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Hand Gesture Controlled Robot Car Electronic and Communication Engineering Department, ABES Engineering College Ghaziabad

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ABSTRACT
This project involves the development of a hand gesture-controlled robot car, which can be operated remotely without the need for physical controllers. The system utilizes a microcontroller and a camera to detect and recognize hand gestures, which are then translated into control signals for the robot car. The robot car is equipped with motors and sensors that allow it to move in different directions and avoid obstacles in its path. The proposed system provides an intuitive and efficient way of controlling robot cars, making it suitable for various applications, including surveillance, exploration, and entertainment. The results demonstrate the effectiveness and feasibility of the hand gesture-controlled robot car system.

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I. INTRODUCTION

The Hand Gesture Controlled Robot Car is a project that aims to develop a system that allows for the control of a robot car using hand gestures. The proposed system is designed to be intuitive and convenient, eliminating the need for physical controllers and providing an alternative method of interacting with robots.

The system consists of a camera and a microcontroller, which work together to recognize and interpret hand gestures. The camera captures images of the hand, which are then processed using image processing techniques to recognize specific gestures. The microcontroller then translates these gestures into control signals, which are used to move the robot car in different directions.

The hand gesture-controlled robot car has a range of potential applications, including surveillance, exploration, and entertainment. In surveillance, the system can be used to remotely control the robot car and monitor a specific area, while in exploration, the robot car can be used to explore inaccessible areas. In entertainment, the system can be used to create interactive experiences, allowing users to control the robot car using hand gestures.

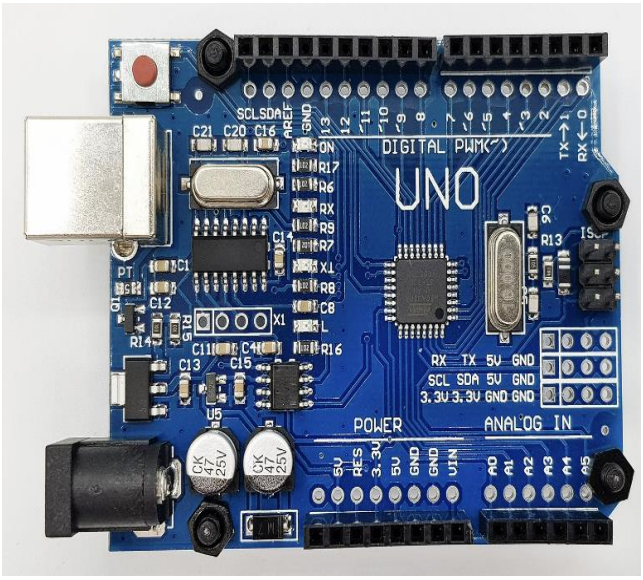
II. OBJECTIVE

1. To design and build a robot car that can be controlled wirelessly using hand gestures.
2. To use an accelerometer to detect the motion of the user's hand and translate it into directional signals for the robot car.
3. To use an RF module to transmit the directional signals wirelessly from the user's hand to the robot car.
4. To use motor control circuits to control the movement of the robot car based on the directional signals received from the user's hand.
5. To develop a microcontroller-based system that can interpret the hand gesture signals and translate them into motor control signals for the robot car.
6. To provide a hands-free and intuitive control mechanism for the robot car, enabling users to control its movement without the need for any physical input devices.
7. To provide an educational and fun project for students and hobbyists to learn about

Arduino UNO

Arduino is an open-source hardware and software platform that is designed for building electronics projects. The platform consists of a microcontroller board that can be programmed using a simple and intuitive programming language, and a development environment that makes it easy to write, upload, and debug code.

Arduino boards are based on different microcontrollers, such as the ATmega328P used in the Arduino UNO, and come with various input/output pins that can be used to connect to sensors, actuators, and other electronic components. The platform is also compatible with a wide range of sensors, modules, and shields, making it suitable for a wide range of applications.The board is compatible with various sensors, actuators, and modules, making it suitable for a wide range of applications such as robotics, home automation, and IoT projects. It is also open-source and can be easily programmed using the Arduino Integrated Development Environment (IDE), which is available for free on the Arduino website. Overall, the Arduino UNO is an excellent platform for learning and prototyping electronics and programming projects.

