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Gesture Control Robot by Interfacing LabVIEW and Arduino

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Abstract

Robot is a machine that is specially programmed by a user or computer. Robot is mainly used for carrying things with complex action and it can be guided by external control device. This article depicts that controlling of robot is based on hand gesture movement. The gesture movement is done with the help of 3-axis accelerometer (i.e.ADXL 335).It works based on tilting the accelerometer in various directions. Based on the accelerometer directions the robot is controlled. An accelerometer is placed on the hand that is used to transmit the signal that is configured with Arduino UNO and the controlling the motor is done with NI-MYRIO using LabVIEW. Based on the transmitting device value the robot movement is controlled in various directions like forward, backward, left, right and stop. The movement of indication is viewed in LabVIEW.

Keywords: *3-axis Accelerometer, Arduino UNO, LabVIEW, NI-myRIO*

INTRODUCTION

In the emergent technology robotics is majorly used in all fields like automation, military and in surveillance purpose. Robots is majorly classified into autonomous or semi-autonomous. It can be deal with technology based on design, construction, and operation. It can be of wireless or wired. But both required controller. To control the robot in desired direction they are some of the methods are available like switch, voice etc.

One of the method is used in recent years is gesture based controlling of robot. This helps the user to control the robot in natural way and it provides interaction with human and robot. Now a day's wireless robot is used and it has large amount of scope and used to develop variety of applications. By dealing with gesture control robot, makes wireless transmission is helpful in easier interaction with robot.

Basically gesture is a term that controlling the robot with human hand movement. Inthis article described that interfacing of LabVIEW and Arduino. With help of these two software platforms the robot is being controlled.

II. RELEATED WORKS

The main theme of paper [1] is to make a system by which the human can give commands to robot over wirelessly by gesture action. Here user can navigate the robot by action of gesture that is placed on palm. The goal of [4] describes about the gesture is done with the help of flex sensor. One of the conference paper [3] portrays that based on the technique of image processing in Lab VIEW. By using vision acquisition and vision assistant the objective is obtained. The paper [2] is based on development of robotic arm that is used for industrial automation. For use of small applications flux sensor is used for the robotic arm movement.

III. HARDWARE TOOLS

In this paper majorly two hardware components is used. These two components plays a major role. The two components are listed below

1. Arduino UNO
2. NI-MYRIO
3.3-axis accelerometer ADXL335

1. Arduino UNO

Arduino which is an open source hardware and software that licensed by LGPL and GPL.It is one of microcontroller kit for making interactive objects that can sense and control objects in physical world. Arduino UNO is one of microcontroller based on the family that ATmega328, which is 28 pin IC.

In Arduino UNO they has 14 DIO pins. Out of 14 pins, 6 pins can be used for PWM outputs, also it has 6 analog pins. Arduino UNO is powered with USB cable that is connected with Personal computer or we can give through external battery. Along with DIO pins it has 6 analog pins. It has an

onboard transmitter and receiver LEDs and various levels of input voltage to power up Arduino. **See Fig 1.**

2. NI-MYRIO

The term NI-myRIO defines that Reconfigurable Input Output that from National Instruments. It has comes in two variants namely NI myRIO-1900 and NI myRIO-1950.It has onboard accelerometer, 4 power LEDs, and wireless communication. In NI-myRIO totally they have 3 ports namely A, B, C. A and B constitutes myRIO Expansion Port(MXP) which consists of 64 pins whereas Port C represents that Mini System Port(MSP) that consists of 8 DIO pins (DIO 0-DIO 7)and Analog input pins (A0±,A1±)and Analog output pins (A0,A1)Majorly it is used to design and control robotics applications.

