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HAND GESTURE CONTROLLED ROBOT USING ARDUINO

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ABSTRACT

In this project, we will show you how to build an Arduino-based hand gesture controller for a robotic car. The suggested setup uses an Arduino board to decode hand signals and use them to steer a robotic vehicle. A Bluetooth module allows the robot vehicle and the hand gesture controller to communicate wirelessly, and an ultrasonic obstacle detector is also part of the system. In order to reliably record the hand's motions, the hand gesture controller incorporates an accelerometer. The motors of the robot vehicle are controlled by the Arduino board, which analyzes the data sent by the hand gesture controller. Using just hand gestures, the testing findings demonstrate that the suggested approach successfully controls the robot car's movement. Search and rescue operations, exploration, and surveillance are just a few of the possible uses for the Hand Gesture Controller Robot Car.

Keywords: Hand Gesture Recognition, Arduino, Robot Control, Gesture-based Interface

I.INTRODUCTION:

Many industries, like as healthcare, entertainment, and industrial automation, might benefit from human-robot interaction, which is why it has piqued the attention of academics. Because of its inherent simplicity and ease of use, hand gesture control has become one of the most popular methods of interaction. The researchers in this work constructed and evaluated an Arduino-based Hand Gesture Controller Robot Car, which allows users to direct the

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robotic vehicle's movement with the simple wave of a hand.

II. LITERATURE REVIEW

Using hand gestures as a controller, this work presents a method for mobile robots [1]. Mobile robots are able to navigate by responding to signals sent by hand movements. Image processing and image counter processing are among the many approaches used to detect hand motions. Data that can be read and recognized is essential for the control system of a mobile robot.

Here, the user's motions control the project's mobile robot. In this case, we're talking about a transmitter unit that uses a PIC Microcontroller to recognize gestures. A mobile robot with a PIC microcontroller serves as the receiving unit and will execute the commands. The development of this system was reasonably priced, even if it is very efficient. The subsequent The goal of this project is to teach a mobile robot to follow human hand gestures. To do this, we locate the important targets in the recorded hand pictures using a technique based on the circular Hough transform. To move the robot around, the next thing to do is send signals to the receiver unit.

According to the article, simple hand gestures might be the key to human-machine interaction in the future [4]. That is absolutely possible with a Leap motion sensor. If the robot has emotional intelligence, we may proceed with this scenario. The best ways for humans to communicate with robots via hand gestures are detailed in this research.
A user-friendly interface for controlling a car-robot using hand gestures is shown in this study. The inclusion of a three-axis accelerometer allows for the monitoring of the user's hand gestures. Wireless data transmission to a microcontroller is possible via any kind of connection. Next, the signals that the car-robot receives are transformed into one of six directions that regulate its navigation.
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III. EXISTING SYSTEM:

A Bluetooth module allows the robot car and the hand gesture controller to communicate wirelessly, and the device also has an ultrasonic obstacle detector. The hand gesture controller captures motion with pinpoint precision using a flex sensor and an accelerometer. The hand gesture controller sends signals to an Arduino board, which in turn controls the wheels of the robot automobile.

IV. PROPOSED SYSTEM:

According to the experimental findings, the suggested method is able to direct the robot car's movement by means of hand gestures. Among the many possible uses for the Hand Gesture Controller Robot Car are exploration, rescue, and spying. The idea behind the suggested method is to let people direct the robot car's movement using hand gestures instead of fiddly controls. This makes it both simple and practical. This lowers the learning curve and makes the system more accessible to a wider audience. This study adds to our knowledge of how to employ hand gesture control technology to make human-robot interaction more intuitive and natural.

