Gesture controlled Robotic Arm

Team FuTech

The basic idea behind our project is controlling a robotic arm using gestures. We used arduino and sensors in order to build this project. The arm will be controlled using two palms which makes the control comfortable and easy.

MOTIVATION FOR OUR PROJECT

Automated robots can be used in different factories for doing different tasks more efficiently and accurately. These kind of robots can also be used in order lift and control heavy objects conveniently which could not be performed by humans .

PLAN OF ACTION

- WEEK 1
  We planned the basic mechanical model and started learning Arduino programming.
- WEEK 2
  We bought mechanix set which we were going to use to make our mechanical model.
  We made the clippers (to grab or hold an object) and we were able to and started working on other parts such as the elbow, shoulder mechanisms.
  test it using arduino by then.

Accelerometer was also calibrated in this week.

- WEEK 3

Our mechanical model was nearly ready, all the servos were mounted by this time.

We brought the wooden base and mounted stepper on it.

Flex sensors were also calibrated by now.We started working on. the code to be used

- WEEK 4

Figured out the Wireless Module NRF24L01.

All the mechanical part was assembled on the base and connections were completed.

Debugging(which began in week 3 itself) was done and then sensors were mounted on gloves and again debugging was done...everything worked out and finally the our arm was up and running!!.

TEAM MEMBERS

			
Viraj Karambelkar	Siddesh Choudhary	Nikhil Gawade	Kaustubh Vyas

THEORY INVOLVED

We used arduino uno in order to control our servo motors and to receive data from the sensors. We used 4 servo motors. Accelerometers were used in order to control wrist and shoulder motion and flex sensors were used in order to control the gripping action and elbow motion. L298N motor driver was used to control the stepper motor. Stepper motor gave rotational degree of freedom to the shoulder. We used SMPS in order to convert AC from the mains to a 5V DC power supply.

CONCEPTS

MECHANICAL PART :-

1. Designing the robot taking into consideration the torques and weights of the servo motors.
2. Applying the gear system for the rotation through stepper motor so that it's shaft doesn't bear much load.
3. Choosing a suitable base so that the robotic arm doesn't topple.
4. Using ball bearings to attach motor shaft to a stationary plywood base.
5. Using class 1 lever mechanism for shoulder region.

CODING PART :-

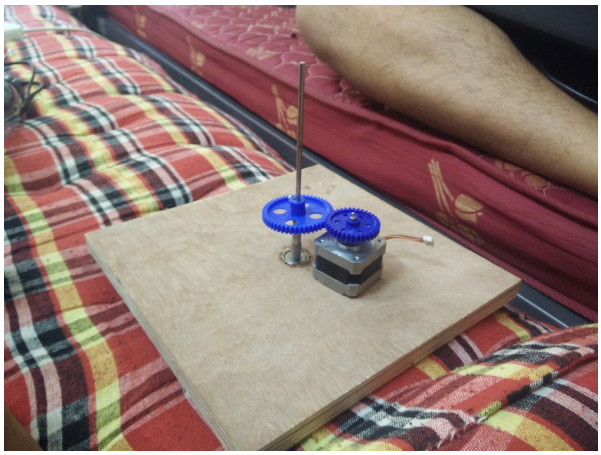
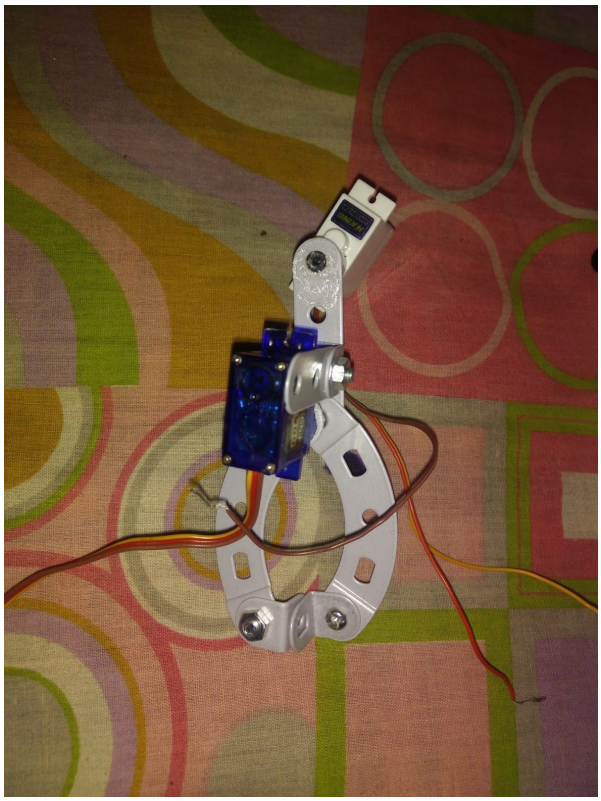
1. Adding libraries to arduino IDE to control and calibrate data from flex sensors and accelerometers.
2. Implementing stepper and servo libraries to monitor the movement of the respective motors.
3. Using NRF24 for wireless transmission between robotic arm and our palms to read gestures and enact respective motion of the arm.

