Sanket- The Gesture Controlled Bot

Project Report

By Team Technico-Forza
Himanshi Swarnkar | S. Vaishnavi | Chinmayee Panigrahi
in
ITSP 2013

Index

1. Project Abstract

The project aims at making a gesture controlled bot which will be controlled by the hand gestures . The movements of the hand will enable the bot to manoeuvre accordingly.

There are two parts to this project:

1. The glove: This consists of the sensor which will detect the gesture and a microcontroller which will transmit a signal to the bot accordingly at regular intervals of time. This could be either- USB powered or Battery powered.

2. The bot: This consists of a receiver which will receive the signals and a microcontroller which will be coded to move the bot according to the predefined moves allotted to the gesture.

There is an additional feature

1. The gripper: This will be controlled by the microcontroller on the bot. There is a specific gesture for the whole gripping and dropping action. Thus an object of specific width and weight can be lifted.

Thus the final bot can be gestured to move around, lift an object and drop the bot elsewhere needed.

2. Principle of working

Working of the different parts:

The Glove

There is an analog accelerometer attached to the finger part of the glove.

What does an accelerometer do?

An accelerometer is a sensor that measures the acceleration along three predefined axes mentioned in that accelerometer and returns a raw value to the microcontroller that controls it. These raw values are exploited to get the voltage differences along the axes and the accelerations. Often, the sensitivities of the accelerometer can be changed which will be accompanied by a loss in the g-Range that the accelerometer measures. The data transferred differ in the case of analog and digital accelerometers and would need the inclusion of different header files in the coding of the microcontroller.

The accelerometer will send the needed values to the microcontroller which will pass on specific data to the transmission module depending on the values received.

What does a transmission module do?

Transmission modules are used in data transfer. They transmit through radio waves in an encoded format. Most transmission modules are accompanied by a corresponding receiving module which decode the radio waves and pass on data exactly as that received by the transmission module. Transmission modules include different antenna types like chip antenna and whip antenna. It is preferable to attach the modules to a shield rather than directly to the circuit board to ensure safety of the module.

The microcontroller will be powered by an on-glove battery which will power the transmission module and the accelerometer.

The Bot

The bot consists of an on board battery which powers a microcontroller. To this microcontroller is attached the receiver counterpart of the transmission module.

What does a receiver module do?

The receiver module decodes the received data and passes it on just as received by the transmission counterpart. This module too, is better safe, with a shield as in the case of the transmission module.

The microcontroller passes on the received data to a motor driver circuit powered accordingly. The motor driver powers the motors to manoeuvre the bot as indicated by the gesture on the glove.

The Gripper

The gripper mechanism used consists of one servo for gripping and two servos for lifting the gripper arm.

What does a servo motor do?

Servo motors are used for almost accurate rotational motion. They have torque ratings which defines the amount of torque that can be provided. It is essential to choose servos of the right torque ratings to ensure that it serves the needed purpose.

This gripper has a corresponding gesture on the glove. This gesture is same for gripping and releasing. If the object is being gripped, it will be released, or else the object in front will be gripped, ready to be moved.

3. Technical Specifications

Components used:

1. Accelerometer: MMA7361
2. Transmission/ Receiver module: Xbee Series 1 with 802.15.4 protocol
3. Microcontroller: Arduino Duemilanove
4. Servo Motors: 2 kgcm V3001 and 6 kgcm torque rating : V3006
5. DC Motors: 150 rpm
6. Motor Driver: L293DNE
7. Voltage Regulator IC: 7805, 7809
8. Glove: NIVIA Goal-Keeping Glove (Latex Foam) - [reduces hand noise]
9. Acrylic Chassis and Transparent Chassis
10. Battery - 12V - LiPo on Bot - Not to fall below 8.5 V at any stage
    Battery - 9V - Duracell on Glove - Not to fall below 7.5 V at any stage
11. Wheels - High Traction: 7 cm diameter

Gripper:

Object Specifications:

Maximum Width : 6 cm

Maximum Weight: 0.5 kg

Gestures:

Forward

Backward

Left

Right

Stop or

Grip Quick Jerk Downwards or Upwards

4. Problems Faced

Problems faced in any technical project are never sparse. Most often an important part of the project becomes overcoming the innumerable obstacles faced. Here are some of the problems encountered on the way to finishing our project.

