3.1.1 Front view of the vehicle

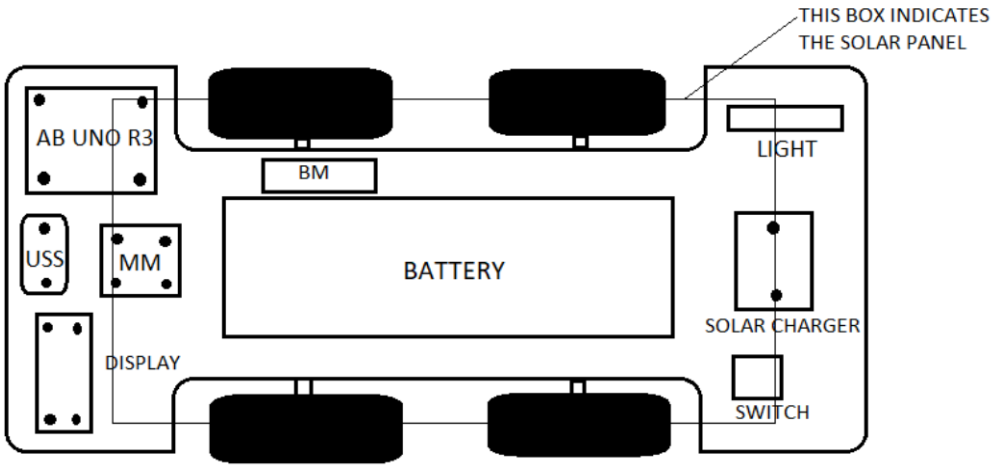

Fig.3.1.2 Top view of the vehicle

3.2 Circuit diagram

The circuit diagram of a voice-recognized Arduino car illustrates the electrical connections and components that enable the integration of voice recognition technology with the vehicle's control system. At the center of the diagram is the Arduino Board, serving as the main processing unit, and connected to a Microcontroller that manages the overall functionality. The Voice Input block encompasses a Microphone, capturing voice commands, and a Voice Recognition Module that processes the analog signals. Connected to the Microcontroller are Motor Drivers facilitating control over the motors responsible for the car's movement. Additionally, the circuit incorporates Ultrasonic Sensors for obstacle detection and avoidance[7]. A Wireless Module establishes communication between the Arduino Board and external devices, such as a smartphone. The overall system is powered by a Battery, ensuring the necessary electrical supply. The connections between these components, represented by lines and symbols, define the pathways for data and signals, creating a comprehensive circuit that integrates voice recognition capabilities into the operational framework of the Arduino car. It showcases the interplay of electronics essential for the successful implementation of a voice-controlled vehicle system. The circuit diagram of vehicle is shown in the figure 3.2.