PROJECT LINKS AND VIDEOS

Project video link -

https://www.youtube.com/watch?v=rZBm9hwJNlU

Code:https://drive.google.com/open?id=0B-gFsHbvoCPYVDhTVG0xdFJMTVU

COMPONENTS

- Arduino Uno - 2
- Servo Motor 1 kg Torque - 2
- Servo motor 6 kg Torque - 1
- Servo motor 15 kg Torque - 1
- Stepper Motor 2 kg torque - 1
- Flex sensors - 2
- Accelerometer - 2
- Mechanix set - 1
- NRF24 L01- 2

REFERENCES

1) https://en.wikipedia.org/wiki/Eccentric_(mechanism) - For moving rope and ultimately transferring torque to the arm
2) https://www.youtube.com/watch?v=fCxzA9_kg6s&list=PLA567CE235D39FA84 -For arduino tutorials
3) http://www.instructables.com/id/Accelerometer-Gyro-Tutorial/ -For gyro and accelerometer sensors
4) http://learnpythonthehardway.org/ -For Python.

5) https://www.arduino.cc/en/Products/Compare -Different arduino boards
6) http://www.instructables.com/id/Arduino-Wireless-Serial-Communication/?ALLSTEPS#step1 http://www.instructables.com/id/Wireless-communication-Arduino-RF/step7/step7/ http://www.instructables.com/id/Gesture-controlled-robot-using-Arduino/step4/Interfacing-ADXL335-with-Arduino/ wireless serial communication
7) https://www.sparkfun.com/datasheets/Sensors/Flex/FlexSensor.pdf -Flex sensor daatasheet
8) https://www.arduino.cc/en/Tutorial/ADXL3xx -Arduino accelerometer interfacing
9) http://spectrum.ieee.org/automaton/robotics/space-robots/heres-how-nasa-will-grab-an-asteroid - Grabbing mechanism .
10) Wireless Module - https://arduino-info.wikispaces.com/Nrf24L01-2.4GHz-HowTo
11) PID - https://en.wikipedia.org/wiki/PID_controller
12) NRF24L01 - https://github.com/TMRh20/RF24/blob/master/examples/GettingStarted/GettingStarted.ino
13) Transceiver for nrf24l01 complete help- http://www.instructables.com/id/Wireless-Remote-Using-24-Ghz-NRF24L01-Simple-Tutor/
14) Some basic sketches for receiver code - http://arduino-info.wikispaces.com/Nrf24L01-2.4GHz-ExampleSketches#js1
15) Interpreting data from Accelerometer- http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19970034695.pdf
16) Flex Sensor - https://learn.sparkfun.com/tutorials/sik-experiment-guide-for-arduino---v32/experiment-9-using-a-flex-sensor
17) Basic project Arduino - https://circuito.io/
18) For improving data collection algorithm - http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6726354