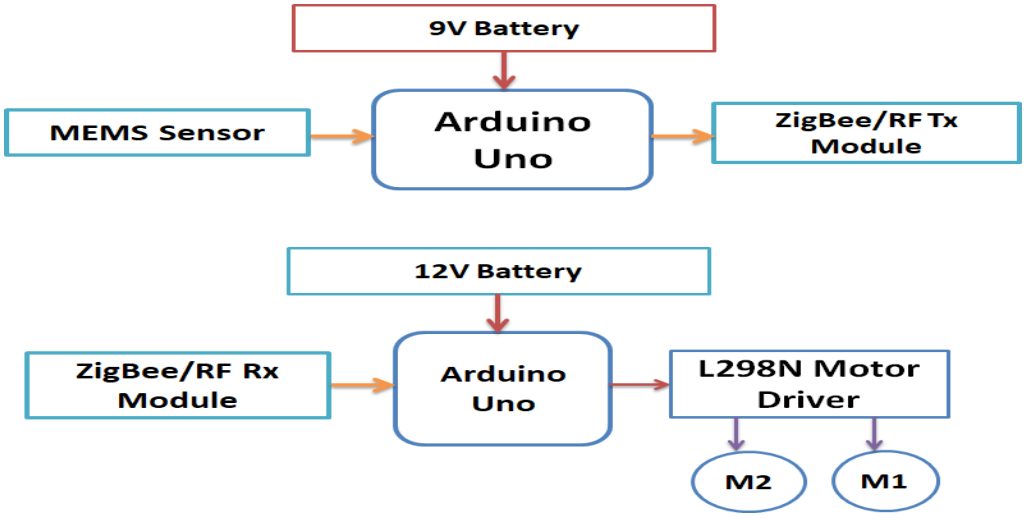

Fig.1: Block Diagram

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V. WORKING METHODOLOGY

With the use of wireless networking, gesture recognition, and Arduino, the "Hand Gesture Controlled Robot using Arduino" can move its limbs. Attached to the transmitter end of the device is a Micro-Electro-Mechanical System (MEMS) sensor, which can detect movements such as tilting to the left, right, forward, or backward. These movements generate analogue signals by modifying the sensor's inclination. A sensor feeds data into an Arduino Uno, which then determines the direction of motion based on the data. The commands are then wirelessly sent to the robot by a ZigBee or RF transmitter module. The whole transmitter system is powered by a single 9V battery, which makes it very portable. At the other end of the robot's arm, ZigBee or an RF receiver module relays the commands to yet another Arduino Uno. The L298N motor driver module is controlled by the Arduino when it reads the instructions and understands their meaning. The robot's speed and direction may be adjusted by the motor driver, who also controls the two DC motors, M1 and M2. A forward tilt of the hand may move the robot ahead, while other gestures can spin it or make it go backward. A 12V battery is attached to the receiver section so that the motors and Arduino may be powered.

This approach demonstrates a simple but successful strategy to control a robot using hand gestures, allowing for a natural and intuitive interface. Using micro electromechanical system (MEMS) sensors for gesture detection and wireless modules for data transmission makes the design quick and effective. The Arduino-based controller and motor driver circuits enable the robot to faithfully react to the user's hand gestures.

VI. HARDWARE DESCRIPTION

Arduino UNO:

The ATmega328P microcontroller must be programmed via a serial communicator. The

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most common way to link a microcontroller to a PC is via serial connection. There are a number of popular serial interfaces, but UART is among the most well-known. In order to convert data from a serial to a parallel format, one piece of hardware may be the Universal Asynchronous Receiver/Transmitter, or UART. For a long time, computers and microcontrollers have been connected via the DB9 serial connector. One must use a level shifter in order to link the TTL UART interface of the microcontroller to the computer's serial port (RS232 protocol). Quite a few level changers are available, and you can even find ones that can be connected to your computer via USB. The level shifter is notoriously unstable due to its design, and translating C code to hex or machine language sometimes requires many programs. Additionally, connecting the microcontroller to the computer may need still another application.

The Arduino UNO is an option that has all the necessary connectivity ICs on its internal board. Because it is constructed into a PCB with connectors, prototyping it is also a breeze.

L298N Motor Driver Hardware Overview: Its main components are the 78M05 5V regulator and the L298 motor driver integrated circuit.

