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Tactile Controlled Robot

Using Microcontroller

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Abstract : The potentiality to feel the world through the tools we hold is Haptic Touch. The sensory element that will transform information into experience by remotely interacting with things is demanding. This project is a Real time monitoring system, by which humans interact with robots through gestures. This is an immense aid for people for whom mobility is a great challenge. The user will wear a gesture device (controller) which is also the transmitter. The robot car which is the receiver and the gesture device (transmitter) are connected wirelessly through an RF module. The transmitter will track the movements of the hand in a specific direction which will result in the motion of the robot in the respective directions. Users can interact with the robot in a more cordial way due to the wireless communication. This idea brings much comfort, convenience and physical cost reduction in daily life and industry applications. To broaden the utilization of robots where conditions are uncertain, for example, security tasks, emergencies, robots can be constructed to such an extent that it will follow the guidance of humans and perform the given assignment. The major fields that elect hand gesture robots are healthcare, defense, industrial robotics, automobile industry, construction etc.

IndexTerms **– Haptics, Hand Gesture, Wireless communication, Robot.**

1. INTRODUCTION

Robots are rapidly being installed and used into industries to replace humans especially to perform dangerous and unpredictable tasks. A hand gesture controlled robot is capable of carrying complex actions automatically or under human supervision. In this project, we are using an Arduino circuit for the robot car and the controller. The controller which has a MPU6050 module measures acceleration, velocity, orientation, displacement that are the motion related parameters of the hand when we perform any movements or even tilt it. The hand gestures are sensed and the coordinates are generated which are considered as the parameters and if obligatory conditions are fulfilled, then the prescribed Arduino code is executed and the direction of the robot is changed accordingly. The robot car performs the task of moving forward, backward, turning left, turning right and stopping. A NRF module is used as a transmitter and receiver for seamless wireless communication between the controller and robot. This technology can be used to perform heavy duty tasks by just making simple hand gestures.

2. PROBLEM STATEMENT AND OBJECTIVE

With the development of omnipresent computing, current user interaction approaches with keyboard, mouse and pen are not sufficient. Due to the limitation of these devices the usable command set is also limited. The traditional wired button controlled robot becomes very bulgy and it also limits the robot distance. Instead of this, direct use of hands can be used as an input device for providing natural interaction.

The basic idea of our project is to develop a robot which can recognize the Human Interaction with it and carry out tasks assigned to it.

The main objectives of this project are:

1. To portray the control of the robot wirelessly using the microcontroller with the help of human hand gestures that is to connect and communicate with physical devices.
2. To make this device simple and cheap so it can be fabricated and used for a number of purposes.
3. To develop a human machine interface used to control robots.

4. Ability to perform doubtful and hazardous tasks.
5. Rapid and Smart innovation.
6. Convenience: We can exhibit very small movements on a very large scale. In this way, we can do maximum work which requires minimal human energy.

3. LITERATURE SURVEY

Survey Of Existing System 1:

May 2018 IJSDR | Volume 3, Issue 5 "A Study On Gesture Control Arduino Robot"

Moniruzzaman Bhuiyan and Rich Picking in Centre for Applied Internet Research (CAIR), Glyndŵr University, Wrexham, UK, proposed a review of the history of Gesture controlled user interface (GCUI), and identifies trends in technology, application and usability. Their findings conclude that GCUI[1]affords realistic opportunities for specific application areas, and especially for users who are uncomfortable with more commonly used input devices. They have tried collating chronograph research information which covers the past 30 years. They investigated different types of gestures, its users, applications, technology, issues addressed, results and interfaces from existing research. They consider the next direction of gesture controlled user interfaces as rich user interfaces using gestures seems appropriate for current and future ubiquitous and ambient devices. Moniruzzaman Bhuiyan, Rich Picking of Institute of Information technology, University of Dhaka, Dhaka, Bangladesh; Centre for Applied Internet Research, Glyndwr University, Wrexham, United Kingdom on September 2011 in Journal of Software Engineering and to meet the challenges of ubiquitous computing, ambient technologies and an increasingly older population, research-ers have been trying to break away from traditional modes of interaction. A history of studies over the past 30 years reported in this paper suggests that Gesture Controlled User Interfaces (GCUI) now provide realistic and affordable opportunities, which may be appropriate for older and disabled people. They have developed a GCUI prototype application, called Open Gesture, to help users carry out everyday activities such as making phone calls, controlling their television and performing mathematical calculations. Open Gesture uses simple hand gestures to perform a diverse range of tasks via a television interface. They describe Open Gesture and report its usability evaluation. They conclude that this inclusive technology offers some potential to improve the independence and quality of life of older and disabled users along with general users, although there remain significant challenges to be overcome.

