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VOICE-CONTROLLED ROBOT USING RASPBERRY PI AND BLUETOOTH

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Abstract:- In this digital technology era for all the risky and dangerous tasks we prefer Robots rather than people. In the early stage of this Robotics the Robes are manually controlled but due advancement in wireless technology now Robes can be controlled via voice This project employs voice commands to control through an Android app linked to a microcontroller via Bluetooth .Users can control the robot either by tapping buttons on the app or by speaking commands. Movement is powered by two DC servo motors connected to the receiver microcontroller. The voice commands are converted in to digital signals by the Bluetooth RF transmitter for an appropriate range to the robot. At the receiver end the data gets decoded by the receiver and is fed to the microcontroller which drives the DC motors for the necessary work. This research objective is to design and implement a cost effective but yet flexible, adaptive and secured voice controlled robotic vehicle to perform the required task by listening to the commands of the user. Voice interfaces offer numerous advantages. Notably, they eliminate the need for technology training making them instantly accessible to users.

Keywords:- *Micro Controller, Bluetooth.*

I. INTRODUCTION

Our aim is to develop a voice-controlled robot car, enabling users to operate it effortlessly with spoken commands. These systems are sometimes referred to as Speech Controlled Automation Systems (SCAS) . The above-mentioned system is a prototype of our design. The idea is to construct a voice-controlled robot, with a smartphone serving as the control hub. Many studies showcase the seamless communication between robots and smartphones. Leveraging a smartphone as a remote interface provides unparalleled convenience in automating the robot's functions. It has a lot of features that can be useful. For the needed work, an android application with a microcontroller is employed in this design.

Bluetooth technology serves as the conduit linking the application and the robot, ensuring seamless connectivity and control. The commands will be passed via the channel to the module, which will receive them. The objective of a Voice Controlled Robotic Vehicle (VCRV) is to attentively heed and promptly respond to user commands. Following accent training, the device gradually familiarizes itself with the commands, which are integrated via codes.

II. LITERATURE SURVEY

M Saravanan [1] In October 2020, introduced the "Arduino Based Voice Controlled Robot Vehicle," aiming to craft a robotic vehicle propelled solely by voice commands. The core objective of this innovation is to engineer a robot vehicle operable through user voice commands, a category often denoted as Speech Controlled Automation Systems (SCAS).

The above mentioned device is a prototype of our design. The concept revolves around constructing a voice-controlled robot, directed by spoken commands. Leveraging a cell phone as the control mechanism, numerous articles showcase the interaction between robots and smartphones. A smartphone emerges as an exceptional interface for remotely automating the robot's operations.

H. Jagadish Kumar [2] Authored in December 2019, "Voice Controlled Car using Arduino and Bluetooth Module" focuses on constructing a voice-activated car responsive to speech commands. However, the report highlights the necessity for enhancements in disturbance and range handling capabilities.

Vipul Mehta [5] In May 2016, "Robot Controlled Car Using Wi-Fi Module" was introduced, delving into the utilization of a Wi-Fi module alongside an Android phone application to control a robot-driven vehicle. Additionally, the review showcases methods to operate the devices independently of an Android phone by utilizing regular SMS. The aim of this paper is to show how tooperate a robot- controlled vehicle using a Wi-Fi module and an Android Smart Phone application.

It also demonstrates that the devices can beoperated by sending a regular SMS even if the user does not have an Android phone. This role can be easily modified to include a covert agent camera that streams the recordings to the client through Wi-Fi.

Instead of the usual lithium-ion battery, the venture would use sunlight-based batteries. Engage the VCRV's Bluetooth connectivity effortlessly, as the application intuitively prompts for activation, ensuring seamless communication between devices. Once Bluetooth is enabled, the application will verify the presence of iBeacon signals. IBeacon functions as an identity for each classroom in the lecture building.4].

III. PROPOSED SYSTEM

In this project, we've engineered a system where the robot responds to voice commands. We've integrated an Android application with a microcontroller to handle essential tasks. The communication between the Android app and the vehicle is facilitated through Bluetooth technology. Users can control the robot using buttons on the application or by issuing spoken commands.

IV. METHODOLOGY

• Step 1: We've implemented voice commands for vehicle control.
• Step 2: Upon receiving "Forward," both right and left wheels rotate clockwise.
• Step 3: When "Left" is detected, the right wheel moves clockwise.
• Step 4: Conversely, upon detecting "Right," the left wheel rotates clockwise.
• Step 5: Upon receiving "Backward," both wheels move anti-clockwise.
• Step 6: If the command is "Stop," both wheels halt immediately.
• Step 7: Utilizing ultrasonic sensors, the vehicle halts if an object or vehicle is detected within a range less than 70 and greater than 40 units.