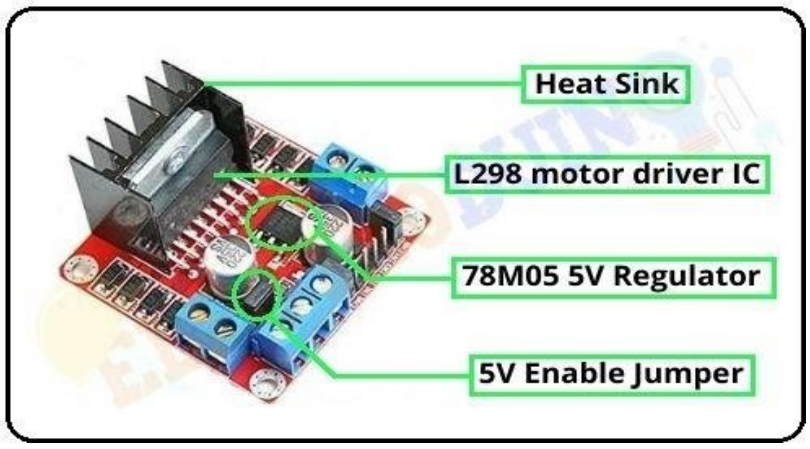

Fig.2: L298N Motor Driver Module Hardware Overview

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L298 motor driver IC:

The L298 is an IC with the ability to provide high voltage and current to two full-bridge motors. Relays, DC and Stepper motors, solenoids, and conventional TTL logic levels (Control Logic) are all inductive loads that it can control. Integrated circuits typically include fifteen pins. A maximum current of 3A per output and a working voltage range of +5 to +46V are specified in the L298 datasheet. The two enable inputs of this integrated circuit allow you to turn the device on and off independently of the input signals. A heat sink with a somewhat darker hue is connected to the L298 IC found in the module. Devices that transfer heat from a mechanical or electrical source to a fluid, often air or a liquid coolant, are known as passive heat exchangers or heat sinks. 5V regulator

How Motor Driver Module Works

The DC motors' speed and rotating direction may be controlled in two ways using this module. Both the speed and the direction of rotation are controlled by the H-Bridge and PWM, respectively.

Different Perspectives

The L298n motor driver module controls the DC motor's rotational direction using H-Bridge technology. By simply flipping the polarity of the input voltage, the H-Bridge driven DC motor may be spun in the desired direction.

Four switching components, such BJT or MOSFET transistors, form an H-shaped structure in an H-Bridge circuit, which houses the motor in its core. Actually, the L298N IC's H-Bridge circuit switches are controlled by inputs IN1, IN2, IN3, and IN4. To alter the electrical current, which alters the way the motor spins, we must simultaneously activate two switches. When we start with the very first None of the four switches (S1, S2, S3, and S4) are open, hence the motor terminals do not receive any electricity. Consequently, under these circumstances, the motor will not turn over.

HC-12 ZIGBEE MODULE:

The HC12 is an affordable and highly effective transparent 433 MHz FSK transceiver for use in serial RF modules. A simple and user-friendly wireless module with a serial data transfer rate of 433 MHz,

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the HC-12 Module is based on the reliable SI4463 RF Chip and the STM8 microcontroller platform. A cheap and effective component of the serial RF module, this transparent FSK transceiver runs at 433 MHz. It is small and powerful, with a high sensitivity level, a long transmission distance, and a high communication data rate. It also features an auto-setup function for regulating data reception and transmission. By providing the required UART data, wireless data transmission may be readily setup using the UART interface. Users have the ability to customize several variables, including UART baud rate, frequency, output power, data rate, frequency deviation, reception bandwidth, and more. If your goal is to create widely applicable products for wireless data transmission in this sector, it is your best bet.

