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Hand Gesture Control Robot

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Abstract- *As more and more features are integrated into the vehicle's human-machine interface (HMI), the processing of the device becomes more complex. Therefore, optimal use of various human sensory channels is an approach to simplify interaction with in-vehicle devices. With this idea, you can realize a Car robot that can be navigated wirelessly with the help of Arduino.*

Robots play a major role in our lives today. There are many types of robots, including wheeled robots, flying robots, and factory construction robots. The current way to control these robots is to use a keyboard, joystick, or pre-programmed commands. This project introduces a new way to control a robot using gestures. This project aims to build a remote control robot (car) that is remotely controlled using only gestures.

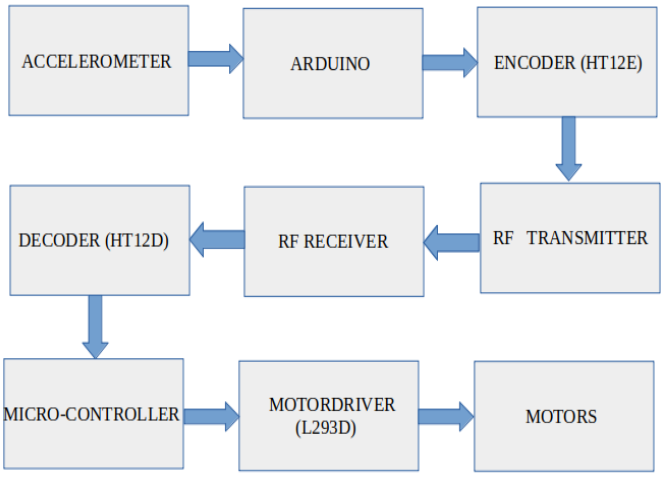
The project consists of two components: a car and a control station. The control station is a computer with gesture recognition hardware, so it can recognize commands and send them to the car. The control station is an Arduino microcomputer. Hand movement data from the accelerometer is sent to the HT12E encoder via Arduino. The value is then transmitted with the help of the transmitter, where the receiver receives the value at the receiver part, where it is decoded by the decoder HT12D and transferred to the motor driver L293D. Therefore, the motor is controlled by the data received from the motor driver.

Key Words: Gesture, accelerometer, gesture control, accelerometer control, manual robot

1. INTRODUCTION

Gesture recognition is a topic of science and language technology aimed at interpreting human gestures through mathematical algorithms. Gestures can occur from any body movement or condition, but usually from the face or hands. Users can use simple gestures to control or operate the device without physically touching it. Many approaches have been developed using cameras and computer vision algorithms to interpret sign language. However, the identification and recognition of posture, walking, personal computers, and human behavior are also subject to gesture recognition techniques. Gesture recognition can be seen as a way for computers to understand the language of the human body. This builds a richer bridge between machines and humans than a primitive text user interface or GUI (graphical user interface). Using a mouse, it interacts naturally without any mechanical devices. The concept of gesture recognition allows you to point your finger at this point and move accordingly. This can result in traditional input on such devices, and can even be obsolete.

2. BLOCK DIAGRAM



The robot operates on the output of an accelerometer (ADXL345) that records hand movements and sends data to the Arduino that assigns the correct voltage level. The information is then sent to the encoder (HT12E), ready for RF transmission. On the receiving side, the information is received by the RF receiver and passed to the decoder (HT12D). Data from the encoder is sent to the motor driver IC (L293D), which triggers motors of different configurations to move the bot in different specific directions.

2.1 CONDITIONS of OPERATION

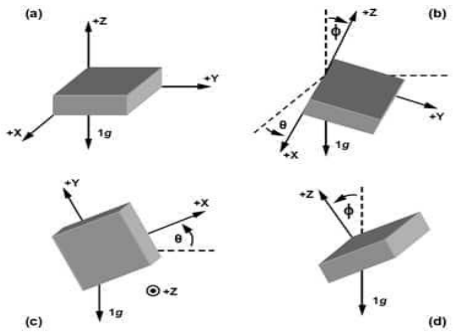
Requirements: The user keeps the accelerometer parallel to the ground. At this point, the signal from the accelerometer is sent to the Arduino and the robot stops moving. This state is called the stopped state here.

Tilt Forward: When the user holds the accelerometer and the accelerometer tilts forward, the x, y, z axes are sent to the Arduino. If the x, y, and z axes meet the conditions x> * 250, y> = 20, z> = 0, the robot will move forward.

Backward tilt: When the user holds the accelerometer and the accelerometer tilts backwards, the x, y, z axes are sent to the Arduino. When the x, y, and z axes meet the conditions x> = 0 and x <= 20, y <= 60 and y> = 20, z> = 150, the robot retreats.

Tilt Left: When the user holds the accelerometer and the accelerometer tilts to the left, the x, y, and z axes are sent to the Arduino. If the x, y, and z axes meet the conditions x> = 0, x & lt; = 20, y> = 3, y> = 250, z> = 1, the robot moves to the left.

