**VOICE CONTROLLED CAR**

By

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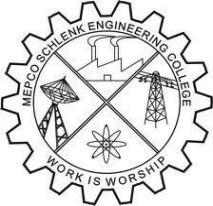
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**(An Autonomous Institution affiliated to Anna University Chennai)**

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**CERTIFICATE**

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***Internal Examiner - I******Internal Examiner - II***

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# ABSTRACT

A voice-controlled car using the HM2007 voice recognition IC, encoder, and decoder is an innovative project that combines speech recognition with motor control technology to create a seamless user experience. The HM2007 is used to capture and recognize voice commands, which are then processed to control the car's movements. When a user speaks a command, the HM2007 processes the speech and converts it into a digital signal that corresponds to specific control actions. This signal is then passed through an encoder, which converts the command into a binary format suitable for transmission.

The decoder receives the binary signal and translates it back into specific control signals that drive the motors, allowing the car to move forward, reverse, turn left, or turn right based on the user's voice commands. This integration of the HM2007 with encoders and decoders ensures accurate and efficient communication between the user's voice and the car's control system. The system provides a hands-free and intuitive way to control the car, making it particularly beneficial for individuals with physical disabilities. The use of encoders and decoders simplifies the circuit design and enhances the reliability of the system, ensuring responsive and precise control of the vehicle.

## ACKNOWLEDGEMENT

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## CHAPTER 1

## INTRODUCTION

## 1.1 PROJECT BACKGROUND:

**1.1.1 INTRODUCTION:**

This project was developed in a way that the robot is controlled by voice commands. An voice controlled with a encoder & decoder is used to perform required tasks. The connection between the encoder and the vehicle is facilitated with HM2007. The robot is controlled by spoken commands of the user. The movement of the robot is facilitated by the two dc servo motors connected with encoder & decoder at the receiver side. The commands from the user are converted in to digital signals by the HM2007 to the robot. The data select lines is connected to the HM2007 is set into 0’s and 1’s thereby the encoder &decoder gives the four output. The four outputs from the encoder & decoder is connected to the motor driver thereby any one of the output is selected as per the command given by the user through the HM2007. The aim of Voice Controlled Robotic Vehicle is to perform the required task by listening to the commands of the user. A prior preparatory session is needed for the smooth operation the robot by the user. For the same a code is used for giving instruction to the controller.

##### 

##### **ADVANTAGES:**

1. Cost-effective: Using ENCODER can be a more affordable option compared to prebuilt Voice-controlled car kits.
2. Customizable: You have more control over the functionality and features of your car, allowing you to tailor it to your specific needs.
3. Educational: Building a voice-controlled car using ENCODER can be a great learning experience, helping you understand electronics, programming, and voice recognition technology.

**DISADVANTAGES:**

1. Complexity: Building a voice-controlled car from scratch can be more complex than using a pre-built kit, especially if you're new to electronics or programming.
2. Time-consuming: It may take more time to develop and troubleshoot your project.
3. Limited voice recognition capabilities: While encoder can be combined with voice recognition modules, their capabilities may be more limited compared to dedicated voice assistants.
4. Potential for errors: There's a higher risk of errors or malfunctions due to the DIY nature of the project.

##### **1.2 .OBJECTIVE OF THE PROJECT:**

The main objective of the project is to design and develop a model of miniature car that will be controlled by human voice and operated by encoder along with the decoder.

## CHAPTER 2

## 2.1. PROPOSED METHOD:

## 

## Figure 2.1: Block diagram of the proposed method

## From this block diagram fig.2.1 we can get to know that the voice signals from HM2007 is connected to the encoder is thereby connected to the decoder so that the motor driver will make the servo motor run according to the code of the motor driver.

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## Figure 2.2: Flow diagram of the proposed method

## The voice signals from the HM2007 is given into the encoder as in fig 2.2 ,the the code from the encoder will be decoded by the decoder .the outputs of the decoder is thereby connected to the motor driver which will operated the servo motor of the corresponding wheels of the chassis.