Survey Of Existing System 2:

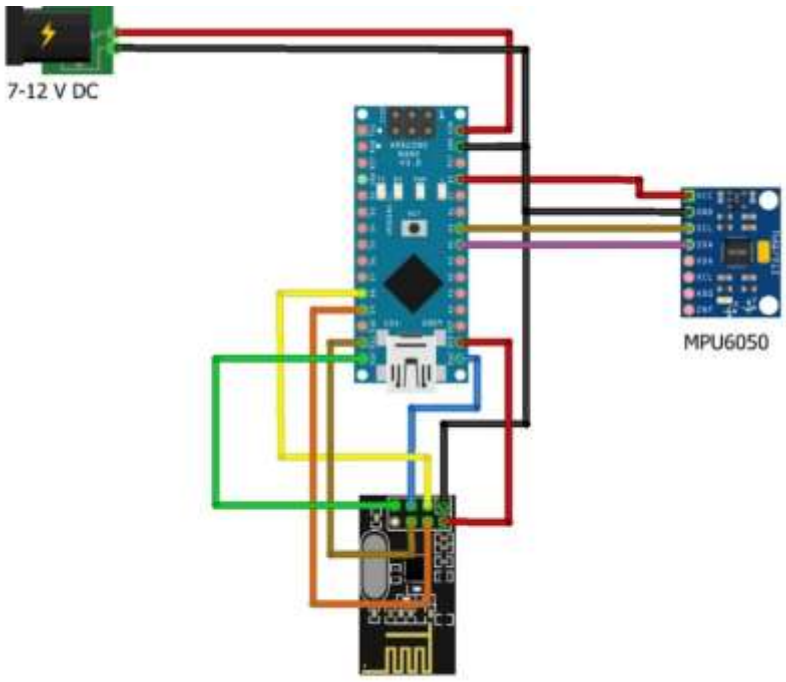
(IJITEE) ISSN: 2278-3075, Volume-9 Issue-2, December 2019 "Hand Gesture Control Robot"

Anala pandit, Dhairya Dand. A simple wearable hand gesture device using institute of medical and early modern studies. Interacting with systems is done with the help of a touch screen, wired or wireless mouse and with the keyboard. In this paper people use a machine communicating device, the most intuitive communicating device, to interact with the device and the other appliance. In case of communicating to the machine commands are being implemented using hand gestures. Here the accelerometer is used to migrate the touchpad to revolve a 3 Dimensional object. Accelerometer changed to wireless communication 3 Dimensional graphics can be done easily.