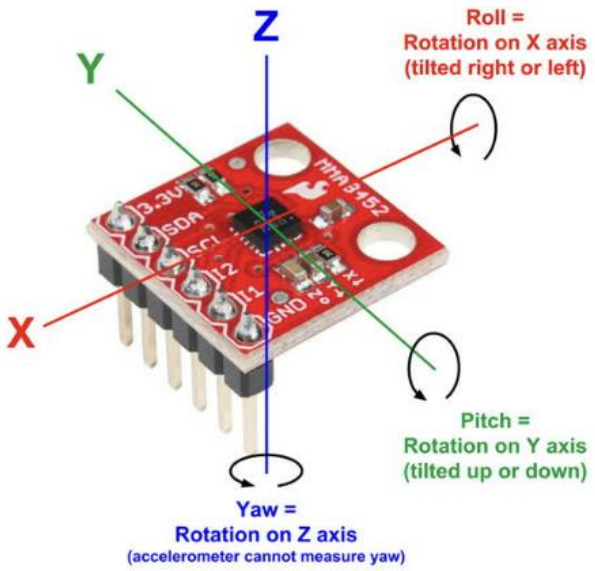


Accelerometer

The ADXL335 is a popular three-axis analog accelerometer sensor manufactured by Analog Devices. It is commonly used in electronic projects to measure changes in acceleration in three axes, X, Y, and Z.

The ADXL335 sensor uses a small cantilever beam that is attached to a mass to detect acceleration. When the sensor experiences acceleration in any direction, the mass deflects and causes a change in the capacitance between the cantilever beam and fixed plates. This change is then converted into an analog voltage signal by an on-chip analog-to-digital converter, which is proportional to the acceleration.

The ADXL335 can detect acceleration in a range of +/-3g, meaning that it can measure changes in acceleration up to three times the acceleration due to gravity. The output from the sensor is typically in the form of three analog voltage signals that can be measured using an analog input pin on a microcontroller or an analog-to-digital converter.

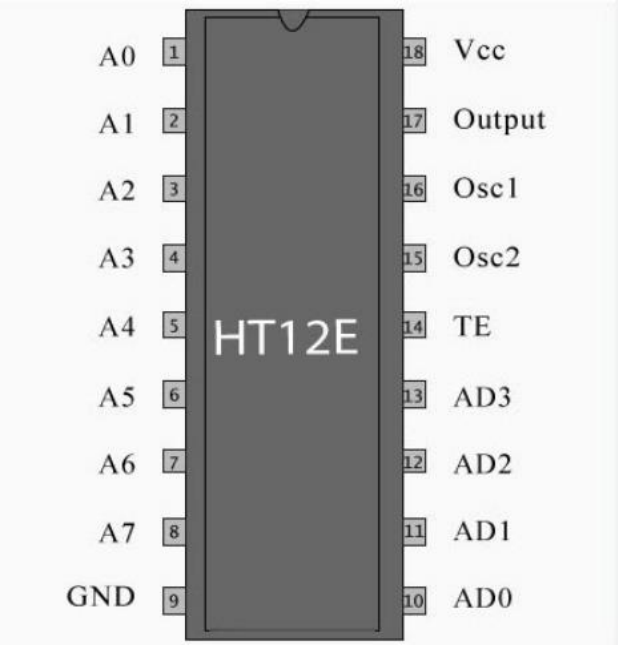


HT12E Encoder

The HT12E is a popular encoder IC (integrated circuit) that is used in wireless remote control systems. It is designed to convert a parallel data signal into a serial transmission signal that can be transmitted wirelessly using an RF transmitter module.

The HT12E encoder IC has four data input pins that can be connected to a microcontroller or other digital devices to send data wirelessly. It also has an address input pin that can be used to select a specific receiver module to receive the data transmission.

The HT12E encoder IC works by encoding the input data using an 8-bit address and 4-bit data word, which is then transmitted serially using an RF transmitter module. The encoded data transmission can be received by a corresponding HT12D decoder IC, which decodes the data and sends it to the microcontroller or other digital device.