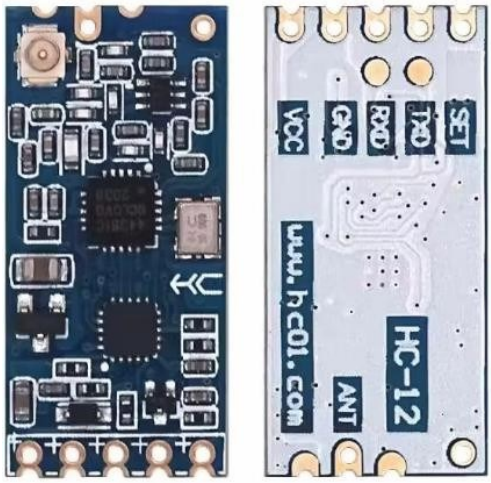

Fig.3.: HC-12 ZIGBEE MODULE

VII. SOFTWARE DESCRIPTION

The Arduino IDE is a Java-based, cross-platform tool that takes its cues from the IDE for the Processing and Wiring languages and projects. A built-in code editor allows for one-click program compilation and uploading to the board. An Arduino "sketch" is a piece of code or software.

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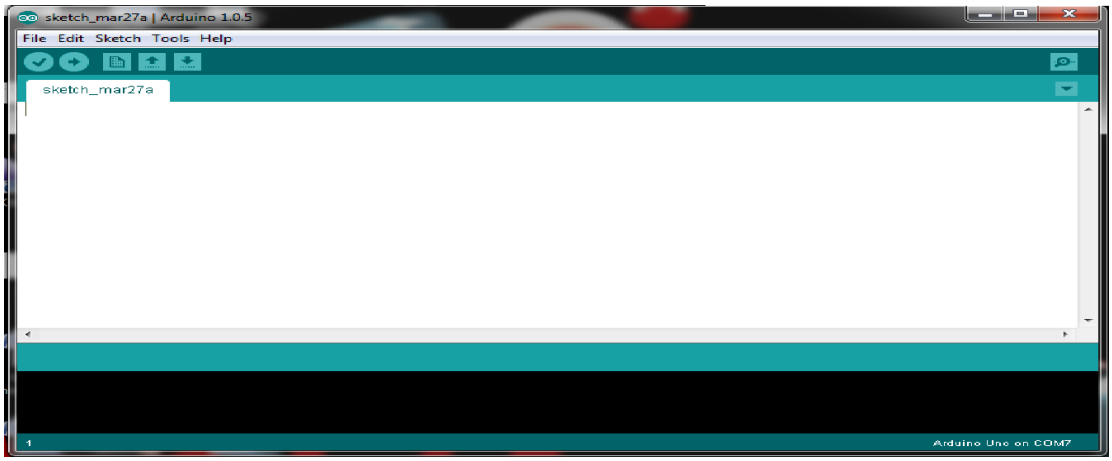
TESTING THE INSTALLATION

1. Open Arduino IDE as shown below



Code produced for Arduino boards is often in C or C++. An integrated software library known as "Wiring" from the original Wiring project is pre-installed in the Arduino IDE. This library streamlines several typical input/output activities. A runnable cyclic executive program may be created by users by defining simply two functions: The setup() method initializes settings and is executed once during program startup. function loop(): executed iteratively until power is removed from the board.

VIII. PROJECT RESULT

One example is wheelchairs and other robotic systems that may be operated by physically challenged people with only a few simple hand gestures. Another is assistive equipment for the disabled. This natural, hands-free method of engagement increases mobility and independence. The second use is in industrial automation, where the robot may be instructed to do various tasks, such as material handling, inspections, and assembly line operations, all by means of hand gestures. This means less need for people in areas that might be hazardous or difficult to reach. Thirdly, the robot's adaptability to remote observation via sensors and cameras may be

