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Hand Gesture Robot

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ABSTRACT

The work proposes constructive design of hand gesture control robot. This system acts as a channel between the human and the robot through physical change such as tilting of hand. Instead of using joystick or physical controller with buttons, hand gestures are used. This device can be very useful for surveillance, military operations and industrial grade robotic arms physically challenged individuals. Navigating and controlling a robot in an indoor and outdoor environment by using the range of body-worn sensor is becoming an increasingly interesting research area in the robotic community.

KEYWORDS: Hand Gesture Control Robot, Body-worn Sensors

1. INTRODUCTION

Robots are playing an essential role in automation across all sectors like construction, military, medical, manufacturing, etc. After making some basic robots like a line follower robot, a computer-controlled robot, etc., we have developed this accelerometer-based gesture-controlled robot with an Arduino Uno. We have used hand gesture motion to drive the robot using an accelerometer.

A gesture-controlled robot is controlled by using the hand in place of any other method like buttons or joystick. Here one only needs to move the hand to operate the robot. A transmitting device is placed in the user's hand, which contains the RF Transmitter and accelerometer to transmit a command to the robot so that it can perform the required task of moving forward, back, turning left, right and stop. These tasks will be identified using the hand gesture.

Here the most crucial component is an accelerometer. An accelerometer is a 3-axis acceleration measurement device with +-3g range. This device is made by using a poly silicon surface sensor and signal conditioning circuit to measure acceleration. The output of this device is in Analog and also proportional to the acceleration. The device measures the static acceleration of gravity when tilted and gives a result in terms of 'g'.

HARDWARE REQUIREMENTS:

- Arduino board
- DC Motors
- Accelerometer
- Motor Driver L293D
- Volt Battery
- Battery Connector
- USB cable • Wires
- Robot Chassis
- switch

2. LITERATURE SURVEY

Ronny mardiyanto, heri suryoatmojo [1] "Development of hand gesture recognition sensor based on accelerator and gyroscope for controlling arm of underwater remotely operated robots". In this paper hand gesture sensor depends on accelerometer and gyroscope. Gyroscope is the sensor which is used to capture the position the operator hand when he is working in underwater operated vehicle and it is attached with a hand.

Anala pandit, Dhairya Dand [2] A simple wearable hand gesture device using institute of medical and early modern studies. Interacting with systems is done with the help touch screen, wired or wireless mouse and with the keyboard. In this paper people machine communicating device, most intuitive communicating device, to interacts to the device and the other appliance

Christian manery [3] "hugging a robot weird? Investigating the influence of robot appearance on user's perception of hugging". Humanoid robots are able to interact with humans using physical interaction like hugging and handshaking. Here the physical interaction has to be planned carefully as a user friendly system which interact normally and minimize repulsion

Akitoshi harada [4] Robot finger design for myoeletric hand and recognition of finger motion via surface ElectroMyGraphy. In this paper, robots hand layout forcing to the software to a ME prosthetic hand and action of finger operation through ground ElectroMyoGraphy are detailed. The robots consists of index fingers or thumb fingers, is produced to apply baeeded in real time, holding or grabbing.

Jianhua Ren, Huichao Wang, [5] "A portable artificial robotic hand controlled by EMG signal using ANN classifier." In this paper, creating a transportable robots for the physically challenged humans to do primary actions. Electromygraphy input and output are gathered Muscle mass of human being arm to get the intensions of actions, where 6 types of Geesture are choosed to exchange ideas .

2. METHODOLOGY

This robot can perform their operations without direct human guidance. They are used basically for industrial applications and can be made laser guided. Navigation is achieved by one of the several means, including following a path defined by buried inductive wires, surface mounted magnetic or optical strips; or alternatively by the way of laser guidance. This is an improved version of my previous robot which we designed years ago. Intelligent spy robot project has been designed for the spying purpose .it is radio controlled and can be operated at a radial distance of 100m radius. Most probably our army youth need to venture into the enemy area just to track their activities. Which is often a very risky job and may cost precious life? Such dangerous job could be done using small spy robot all the developed and advance nations are in the process of making it, a robot that can fight against enemy. Our robot us just a step towards similar activity. This robot is radio operated which is, self powered, and has all the controls like a normal car. A laser gun has been installed on it so that it can fire on enemy remotely whenever required; this is not possible until a wireless camera is installed. Wireless camera will send real time video and audio signals which could be seen on a remote monitor and 224 action can be taken accordingly. Being in size small of it, will not be tracked by enemy on his radar. Robot silently enter into enemy canopy or tent and send us all the information through its' tiny camera eyes. It can also be used for suicide attack, if required. Heart of our robot is microcontroller 8051 family, we are using at89C51 In two microcontrollers where first microcontroller which acts as master controller, decodes all the commands received from the transmitter and give commands to slave microcontroller. Slave microcontroller is responsible for executing all the commands received from the master and also generating pulse width modulation pulses for the speed control driver circuit which drives 4 nos. of motors. Two no bumper switch is added bmp 1 and bmp2 so that in case of accident our battery dose not drains out. Both the motors will stop instantly and after few second robots will move in opposite direction take turn to left or right direction and stops and stop. Navigation and Dead Reckoning, Tilt Compensation in inertial sensors, 3D-Gaming. transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitted. Transmission through RF (Radio frequency)

is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line Of sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/RX) pair operates at a frequency of 433MHz an RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps-10Kbps.