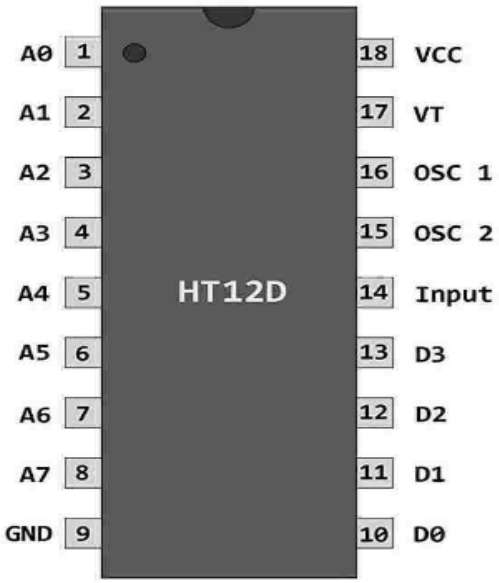


HT12D Decoder

The HT12D is a popular decoder IC (integrated circuit) that is used in wireless remote control systems. It is designed to receive a serial transmission signal wirelessly using an RF receiver module and convert it into a parallel data signal that can be used by a microcontroller or other digital devices.

The HT12D decoder IC has four data output pins that can be connected to a microcontroller or other digital devices to receive data wirelessly. It also has an address input pin that can be used to select a specific transmitter module to receive the data transmission.

The HT12D decoder IC works by decoding the received serial data transmission using an 8-bit address and 4-bit data word, which is then transmitted in parallel to the microcontroller or other digital device. The decoded data transmission can be used to control various electronic devices such as motors, LEDs, and relays.



RF Module

An RF module is an electronic device that enables wireless communication between two or more devices using radio frequency (RF) signals. It typically consists of a transmitter and a receiver module that are used to transmit and receive data wirelessly over short distances.

RF modules are commonly used in various applications, including remote control systems, wireless data transmission, and telemetry systems. They can be used in a wide range of electronic devices, including robots, drones, and home automation systems.

RF modules typically operate in a frequency range of 315 MHz or 433 MHz, and they use amplitude shift keying (ASK) or frequency shift keying (FSK) modulation techniques to transmit data wirelessly. The transmitter module generates an RF signal that is received by the receiver module, which then demodulates the signal to recover the original data.

150 RPM Motors

150 RPM motors refer to DC motors that have a rated speed of 150 revolutions per minute (RPM). DC motors are commonly used in various applications, including robotics, drones, and other electronic projects that require precise control of motor speed and torque.

The rated speed of a DC motor indicates the maximum speed that it can rotate when it is operating at its rated voltage and with no load. However, the actual speed of the motor may vary depending on the load and voltage applied to it.150 RPM motors are widely available in various sizes and configurations, and they are typically rated for a specific voltage range. They can be controlled using various motor control techniques, including PWM (pulse width modulation), which allows for precise control of the motor speed and torque.