## Component used

## The components that are used in our project are as follows:

## 

## ENCODER (74LS148)

## HM2007 board (IC -0078)

## Motor Driver L298N (12V input ,5V output)

## Car chassis model

## Wheels

## 9V battery and battery holder

## Servo Motor

## Cardboard for base

## Jumper wires

## 12 V battery

## 

## 2.2. WORKING OF THE VOICE CONTROLLED CAR:

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## Figure 2.3: Circuit Connection of the Model

## From fig.2.3 only the encoder is connecter to the motor driver inputs but in the actual project a decoder has also been inserted.

## 2.3. INTRODUCTION TO MOTOR DRIVER:

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Motor drivers are crucial components in modern electronics, providing the necessary interface between low-power control circuits and high-power motors. They are designed to amplify the low-power signals from a microcontroller or control unit into higher-power signals that can drive motors. This is particularly important because the microcontrollers themselves cannot supply the current and voltage needed to power motors directly.

One of the most commonly used motor drivers is the L298, a versatile dual H-Bridge driver. The L298 is capable of controlling the direction and speed of two DC motors or one stepper motor. Its dual H-Bridge configuration allows it to handle high currents and voltages, making it suitable for a variety of applications, from robotics to industrial automation. The ability to control two motors independently makes the L298 ideal for differential drive systems, which are commonly used in mobile robots and other motorized vehicles.

The L298 motor driver also supports pulse-width modulation (PWM), a technique used to control the speed of a motor by varying the width of the pulses in a pulse train. This allows for precise speed control, which is essential in applications that require smooth acceleration and deceleration. Additionally, the L298 includes built-in thermal shutdown and protection diodes, which help to prevent damage from overheating and voltage spikes.

In industrial settings, motor drivers are used to control machinery and equipment such as conveyor belts, robotic arms, and automated guided vehicles. These applications require precise and reliable control of motor speed and direction, which motor drivers like the L298 are well-equipped to provide. In consumer electronics, motor drivers are found in devices such as printers, CD/DVD drives, and camera autofocus mechanisms, where they ensure smooth and accurate movement.

Overall, motor drivers are indispensable in a wide range of applications, providing the necessary power amplification and control to operate motors effectively. Their ability to interface with microcontrollers and other control systems makes them an essential component in both simple and complex motor-driven systems. The L298, with its robust features and versatility, exemplifies the capabilities of modern motor drivers, enabling innovative solutions across various industries.

## 2.4. SERVO MOTORS:

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**Servo motors** are renowned for their precision in controlling the position or angle of an object. They are ideal for tasks such as storing objects in a specific position or carrying out operations for a specified duration. Servo motors typically incorporate a feedback mechanism that helps control and adjust the motor’s current position or speed as needed. They can generate high torque (rotational force) and have short response times.

These motors are commonly used in various industrial applications that require precise control and positioning of electromechanical devices.

## 

## Extended Applications of Motor Drivers

Motor drivers play a pivotal role in a myriad of applications, acting as the bridge between low-power control signals and the high-power requirements of motors. Their versatility and capability to manage motor functions efficiently make them indispensable in both consumer and industrial sectors.

## Snapshot of L298:

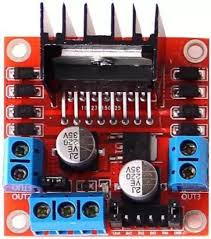


Figure 2.4: PCB diagram of Motor driver (L298)

The main central processing unit of the L298N motor driver is the L298N chip which comes with a big, black heat sink as shown in Figure 1. The L298N IC is a dual channel H-bridge motor which can run two DC motors simultaneously. This makes the L298N motor driver ideal for two and four wheeled projects. VCC pin supplies the power to the motors. It can be anywhere from 5-35V.GND pin is the common ground pin. 5V pin supplies the power to the logic circuitry inside the L298N IC. ENA pin is the enable pin for motor A. Pulling this pin HIGH will make the motor rotate. It can also be used to control the speed of the motors.IN1 and IN2 pins are used to control the spinning direction of the motor A. IN3 and IN4 pins are used to control the spinning direction of the motor B.ENB pin is the enable pin for motor B. Pulling this pin HIGH will make the motor B rotate. OUT1 and OUT2 pins are connected to the motor A.OUT3 and OUT4 pins are connected to the motor B.