V. FLOW CHART

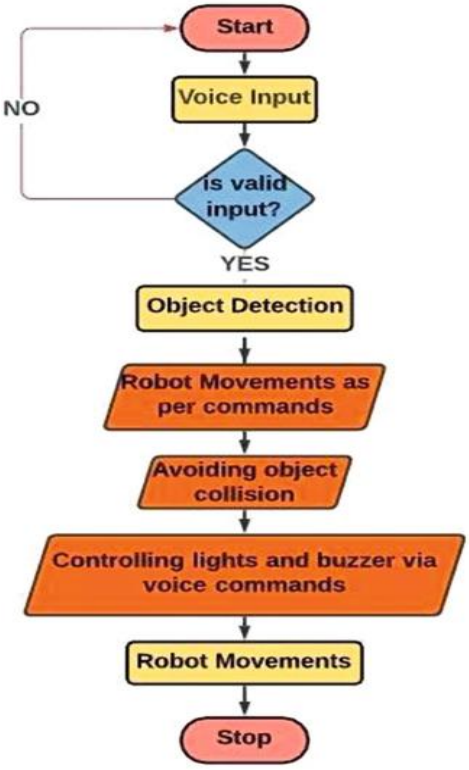

Fig 1. Flowchart of Working

VI. BLOCK DIAGRAM

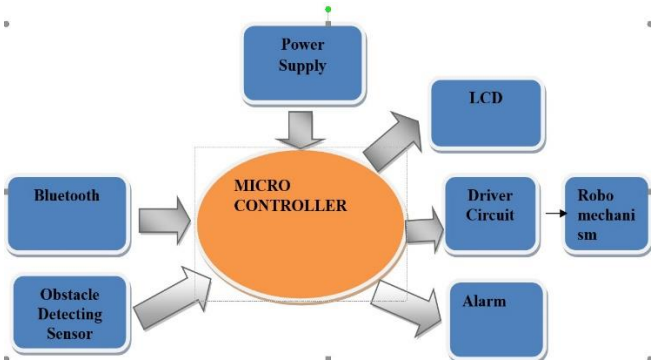

Fig 3 Block Diagram

➢ ***Applications***

- Home Automation.
- Health care.
- Education.
- Security.
- Industrial automation.
- Agriculture.
- Assistive technology,

VII. HARDWARE DETAILS

1.Raspberry pi:

The Raspberry Pi Pico comes in two main variants: the original Pico and the Pico W, which includes a built-in wireless module for automatic Wi-Fi network connection during boot-up. Representing a significant leap in microcontroller technology, the Raspberry Pi foundation continues its tradition of revolutionizing single-board computing with the introduction of the Raspberry Pi Pico. Powered by the RP2040 chip, this budget-friendly microcontroller board is equipped with all the necessary components to kickstart embedded electronics projects effortlessly..

Fig. 1. Raspberry Pi Board.

2. Driver Circuit :

The L293D IC, typically housed in a standard 16-pin DIP package, serves as a motor driver capable of controlling two small motors simultaneously in both forward and reverse directions, utilizing just 4 microcontroller pins (without using enable pins). Operating on the principle of an H-bridge circuit, it facilitates bidirectional voltage flow essential for motor rotation in clockwise or anticlockwise directions. Each L293D chip encompasses two H-bridge circuits, enabling independent control of two DC motors. Due to its compact size and versatile functionality, the L293D finds widespread application in robotics for DC motor control.

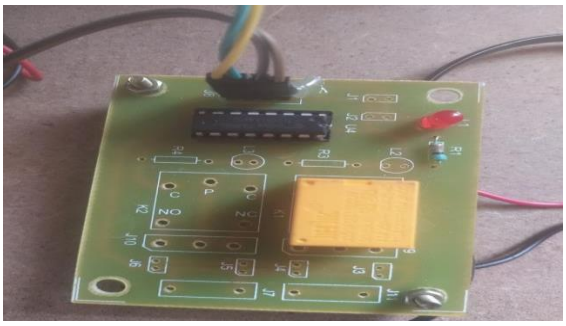

Fig.2..Driver circuit

3. Buzzer:

A buzzer or beeper serves as a signaling device, commonly electronic, employed in various applications like automobiles, household appliances (e.g., microwave ovens), and game shows. It typically comprises switches or sensors linked to a control unit,

determining button presses or preset time intervals. Upon activation, it illuminates corresponding indicators and emits a warning sound, either continuous or intermittent buzzing or beeping. Initially, these devices relied on electromechanical systems resembling electric bells but without the metallic gong for ringing. Often mounted on walls or ceilings, they utilized these surfaces as resonators for sound amplification. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker.