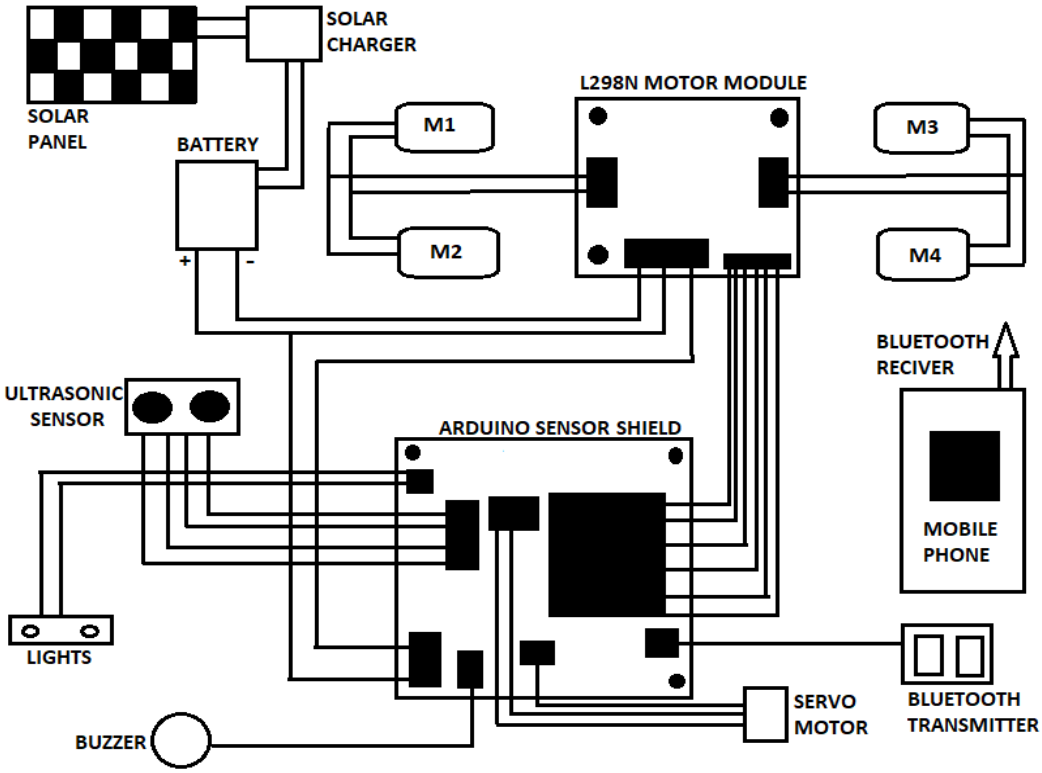

Fig.3.2 Circuit diagram of vehicle

4. REQUIRED COMPONENTS AND ITS SPECIFICATIONS

1. Arduino UNO R3: The Arduino Uno R3 is a microcontroller board based on the ATmega328P microcontroller. It is part of the Arduino family of open-source hardware and software, designed to make electronics prototyping and development accessible to artists, designers, hobbyists, and anyone interested in creating interactive projects.

2. Motor module L298N: The L298N is a popular dual H-bridge motor driver integrated circuit (IC) that is commonly used in robotics and other applications where precise control of DC motors is required.

3. Geared DC Motor: A geared DC motor is a type of electric motor that incorporates a gearbox (also known as a gearhead) to control the speed and torque characteristics of the motor.

4. Ultra sonic sensor: An ultrasonic sensor is a device that uses ultrasonic sound waves to measure distances or detect the presence of objects. It operates on the principle of sending out sound waves at a frequency higher than the human audible range and then measuring the time it takes for the waves to bounce back after hitting an object. Ultrasonic sensors are commonly used in various applications, including robotics, industrial automation, and automotive systems.

5. Battery 12V: It is used to store electrical charge and supplies the electrical energy to all components, and it is recharged by solar power.

6. Solar panel: It is used to convert the solar energy into electrical energy then, the charge is stored in battery.

7. Bluetooth module: A Bluetooth module is a compact electronic device that enables short-range wireless communication between electronic devices. These modules use Bluetooth technology, a widely adopted standard for wireless communication, to establish connections between devices for data transfer, communication, and control. Bluetooth modules are commonly used in various applications, including consumer electronics, IoT (Internet of Things) devices, robotics, and industrial automation.

8. Buzzer: It gives the alarm sound to indicate the driver in the case of any emergency.

5. REQUIRED SOFTWARE

Software installation: Software named as ‘Arduino software’ is installed from the web browser, in that software only we could able to dump or edit the codlings in Arduino board. Using a tripple T cable we connet laptop USB port and the TTT port of the Arduino board, then we start dumping the coding and we can edit those coding also. The Arduino IDE is shown in the figure 5.1.