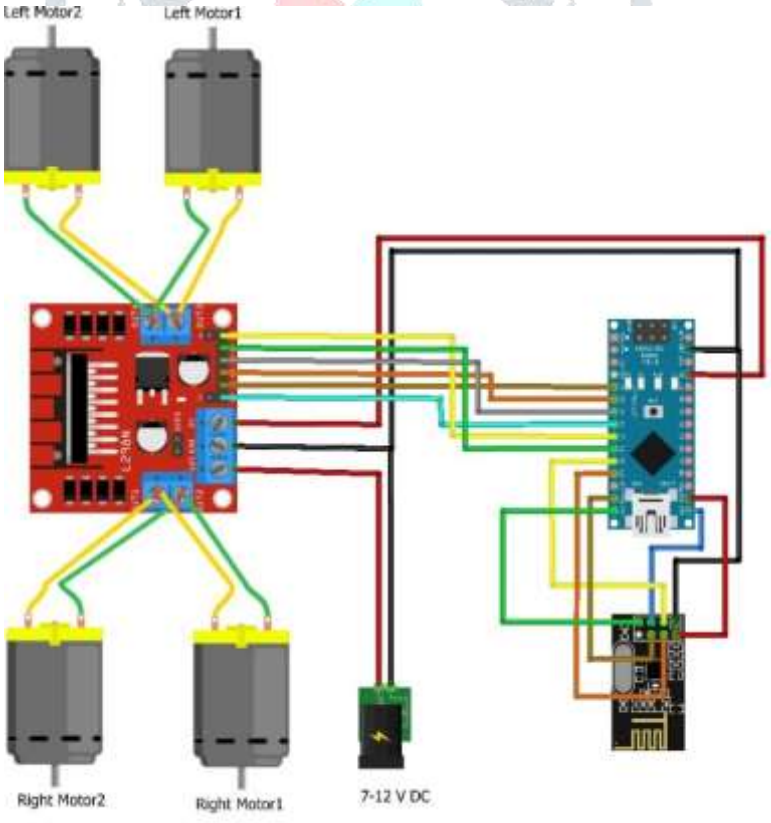
4. METHODOLOGY

Tactile controlled robot moves according to the user's hand movement which is recognized by the controller attached to our hand. When we tilt our hand in front, the robot starts moving forward and continues moving forward until the next command is given. When we tilt our hand in the backside, the robot changes its state and starts moving in the backwards direction until another command is given. Similarly, when we tilt it towards the left side, it will turn left and when we tilt our hand on the right side the robot is turned to the right until the next command. And for stopping robot we keep the hand stable.

- **Circuit Diagram:**



Gesture Device Circuit (Transmitter circuit)



Robot Car Circuit (Receiver Circuit)

- **Proposed System:**

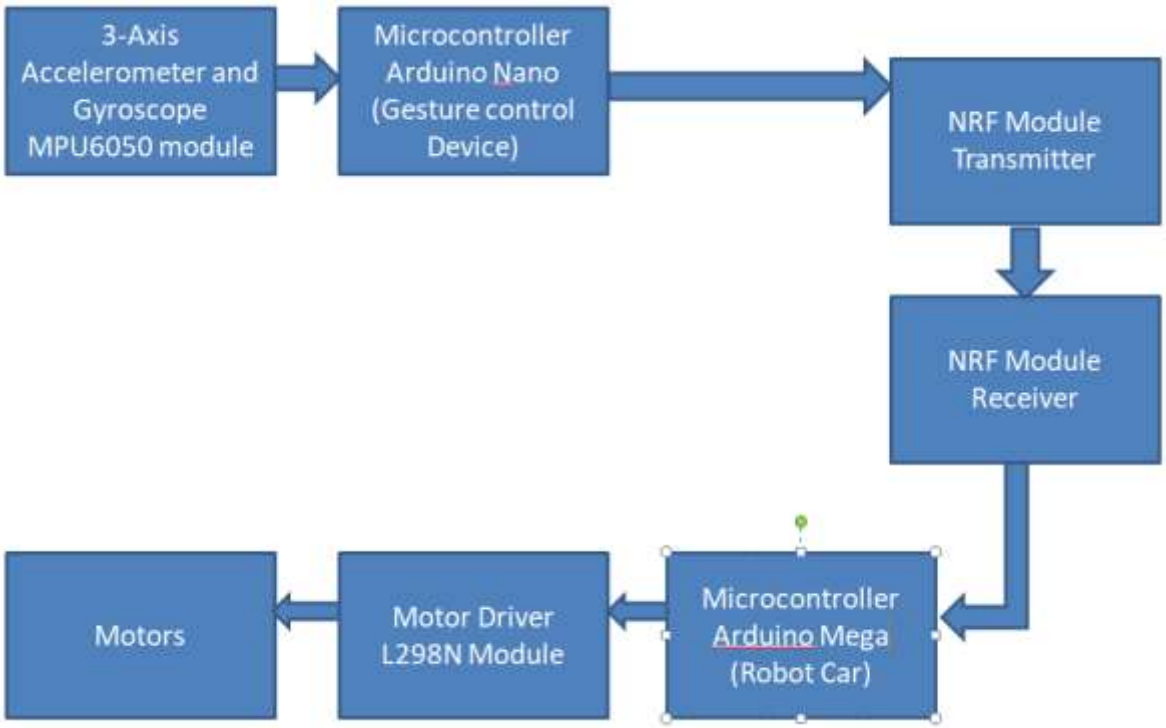


Fig. Proposed Model

The Tactile Controlled Robot is divided into two sections:

1. Transmitter part
   In the transmitter part that is known as the gesture device , we have used a three axis accelerometer and gyroscope MPU6050 module for sensing and measuring acceleration, orientation, displacement of the hand gestures performed by the user. The Microcontroller Arduino Nano is used to read the input signals from the MPU6050. It encodes the data signals received from MPU6050 and then forwards it to the RF module. RF module is used for wireless communication between the controller and the robot car. Here it is used as a transmitter. It transmits the signals to the robot car. This whole circuitry combined forms the Gesture Device (Controller) which is placed on the hand of the user.