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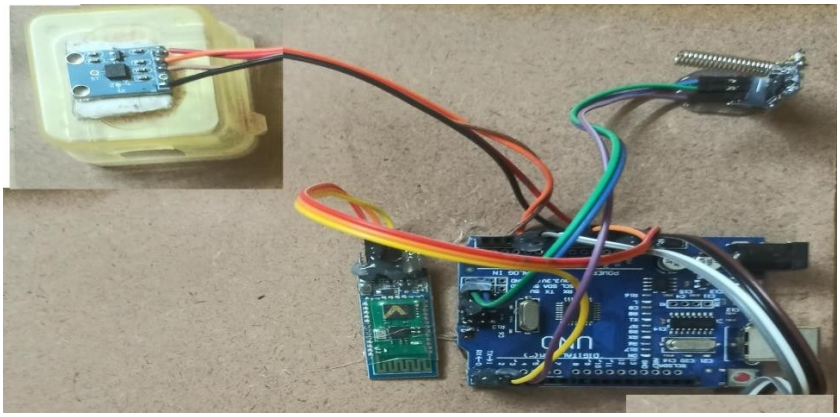
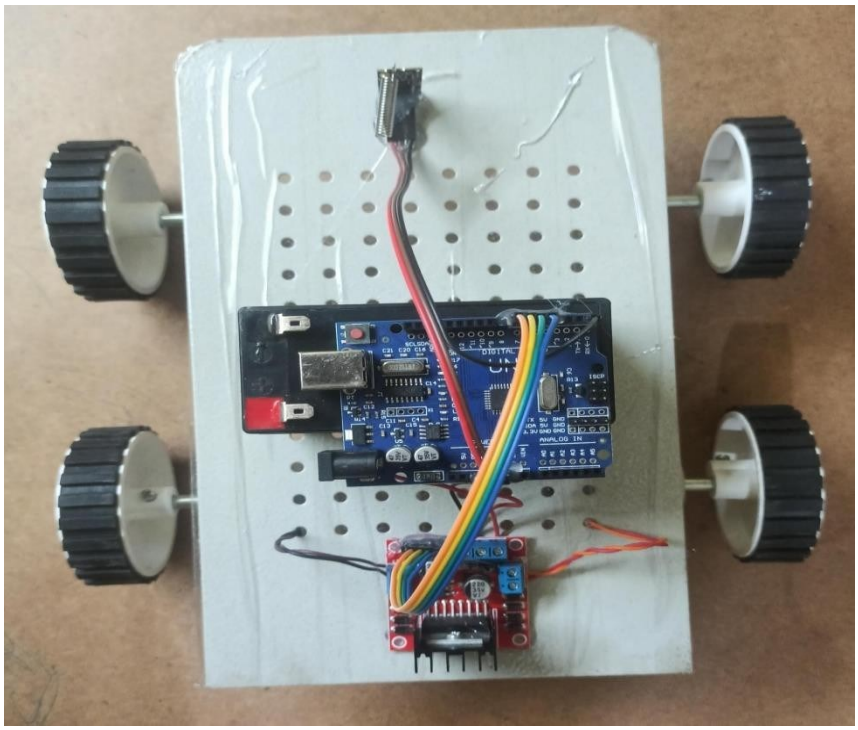
useful for military, police, and search-and-rescue missions. The gesture-controlled interface eliminates the need for complex control systems, making it easy to traverse in limited or dangerous places.





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X. APPLICATIONS

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1. The fourth potential use of gesture-controlled robots is in the entertainment and gaming sectors; for instance, in games based on robotics, players may use their hands to guide robots in cooperative or competitive scenarios.

2. In the fifth place, we have educational and research purposes: this project has the potential to teach students a lot about wireless communication, sensor integration, Arduino programming, and robotics. It may serve as a starting point for future work for developers working on human-machine interfaces and gesture recognition systems.

3. Medical and Rehabilitation Training: The robot has the potential to assist wounded patients in their rehabilitation by directing them to do certain hand movements. The ability to get immediate feedback makes therapy sessions more interactive.

4. Automating and Assisting at Home: In a home, gesture-controlled robots might be used to clean, lift, and distribute items. Avoiding the need to move large objects is a terrific way to save time and energy.

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X. CONCLUSION

Locating the driver's eyes and monitoring them for exhaustion, this real-time drowsiness detection device can identify sleepiness quickly. A typical blink may be distinguished from the tiredness by the system. What can be done to prevent drivers from becoming drowsy behind the wheel? There is room for improvement and commercial usage of the technology in the automobile industry. Knowledge is built from the many photos taken, which may assist the system determine the sleepy state. The real-time device will sound an alert the moment it detects a sleepy state. There will be less opportunity for accidents caused by sleepiness when such a technology is used in cars.

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