Fig.3.BUZZER

4. OLED (Organic Light Emitting Diodes):

OLED, or Organic Light Emitting Diodes, is a revolutionary display technology that produces light by passing an electric current through organic materials sandwiched between conductors. Unlike LCD displays, OLEDs are self-emissive, eliminating the need for a backlight, resulting in thinner and more energy-efficient screens. This technology enables deeper blacks, higher contrast ratios, and vibrant colors with precise pixel control. Its versatility allows for flexible and transparent displays, paving the way for innovative designs across various industries.

OLED displays are not just thin and efficient - they provide the best image quality ever and they can also be made transparent, flexible, foldable and even rollable and stretchable in the future. OLEDs represent the future of display technology!

Fig.4. Liquid crystal display

5. Power Supply:

The power supply section is the section which provide +5V for the components to work. Introducing the LM7805: your steadfast ally in delivering a steady +5V power supply, ensuring reliability and stability for your electronic applications.

The transformation begins with AC voltage, often 220V, routed through a transformer to match the desired DC output. Next, a diode rectifier facilitates full-wave rectification, converting AC to DC. This raw DC is then smoothed by a basic capacitor filter, reducing ripples or AC variations. This process ensures a stable, usable DC voltage for various applications.

A regulator circuit removes the ripples and also retains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

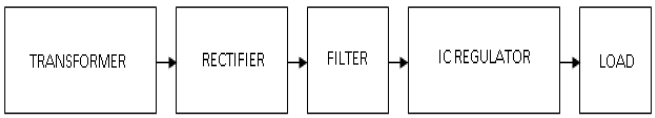

Fig.5. Power supply

6. IR Sensors:

An IR sensor is indispensable for crafting obstacle avoider robots or line-following mechanisms. Our project aims to construct a straightforward IR sensor capable of detecting objects within a 6-7 cm range. Essentially, an IR sensor is a specialized diode sensitive to infrared radiation, enabling precise object detection. This DIY sensor promises simplicity and efficiency, offering a fundamental building block for robotics enthusiasts and hobbyists alike. This infrared transmitter and receiver is called as IR TX-RX pair.

Working:

Unlock the elegance of IR sensor technology, where simplicity meets sophistication. Its operation revolves around the artistry of resistance modulation within the IR receiver, paving the way for seamless detection in diverse environments.

In the intricate dance of light and resistance, our sensor stands sentinel, poised to detect the faintest whispers of infrared radiance. Shielded from illumination, resistance soars to megaohms, a testament to its vigilance. Yet, with the touch of infrared photons, it transforms, descending to kiloohms or mere hundreds of ohms, a signal of unseen presence.

This metamorphosis is but the prelude to a symphony of detection. Through circuitry alchemy, resistance becomes voltage, a subtle fluctuation amidst potential's vast expanse. Enter the comparator IC, arbiter of thresholds, assessing voltage against expectation.

With unwavering resolve, the comparator IC renders its verdict: if voltage breaches the ordained threshold, a proclamation echoes, confirming light's presence. In this ballet of resistance, voltage, and threshold, our sensor fulfills its destiny as a guardian, guiding with precision in the realm of responsive robotics.

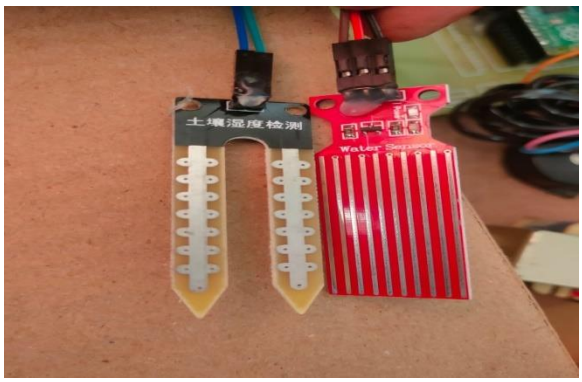

Fig.6. IR Sensor

7.DC Motor :

A DC motor converts electrical energy into mechanical energy by running on direct current. It's a vital component in various industries. While some pure DC designs exist, like Faraday's homo-polar motor, brushed and brushless types are more common. In our project, we're utilizing a brushed DC motor rated at 12V DC 0.6A. Control over its speed can be achieved by adjusting the voltage applied to the armature or by manipulating the field current.

Fig.7.DC Motor

8. HC-05 BLUETOOTH MODULE:

The HC-05 module is a compact Bluetooth serial port unit, streamlining wireless serial connections with its diminutive size of just 12.7mm x 27mm. Perfect for Arduino and other microcomputers, it simplifies the design process. Versatile in function, it can operate as either a Master or Slave. Operating at 3.3V with 3.3V signal levels, it lacks pins and typically solders onto a larger board. With Command Mode for AT commands and Data Mode for data transmission, it offers flexibility. Breakout boards are recommended for easy utilization, mounting the sub-module on a slightly larger board for convenience.