Tilt Right: If the user holds down the accelerometer and the accelerometer tilts to the right, the x, y, and z axes will be sent to the Arduino. If the x,y,z axes satisfies the condition x>=0 and x<=20,y>=250,y>=60 ,z>=1, the robot moves right.



3. HARDWARE REQUIREMENTS

3.1 Atmega 328p

The ATmega328P is a high-performance, low-power 8-bit AVR microcontroller that, thanks to its advanced RISC architecture, can deliver 131 high-performance instructions in the most clock cycles. It is commonly seen as a processor for Arduino boards such as the Arduino Fio and Arduino Uno.

3.2 ACCELEROMETER

An accelerometer is an electromechanical device that measures acceleration force. These forces can be static, such as pulling the foot with constant gravity, or dynamic, generated by the movement or vibration of the accelerometer. It is a type of sensor that records acceleration and provides analog data as it travels in the X, Y, Z directions, or X, Y directions, depending on the type of sensor. The ADXL345 sensor module is a complete 6-axis motion tracking device. It combines a 3-axis gyroscope, 3-axis accelerometer, and digital motion processor in a small package. There is also an additional feature of the on-chip temperature sensor. It has an I2C bus interface for communicating with the microcontroller.

3.3 ENCODER(HT12E)

HT12E is an encoder integrated circuit of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It serially encodes 12-bit parallel data for transmission on the RF transmitter. These 12 bits are split into 8 address bits and 4 data bits.

3.4 RF MODULE

An RF (radio frequency) module is a (usually) small electronic device used to send and receive radio signals between two devices. In embedded systems, it is often desirable to be able to communicate wirelessly with another device. This wireless communication can be achieved via optical or radio frequency (RF) communication. RF communication includes transmitters and receivers. They are different types and ranges. This HF module consists of an HF transmitter and an HF receiver. The transmitter / receiver pair (Tx / Rx) operates at a frequency of 434MHz. The RF transmitter receives the serial data and sends it wirelessly over the RF via the antenna connected to Pin4. The transmission speed is 1Kbps 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as the transmitter.

3.5 DECODER (HT12D)

The HT12D is a decoder integrated circuit belonging to the 212 decoder series. This set of decoders is primarily used in remote control system applications such as burglar alarms, car door controls, and security systems. It primarily serves as an interface for RF and infrared circuits. They are paired with the 212 series encoders. The selected encoder / decoder pair must have the same number of addresses and the same data format. Simply put, the HT12D converts serial inputs to parallel outputs. For example, it decodes the serial address and data received from the RF receiver into parallel data and sends it to the output data pin. The serial input data is continuously compared to the local address three times. If no error or mismatch code is found, the input data code is decoded. Valid transfers are indicated by the High signal on the VT pin.

3.6 MOTOR DRIVER (L293D)

The L293D is an integrated circuit (IC) for two Hbridge motor drivers. The motor driver receives the low current control signal and supplies the high current signal, thus acting as a current amplifier. This high current signal is used to drive the motor. The L293D incorporates two Hbridge driver circuits. In its common mode of operation, two DC motors can be driven both forward and backward at the same time. The motor operation of the two motors can be

controlled by the input logic of pins 2 and 7 and 10 and 15. Input logic 00 or 11 stops the corresponding motor. Logics 01 and 10 rotate clockwise and counterclockwise, respectively. Release pins 1 and 9 (corresponding to two motors) must be raised for the motors to work. If the enable input is high, the associated driver is enabled. This activates the output and operates in phase with the input. Similarly, if the enable input is low, this driver is disabled, its output is turned off, and it is in a high impedance state.

3.7 DC MOTOR

A gadget that converts DC strength into mechanical strength is called a DC motor. Its operation is primarily based totally at the precept that after a modern-day wearing conductor is positioned in a magnetic discipline, the conductor stories a mechanical force. DC automobiles have a revolving armature winding however non-revolving armature magnetic discipline and a desk bound discipline winding or everlasting magnet. Different connections of the sphere and armature winding offer specific pace/torque law features. The pace of a DC motor may be managed via way of means of converting the voltage carried out to the armature or via way of means of converting the sphere modern-day.