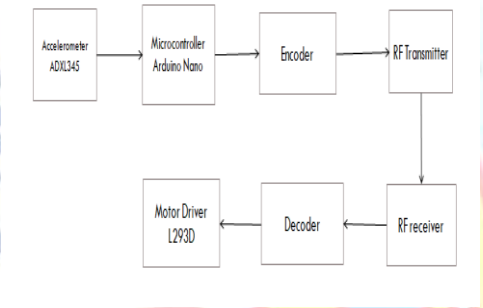
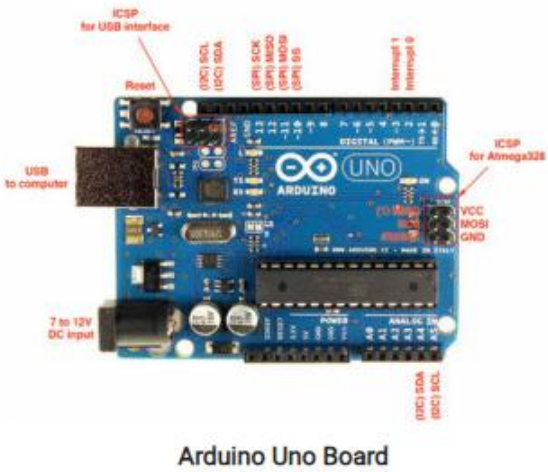


Fig 1: Block Diagram of Hand Gesture Robot

3. HARDWARE REQUIREMENTS

A. Arduino UNO Board:



Arduino Uno Board

Fig 2: Arduino UNO Board

Arduino Uno is an open-source microcontroller board based on the ATmega328P microcontroller. It is a popular choice for beginners and advanced users alike due to its simplicity and versatility. The board has 14 digital input/output pins, 6 analog input pins, a 16 MHz quartz crystal, a USB connection, and a power jack. These features make it easy to control various devices, including sensors, motors, and lights. The board can be programmed using the Arduino Integrated Development Environment (IDE), which is a simple and user-friendly programming environment.

One of the biggest advantages of the Arduino Uno is its versatility. It can be used for a wide range of applications, from robotics to home automation to art installations. It is also highly expandable, thanks to many compatible shields and modules. Shields are add-on boards that provide additional functionality, such as wireless communication, display, and motor control. Modules are smaller boards that can be connected directly to the Uno to add specific features, such as Bluetooth or GPS. In addition, the Arduino community is very active, and there are many tutorials and examples available online to help users get started and explore the possibilities of the board.

B. BO Motors:

DC motor can convert DC electrical energy into mechanical energy. This is different from AC motors. This is to provide AC power to the motors in the most basic range. DC motors are very suitable for use in the robotics field because they allow robots to be charged.

Fig 3: BO Motors

The motor has the ability to operate with minimum or no lubrication, due to inherent lubricity. The motor is ideal for DIY enthusiasts. This motor set is inexpensive, small, easy to install, and ideally suited for use in a

mobile robot car. They are commonly used in our 2WD platforms.

C. L293D Motor Driver:

L293D is a basic motor driver integrated chip (IC) that enables us to drive a DC motor in either direction and also control the speed of the motor. The L293D is a 16 pin IC, with 8 pins on each side, allowing us to control the motor. It means that we can use a single L293D to run up to two DC motorsrun at up to 80MHz, providing plenty of processing power for most applications. Additionally, NodeMCU has a USB interface for programming and power supply, making it easy to connect to a computer and start developing projects.

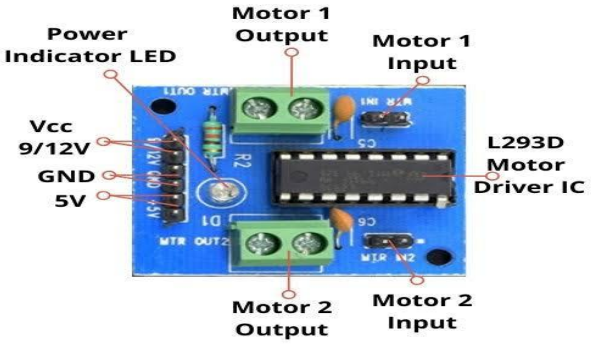


Fig 4: L293D Motor Driver

D. Caster Wheel :

Fig 5: Caster Wheel

A **caster** wheel (or **castor**) is an un driven, single, double, or compound wheel that is designed to be mounted to the bottom of a larger object (the "vehicle") so as to enable that object to be easily moved. They are available in various sizes, and are commonly made of rubber, plastic, nylon, aluminum, or stainless steel.

While making a robot car we need to put normal wheels, but only two them are connected with the motors, other two are free or dummy wheels. In case we put the normal wheels, we need to make a steering mechanism also. To avoid this steering mechanism and adding dummy wheels we use caster wheels which are free to rotate in any direction.