2. Receiver part
   In the receiver part that is known as the robot car , we have used a microcontroller Arduino Mega, RF module, motor driver L298N, motors and car chassis. Here the RF module is configured as a receiver. It receives the data from the gesture device and sends it to the microcontroller Arduino Mega. It decodes the coded signal and the original data bits are recovered. This data is in the form of bits. The microcontroller reads these bits and makes decisions on the basis of these bits. Then it compares the input bits with the coded bits which we have mentioned in the program memory of the microcontroller and outputs on the basis of these bits. The output bits are forwarded to the motor driver L298N module which triggers the motors in different configurations to make the robot move in a specific direction. In this way, we are able to control the moment of the robot car.

   In this project, the task is divided into two sections to make it effortless and simple and to avoid complexity.

5. COMPONENTS USED:

Hardware:

1. Arduino NANO x1
   The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328. It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage. There is one limitation of using Arduino Nano i.e, it doesn't come with a DC power jack, which means you cannot supply an external power source through a battery.

2. Arduino MEGA x1
   The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

3. MPU6050 module x1
   The MPU6050 module is a Micro Electro-Mechanical Systems (MEMS) which consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motion related parameter of a system or object.

4. NRF24l01+ module x2
   The nRF24L01+ transceiver module is designed to operate in 2.4 GHz worldwide ISM frequency band and uses GFSK modulation for data transmission. The data transfer rate can be one of 250kbps, 1Mbps and 2Mbps. The operating voltage of the module is from 1.9 to 3.6V. The nRF24L01+ transceiver module communicates over a 4-pin Serial Peripheral Interface (SPI) with a maximum data rate of 10Mbps.

5. NRF Adapter x2
   NRF Serial Adapter board allows you to plug in your NRF modules and communicate through Serial communication. These modules allow very reliable and simple communication between microcontrollers, computers, systems, really anything with a serial port. By default these modules are in broadcast mode.

6. L298N drive module x1
   The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

7. 7-12V DC battery x2
   LIPO 2s battery
   LIPO 3s battery

8. Rubber Wheels x4
   Rubber wheels are widely used and provide elasticity and provide good traveling performance on uneven road surface. In addition, rubber wheels are cheaper than urethane wheels.

9. Breadboard x2

10. DC Motors x4

11. Antenna

12. Car Chassis

13. Jumper Wires

Software:

Arduino IDE

- Programming Language Used

- Embedded C/ C++

6. CONCLUSION

In this paper, we introduced a hand-gesture-based interface for navigating a robot car. The sensors are intended to replace the old fashioned remote control that is usually used to operate the robot. A user can command the robot directly by using his/her hand trajectories. Human errors are reduced on a large scale and results are achieved with great accuracy within a short duration. In various fields, it is quite complicated to control the robot or particular machine with remote or switches, sometimes the users may get confused in the switches and button itself, so a new concept is introduced to control the machine with the movement of hand gestures which will simultaneously manage the movement of the robot.

7. REFERENCES

1. International Journal of Innovative Technology and Exploring Engineering (IJITEE) ,ISSN: 2278-3075, Volume-9 Issue-2, December 2019 - “Hand Gesture Control Robot”
2. Journal of Xi'an University of Architecture & Technology, ISSN No : 1006-7930, Volume XII, Issue V, 2020 - "HAND GESTURE CONTROLLED ROBOT CAR"

3. International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 9 Issue 11, November-2020 - "Hand Gesture Controlled Robot"

4. ISSN: 2455-2631, May 2018 IJSDR | Volume 3, Issue 5 - "A STUDY ON GESTURE CONTROL ARDIUNOROBOT"

5. International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, ICSITS - 2020 Conference Proceedings

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