There is a voltage drop of about 2V due to the H-bridge transistors. So if we want to run a 12V motor, approximately we will have to supply around 14V to the power supply pin. The motor driver output pins for both the motors are provided on the boundary of the motor driver. There are 3.5mm screw terminals provided on both the sides to connect the DC motors. These motors can be anywhere from 5-35V. Each terminal can supply upto 2A to the DC motor. However, this depends on the main power supply. There are two other pins located on either side of the directional control pins. These are the speed control pins ENA and ENB. These pins are generally shorted as the speed of the motor is constant in most of the projects. Pulling these pins HIGH will start the motors and pulling these pins LOW will stop the motors. Further we can control the duty cycle and vary the speed of the motors.

## 2.5. HM2007:

## IMG_256

## Figure 2.5: Voice Recognition Module (HM2007)

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The **HM2007** voice recognition IC is a versatile and innovative component used in various speech recognition applications. It is designed to capture, analyze, and recognize spoken words, allowing users to control devices and systems through voice commands. The HM2007 integrates several functions including an analog front end, voice analysis, regulation, and system control, making it a comprehensive solution for voice recognition tasks. This CMOS LSI circuit can recognize up to 20 programmable words, providing flexibility for different applications and user requirements.

One of the primary applications of the HM2007 is in home automation. By integrating this IC into home automation systems, users can control lights, appliances, and other devices through simple voice commands. This enhances convenience and accessibility, particularly for individuals with mobility issues. For example, users can turn on or off lights, adjust thermostats, or even control entertainment systems without needing to physically interact with the devices. This voice control capability adds a significant level of comfort and efficiency to modern smart homes.

In the field of robotics, the HM2007 plays a crucial role in enabling voice-activated control of robotic systems. Robots equipped with this IC can respond to voice commands, allowing for more intuitive and natural interaction.

## 

## Advantages

1. Customization
2. Stand-Alone Operation
3. Real-Time Processing
4. Non-Volatile Memory

## Applications

1. Voice-Controlled Appliances
2. Smart Home Devices
3. Voice-Activated Robots
4. Interactive Educational Robots
5. Voice-Controlled Wheelchairs
6. Accessibility Tools
7. Voice-Activated Remote Controls

The HM2007 voice recognition IC is a powerful and flexible component that significantly enhances the capabilities of various systems and devices. Its applications in home automation, robotics, assistive technologies, and consumer electronics demonstrate its versatility and impact on modern technology. By enabling voice control, the HM2007 not only improves convenience and accessibility but also opens up new possibilities for innovation and user interaction in a wide range of fields. As voice recognition technology continues to evolve, the HM2007 will play a critical role in driving advancements and making everyday interactions more seamless and intuitive.

## 2.6. ENCODER AND DECODER:

Encoders and decoders are fundamental components in digital electronics, essential for the efficient conversion of data between different formats. An encoder converts information from one format or code to another, typically transforming an analog input or multiple input signals into a standardized digital output, such as binary code. The **decoder** performs the reverse function, converting encoded data back into its original form. These devices are crucial in applications where data needs to be manipulated, transmitted, or stored in a more compact or efficient manner.

The working principle of an encoder involves taking multiple input lines and encoding them into a smaller number of output lines. For example, a 16-to-4 encoder receives 16 input signals and converts them into a 4-bit binary output. This process reduces the complexity of wiring and simplifies the design of digital systems. A priority encoder is a common type that outputs the binary code of the highest-priority active input signal when multiple inputs are active simultaneously. Encoders are widely used in digital systems to minimize the number of connections and streamline data processing.

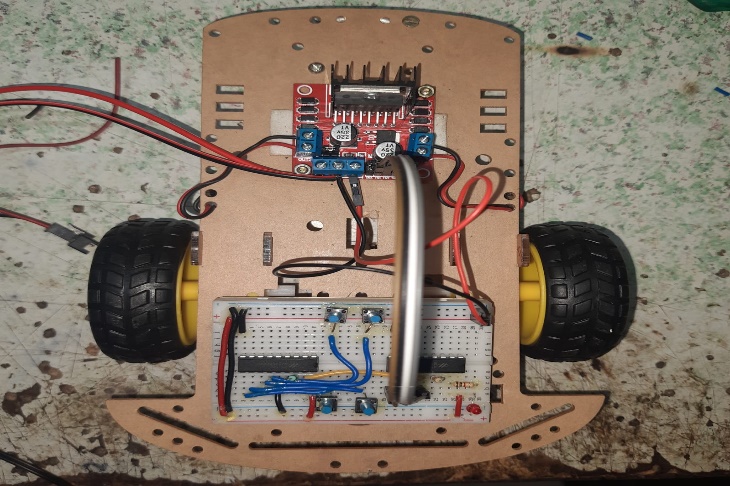
Decoders, on the other hand, take encoded data and convert it back into its original format. In digital circuits, a decoder typically takes n input lines and produces 2^n output lines. For instance, a 2-to-4 decoder receives a 2-bit binary input and generates one of four possible outputs. Decoders are essential in applications where data needs to be distributed to specific destinations based on its encoded value. They are commonly used in memory address decoding, where they enable access to specific memory locations within a larger memory array.