E. Metal Chassis:

One can use many kinds of chassis but it should be kept in mind that chassis has to support all devices and also has to be strong. It can be made from glass, plastic, aluminum or any other lightweight materials.Devices are installed above the chassis and motors and sensors are installed below the chassis by screws.

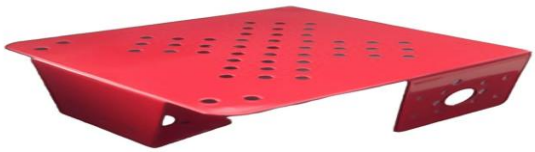


Fig 6: Metal Chassis

The best material for a robot chassis metal.It is hard to beat metal for building a robot frame. It is extremely strong, durable, and can be joined by either welding or using bolts/nuts.

F. Jumper Wires :

A jumper wire is an electric wire that connects remote electric circuits used for printed circuit boards. By attaching a jumper wire on the circuit, it can be short-circuited and short-cut (jump) to the electric circuit.Jumper wire is a type of hook up wire that has been cut and stripped in preparation for use in many electronic applications. Each jumper has one input and one output. The jumper input must be connected to one pin output; the jumper output can be connected to multiple pin input. Jumper wires come in three

versions: Male-to-male jumper. Male-to-Female jumper. Female-to-Female jumper.

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Fig 7: Jumper Wires

4. WORKING

Gesture controlled robot moves according to the user's hand movement recognized by the device in our hand. When we tilt hand in front side, the robot starts to moving forward and continues moving forward until the next command is given. When we tilt hand in the backside, the robot changes its state and start moving in the backwards direction until another command is given. When we tilt it towards the left side, it will turn left till next command. When we tilt our hand in right side robot is turned to the right.

MOMENT OF HAND	INPUT FROM GESTURE					DIRECTION
	PIN 5 (13)	PIN 4 (10)	PIN 3 (9)	PIN 2 (6)	PIN1 (5)	
Static	1	0	0	0	0	stop
Tilt Right	0	0	0	1	0	Turn right
Tilt left	0	0	0	0	1	Turn left
Tilt backward	0	0	1	1	0	Reverse
Tilt forward	0	1	0	0	1	Forward

Fig 8: Input for the gesture

6. RESULT

An automated robot has been developed which works according to your hand gesture. The robot moves wirelessly according to palm gesture. The RF module is working on the frequency of 433 MHz and has a range of 50- 80 meters. This robot can be upgraded to detect human life in earthquake and landslide by implementing the sensor accordingly. It can also be upgraded to bomb detecting robot by adding robotic arm which can also lift the bomb as well as in general terms, a robotic arm can be added which can be used in our day to day activities making human life easy.

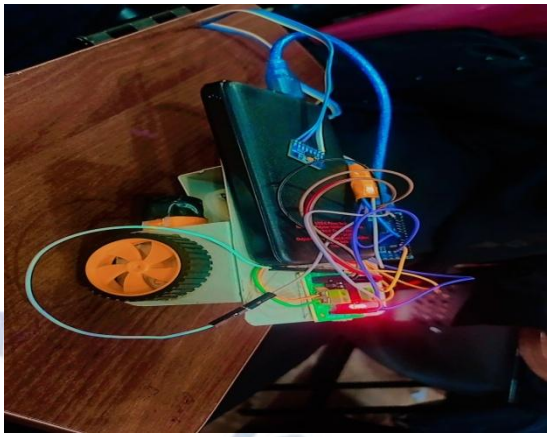

Fig 9: Hand Gesture Robot

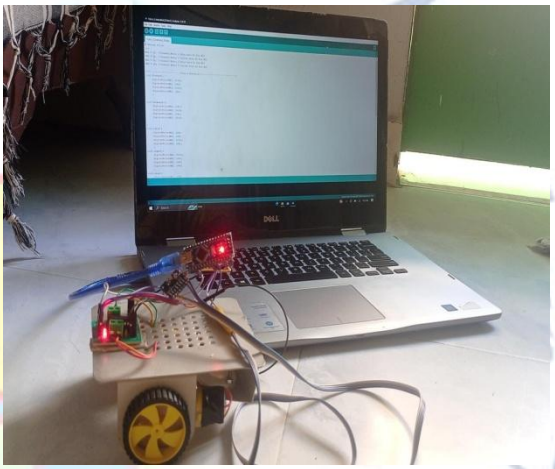

Fig 10: Experimental Results

7. CONCLUSION

The robotic actions via cord consistent with palm gesture. The robotic can pass approximately 300 mtr. The expected efficiency is achieved with the above mentioned handheld device and in future we are aiming to replace the wired component with wireless technology. And it is expected to perform more efficiently such as increase in the distance travelled by the robot and the physical limitation is overcome. This robots can be upgraded to detect human life styles earthquake and landslide by ways of enforcing the sensor therefore it can also be upgraded to bomb detecting robotic because it has robotic arm it may additionally elevate the bomb which is positioned at distant location. And these type of methodology can be used in rescue operation to view the sight without any complexity.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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