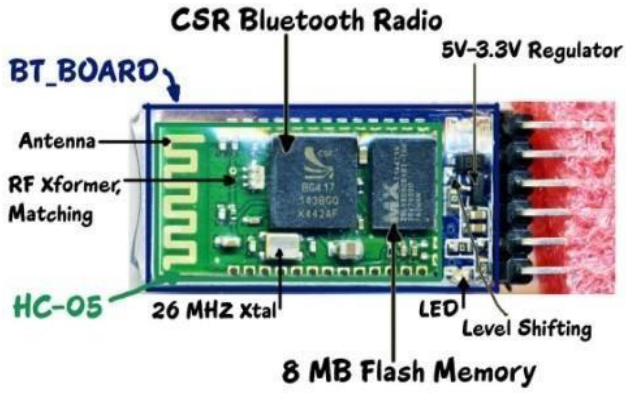

Fig 8. HC - 05 Bluetooth

Circuit Connection:

At first user must connect android to Bluetooth technology. After the connection user open the application in smart phone to give commands. The command can be fetched using an app which convert the voice command int text. The phone will be connected to microcontroller using Bluetooth. After conversation of voice into text the app will send necessary data to microcontroller using Bluetooth and microcontroller receives the data. According to command, the robot will move farward, backward, left and right.

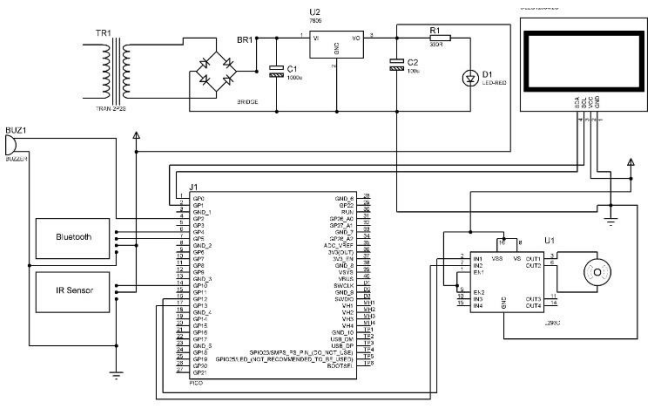

Fig 9. Circuit Diagram

VIII. RESULT

In the realm of Android smartphones, human voices are captured via built-in microphones. These voices undergo intricate analysis and are transformed into English words using the sophisticated coding of the Android OS and AI algorithms. Employing a Bluetooth application, dubbed Mobile Voice Control, the voice data is transmuted into text format and seamlessly transmitted through Bluetooth devices, ensuring efficient communication and control.

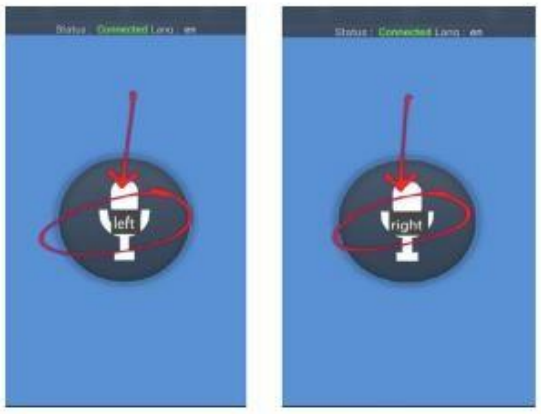

Fig 10. Left Right Commands

Fig 11. Output

IX. CONCLUSION:

The "Voice Controlled Robotic Vehicle" project offers multifaceted utility both presently and in the foreseeable future. As advancements continue, the project stands poised for enhancement, promising heightened effectiveness. Its applications span diverse domains such as military operations, home security, rescue missions, industrial tasks, and medical aid. Leveraging available resources, we've crafted a basic yet functional model of a voice-controlled robotic car, underscoring its accessibility and utility. This innovation holds promise for enhancing human life, particularly in aiding and monitoring individuals with disabilities, thanks to its straightforward operation via basic voice commands. Its compact size renders it versatile for accessing otherwise inaccessible areas and lends itself to covert surveillance applications. The integration of a webcam bolsters its capabilities for security purposes, while the precision and adaptability of its voice recognition software ensure reliable performance even amidst background noise, distinguishing it as a dependable asset in various scenarios.

FUTURE SCOPE

The future trajectory of this paper entails further enriching the framework with advanced functionalities, such as integrating diverse voice controls like pick-and-place maneuvers utilizing robotic arms and motor-driven controls. Harnessing emerging connectivity advancements will expedite information transfer, amplifying efficiency. Furthermore, the integration of IoT-enabled frameworks holds promise for expanding application domains. An exciting avenue for enhancement involves incorporating image processing capabilities into the robot, enabling it to discern object colors or target systems with precision, thereby augmenting its versatility and utility.

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