## CHAPTER 3

## RESULT AND DISCUSSION

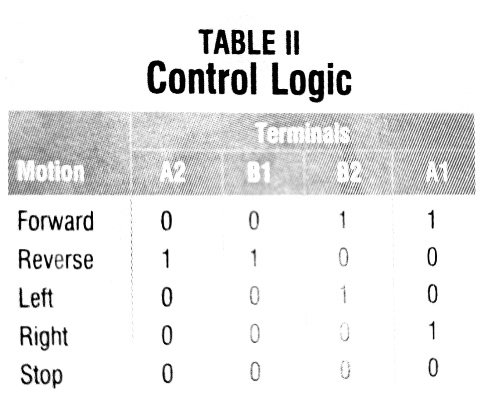
## 3.1. RESULTS:

The project of developing a voice-controlled car using the HM2007 voice recognition IC, encoder, and decoder involves various critical components and steps that integrate speech recognition with motor control technology.



**Figure 3.1: Working Model of the Voice Controlled Car**

This is the working model of our project in bread board, the voice commands from the HM2007 is given externally to the circuit that consists of encoder that encodes the voice signals and sent to the decoder where those signals are decoded and linked to the output that is motor driver.So the motor driver will thereby control the servo motor and helps in the rotation of the wheels of the car.



**Voice Recognition and Command Processing** the core of this project is the HM2007 IC, which captures and recognizes voice commands. The accuracy and reliability of the HM2007 in noisy environments can significantly impact the overall performance of the system. Environmental noise and variations in voice commands may lead to misinterpretations, which necessitates the use of noise-canceling techniques or additional filtering to improve recognition accuracy. Moreover, the limited vocabulary (up to 20 words) restricts the complexity of commands that the system can process, potentially limiting the car's functionality.

**Encoding and Decoding of Commands** The use of an encoder to convert recognized voice commands into binary signals is essential for efficient transmission to the car's control system. The encoder simplifies the communication process by reducing the number of signal lines required. However, any delay in encoding or decoding can affect the responsiveness of the car. Ensuring that the binary signals are accurately decoded into control actions is crucial for precise and timely execution of commands. The decoder must reliably interpret the incoming signals and activate the appropriate motor control circuits without errors.

**Obstacle Detection and Safety Features** Enhancing the safety and reliability of the voice-controlled car involve incorporating obstacle detection sensors, such as ultrasonic or infrared sensors. These sensors can detect obstacles in the car's path and trigger appropriate responses, such as stopping or rerouting the car. Implementing such safety features ensures that the car can navigate autonomously and avoid collisions, which is particularly important for real-world applications. The integration of these sensors with the voice-controlled system requires careful calibration and coordination to ensure seamless operation.

**Power Management and Efficiency** Continuous operation of the voice recognition system, along with the HM2007 and motor drivers, results in significant power consumption. Efficient power management strategies are essential to maximize battery life, especially in battery-operated models. This includes optimizing the power usage of each component, implementing power-saving modes, and ensuring that the power supply can handle the peak demands of the system. Balancing performance with power efficiency is a critical aspect of the project's success.

**SOFTCOPY link for our project is given below:**

## CONCLUSION

The voice-controlled car project using the HM2007, encoder, and decoder demonstrates the integration of advanced speech recognition and motor control technologies. While it offers significant benefits in terms of accessibility and ease of use, addressing the challenges related to recognition accuracy, command processing, and power management is essential for creating a reliable and functional system. By carefully analyzing and optimizing each component, developers can achieve a seamless and responsive voice-controlled car that enhances user interaction and provides a practical solution for hands-free vehicle operation.

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