4. WORKING

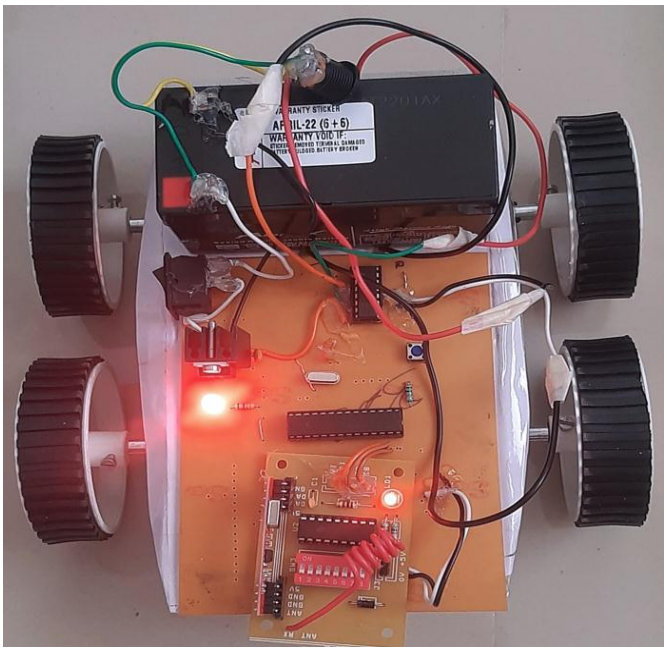
Gesture controlled robot make movements according to the user`s hand gesture recognized by the transmitter device on our hand. When we tilt hand on front side, the robot starts moving forward direction and continue moving forward direction until the next command is given. When we tilt hand on the backside, the robot switch its state and start going in the backward direction until another command is given. When we tilt hand towards left side, it will turn left till next command. When we tilt our hand in right side robot will turn to the right side. The circuit of this hand gesture control robot is very simple. RF pairs are used to communicate and connect with Arduino. The motor driver interfaces with the microcontroller to operate the robot. Here we use two used DC motors to drive the robot, one motor connected to the outputs of motor drivers 3 and 6 and the other motor connected to 11 and 14. The 9 volt battery power is also used to power the motor driver to operate the motor.

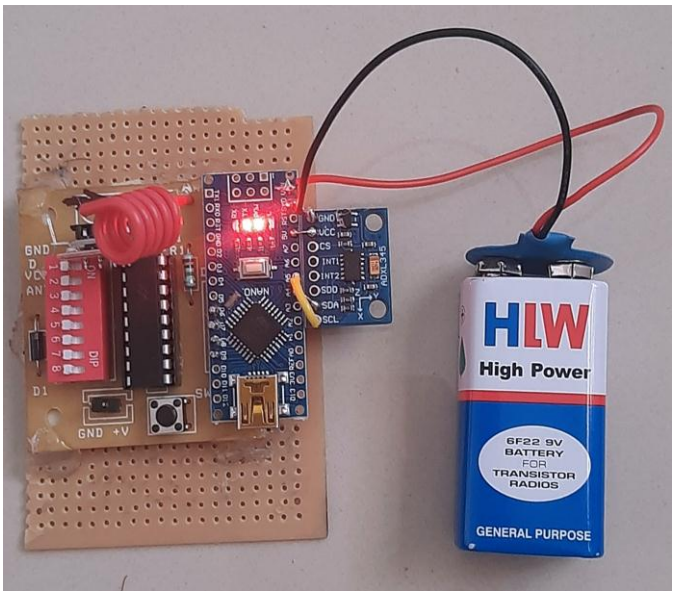
Table:- Condition for motor

SIGNAL INPUTS				
ROBOT OPERATIONS	PWM 1	DIR 1	PWM 2	DIR 2
FORWARD	HIGH	HIGH	HIGH	HIGH
REVERSE	HIGH	LOW	HIGH	LOW
TURN LEFT	HIGH	LOW	HIGH	HIGH
TURN RIGHT	HIGH	HIGH	HIGH	LOW

5. RESULT

During this task, a gesture control robot was designed that was operated by the gestures of a human hand. The user must have a transmitter device in his hand, including an accelerometer that sends certain commands to the robot to navigate in harmony with the movement of the user's hand and the receiver of the robot. RF modules typically operate at frequencies of 434MHz and range from 100 meters. The transmission speed is 1Kbps 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as the transmitter. Transmission over RF is always better than IR





6. LIMITATION AND FUTURE WORK

i. The 9V battery used provides only a limited amount of power to the system. Instead of a battery, another power source would be more useful.

ii. The range of the RF module (RF 434) is limited (about 500 feet). This issue can be resolved by using a GSM module for wireless transmission. GSM infrastructure is installed almost everywhere in the world. GSM offers not only wireless connectivity, but also very long distances.

iii. Third, you can install an in-vehicle camera to remotely monitor the robot. All you need is a send and receive module that provides livestreaming.

7. CONCLUSION

The main goal of this project was to build a robot car to drive using hand gestures received from the ADXL345 accelerometer via RF wireless communication. The Atmega328p is used as a microcontroller. The car shows the correct movement for various hand gestures given and adjusted. Hand movement data from the accelerometer is sent to the HT12E encoder via Arduino. Then the value is sent with the help of the transmitter. The receiver receives the value in the receiver section, where it is decoded by the HT12D decoder and sent to the L293D motor driver. Therefore, the motor is controlled by the data received from the motor driver. The car will only move if the accelerometer moves in a particular direction according to the given calibration values.

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