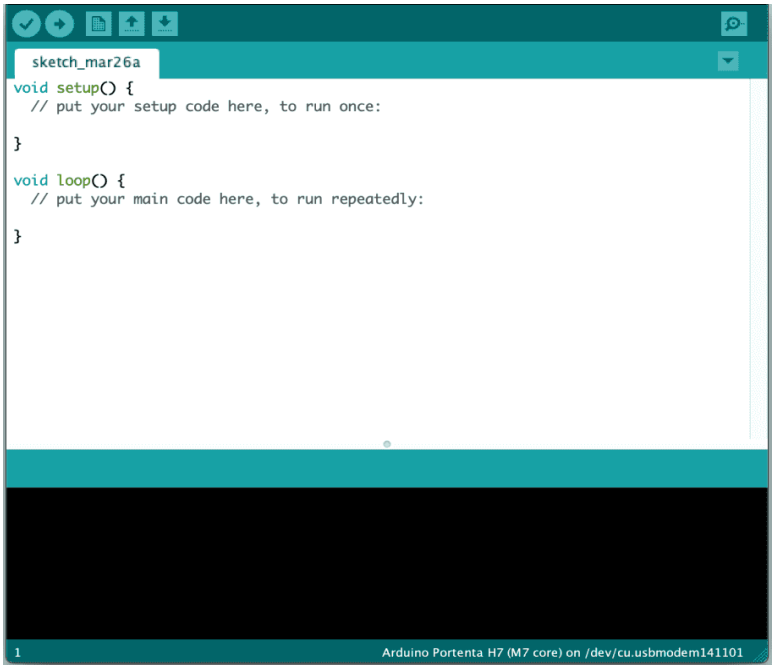

Fig.5.1 Arduino IDE

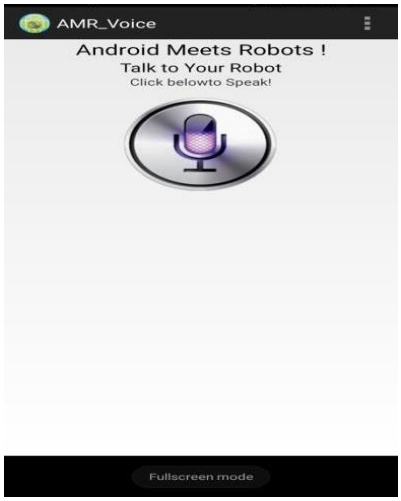

Fig.5.2 App interface

Fig.5.3 App logo

App Installation: An application is installed from the Google play store, named AMR application (Android meets Robots). Then we switch on Bluetooth in that app then we connect our vehicle using the password "1234". We can give comments, as per comments our vehicle starts moving. The app interface and app logo is shown in figure 5.2 and 5.3.

6. WORKING PRINCIPLE

The working principle of a voice-recognized Arduino car involves the integration of voice recognition technology with an Arduino microcontroller to enable control commands[8] based on spoken words. Typically, the system comprises a microphone to capture voice commands, a voice recognition module to process and interpret the spoken words, and an Arduino board to execute corresponding actions. When a user speaks a predefined command[2], such as "forward," "backward," "left," or "right," the microphone picks up the audio input and sends it to the voice recognition module. The voice recognition module analyzes the received voice data, identifies the specific command, and converts it into a signal that the Arduino can understand. The Arduino, programmed with a corresponding code, then processes the signal and triggers the appropriate motors or actuators connected to the wheels of the car, directing its movement accordingly. This integration of voice recognition technology with Arduino facilitates a hands-free and interactive control mechanism for the car, offering a novel and user-friendly approach to commanding and maneuvering the vehicle. The working image of the vehicle is shown in figure 6.1.

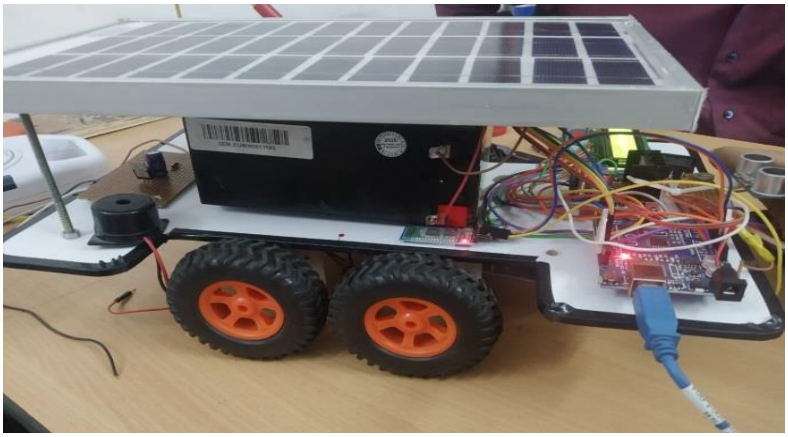

Fig.6.1 Image of working vehicle

7. MERITS

- This system is more safe to the operator.
- Quick in response.
- It is very useful to differently abled peoples to drive the car.
- Time saving.
- Driver stress reduced.
- Future scope is higher

8. INTERENCE AND RESULT

The implementation of a voice-recognized Arduino car provides a user-friendly and intuitive method for controlling the vehicle through spoken commands. The integration of voice recognition technology with Arduino allows users to interact with the car using natural language, eliminating the need for physical interfaces such as remote controls. The system relies on a microphone to capture voice input, a voice recognition module to interpret the commands, and an Arduino board to execute corresponding actions.
As a result, users can issue commands such as "forward," "backward," "left," or "right," and the car responds by translating these spoken instructions into motor control signals. This hands-free approach enhances user convenience and opens up possibilities for applications in scenarios where manual control may be challenging or impractical.

The inference is that voice recognition technology adds a layer of interactivity to the Arduino car, making it more accessible to users who may have limitations in using traditional controllers. Additionally, the implementation of this technology showcases the versatility of Arduino in integrating with various input sources and adapting to different user interfaces.

9. CONCULSION

In conclusion, the development of a voice-recognized Arduino car represents a notable advancement in the realm of interactive and user-friendly control systems. By seamlessly integrating voice recognition technology with the versatile Arduino platform, this project enables users to command and control the car effortlessly through spoken instructions. The hands-free nature of this interface not only enhances user convenience but also expands the applicability of the Arduino car in scenarios where traditional manual control methods may be impractical or challenging. The implementation underscores the adaptability of Arduino microcontrollers to various input sources, showcasing their capability to integrate with sophisticated technologies such as voice recognition modules. However, it is crucial to acknowledge potential challenges related to the accuracy and robustness of the voice recognition system. Factors such as ambient noise and variations in speech patterns may impact the system's performance, necessitating ongoing refinement and optimization.

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