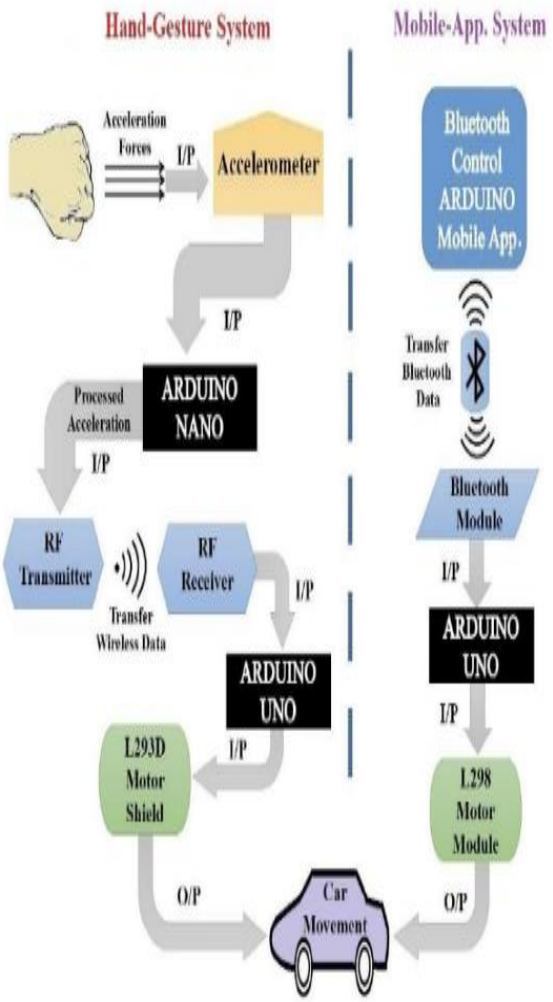
IMPLEMENTATION

A .Circuit Connections

• The readings (movement of the hand) are taken from the accelerometer attach on the hand. These readings are sent to Arduino uno

• Through Arduino the readings are encoded by HT12E. The Encoder sends these readings through RF transmitter to the receiver attached on the car.

• These readings are sent to the receiver and are decoded by HT12D . After the readings are decoded they are send to L298N motor driver due to which the motors are moved. Thus the movement of car is achieved.



B. Working

Image Capture: The robot car has a camera mounted on it, which captures the image of the hand gestures.

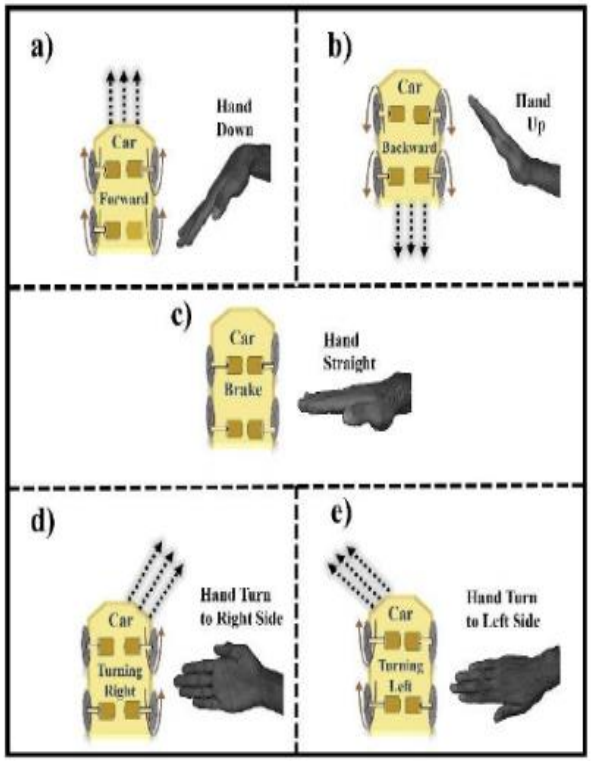
Image Processing: The image captured by the camera is processed to extract relevant features from it, such as the shape and movement of the hand.

Gesture Recognition: The extracted features are then used by the gesture recognition algorithm to identify the hand gesture made by the user.

Command Generation: The gesture recognition algorithm generates a command based on the recognized hand gesture. For example, if the user makes a gesture to move the robot car forward, the command generated will be to move the robot car forward.

Motor Control: The command generated by the gesture recognition algorithm is sent to the microcontroller of the robot car, which controls the motors of the car to move it in the desired direction.

Feedback: The robot car can be equipped with sensors to provide feedback to the user. For example, if the robot car encounters an obstacle, it can send a signal to the user that the path is blocked.
The above steps are repeated continuously to enable the user to control the robot car using hand gestures. With the help of this technology, the user can easily control the robot car without using any remote control, which makes it an innovative and intuitive way of controlling



III. CONCLUSION

a hand gesture controlled robot car is a fascinating project that demonstrates the use of various electronic components and technologies, including an accelerometer, an RF module, and motor control circuits. By detecting the motion of the user's hand and transmitting it wirelessly to the robot car, the project enables intuitive and hands-free control of the robot's movement.

The project involves various stages, including designing the hardware and software components, assembling the robot car, and programming the microcontroller to interpret the hand gesture signals and control the motors. It also requires a basic understanding of electronics, programming, and wireless communication technologies.

The project offers a great opportunity for students and hobbyists to learn about the various electronic components and technologies involved in building a robotic system. It can also be customized and extended in various ways, such as adding sensors or integrating it with other electronic devices

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