1. Calibration of the accelerometer:
   To identify the different gestures it was important to calibrate the accelerometer properly. We finished the calibration and then fixed the accelerometer permanently. This led to a certain offset in the values we received. Hence we had to calibrate once again.

2. Transmission through Xbee:
   We had to transmit signals denoting different gestures from the glove to the bot via Xbee communication. We planned to send strings (if the accelerometer detected a forward motion we would send “forward” via Xbee). However this invited problem of comparing strings at the bot. Due to the delay of transmission the complete word was not being transmitted and hence the bot did not move accordingly. Thus we had to transmit single characters for the different gestures.

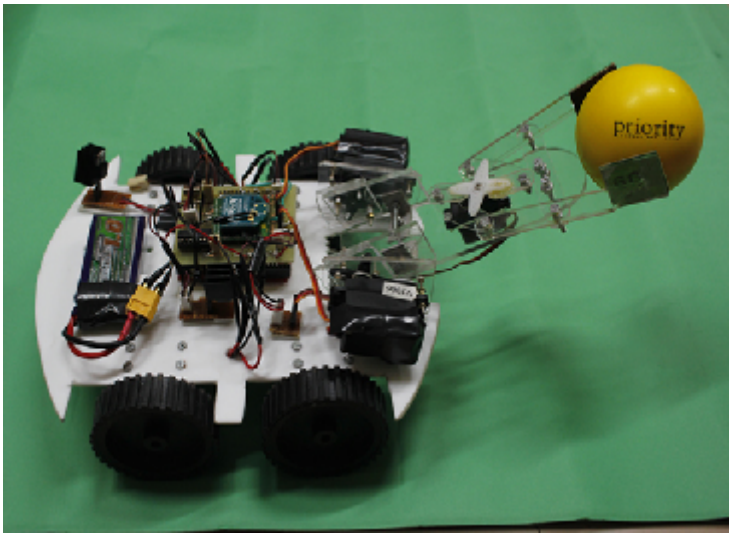
3. Wheels are never perfectly aligned:
   We took a lot of care so that the wheels form a rectangle. But this never happens. Hence the bot does not move in perfectly straight lines

4. Problem uploading the program to the Arduino board:
   We faced this problem many times. We later recognised the problem that Xbee when connected to the arduino (Arduino provided power to the Xbee) was creating unnecessary errors. In other words, it is best to disconnect the digital pins 0 and 1 while uploading a program onto the Arduino

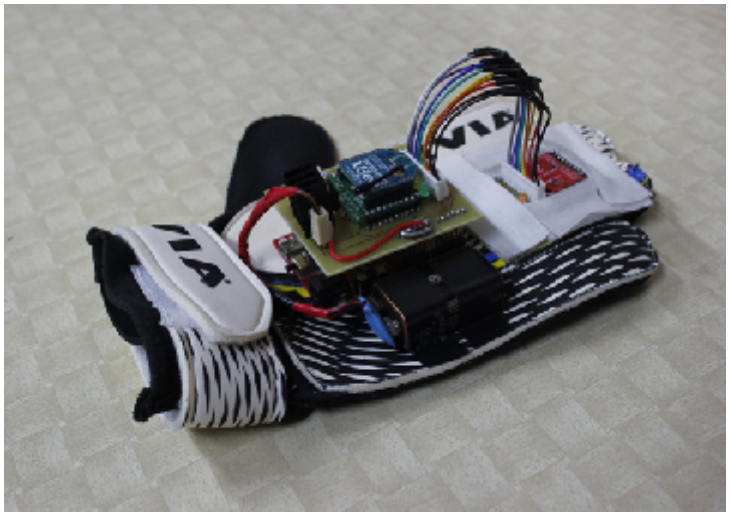
5. Procuring Components:
   Lamington Road, the robot-house of Mumbai, where we get all the components needed, happened to be closed in the first two weeks of our project. This forced us to buy some of the components online at an increased cost and lots of doubts as to how the components will function.

5. Final Working Model

The Bot:



The Glove:



6. Acknowledgements

We would like to thank ITSP IIT Bombay for giving us a chance to spend our summer in the enthralling endeavour of building technological projects. We would also like to thank the Managers of ITSP.

A special thanks Varun Sudarsanan, Lalit Kumar, Urvesh Patil, Anushree Pamparee and the IITB Racing Team for their support and help.

Not to forget, our mentor, Vallari Gore and our manager Prajwal Raut.

Thank you all for the wonderful opportunity and the help and support.