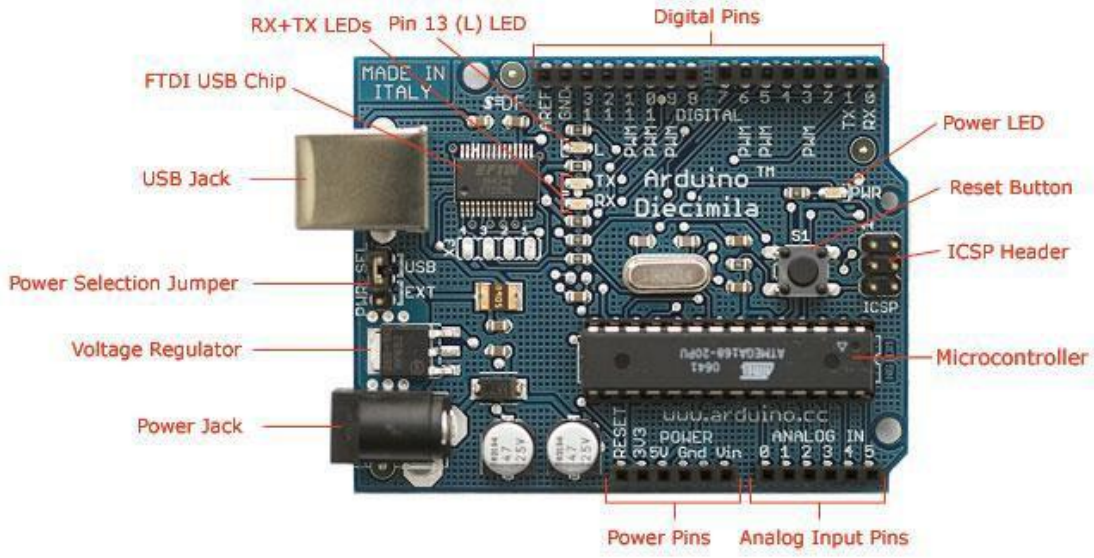

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Figure 1. Arduino UNO

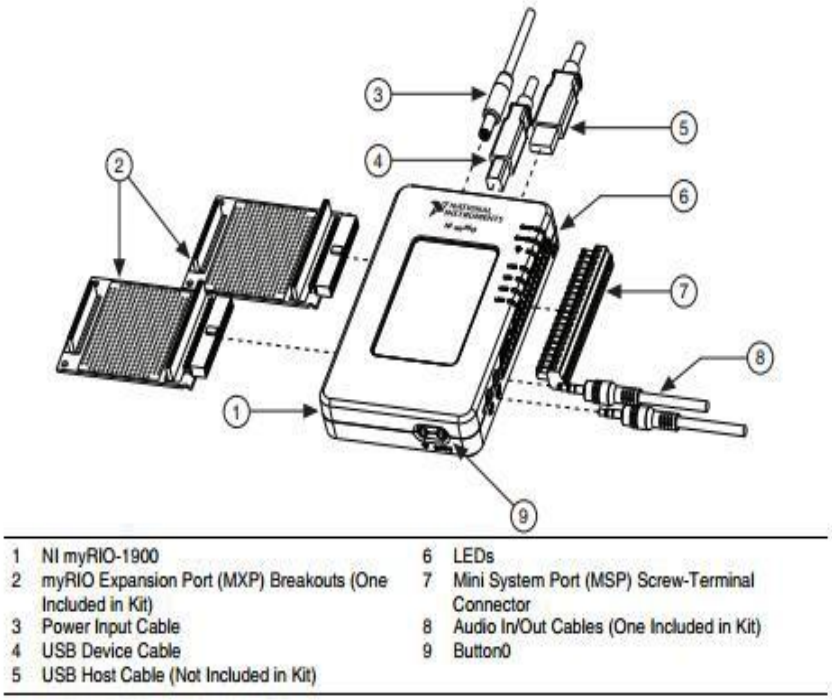

Figure 2. NI-my RIO

In this paper the use of NI-my RIO is configured with wireless network. The frequency range is between 2.4GHz-2.5GHz.Normally configuration of Wi-Fi is done by using Measurement and Automation explorer (i.e. NI-MAX).

3. ADXL335 (3-axis Accelerometer)

ADXL335 is one type of 3-axis accelerometer which is small in size and low power consuming device. Totally it has 16 pins, whereas Pins 8, 10, 12 represents Zout, Yout, and Xout respectively. It can able to measure acceleration with minimum full scale range up to ±3g.Using ADXL335 we can measure both static acceleration and dynamic acceleration that results in vibration.

Technical Details: ADXL335

Capable of sensing 3-axis

Good temperature stability

Low Power consumption: 350µA

Supply voltage: 1.8V-3.3V

It has 3 axis namely X, Y and Based on these axis, the accelerometer is calibrated with use of Arduino. Because of these 3-axis the robot movement is controlled. For example if the robot is stop condition X-axis value is considered. Similarly for other directions like forward, reverse, left and

right considered any one the axis. The ADXL 335.
figure 3(a) shows that schematic layout of

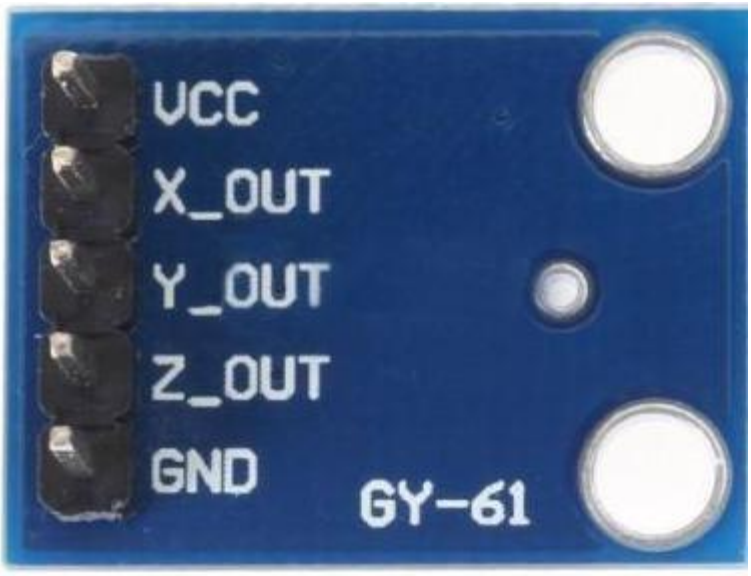

Figure 3(a). ADXL335

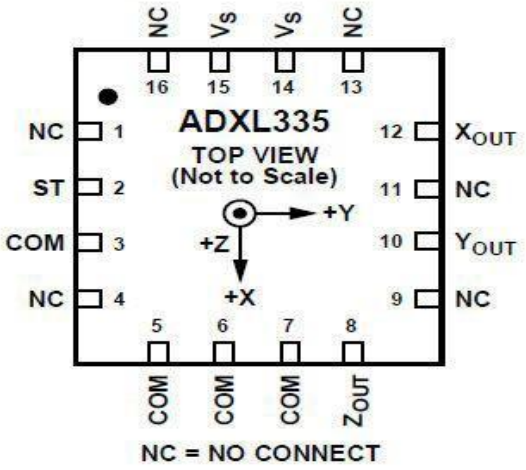

Figure 3(b) Schematic Layout of ADXL335

IV. SOFTWARE PLATFORMS

1. Arduino

In this article Arduino plays a very important role. Here Arduino is used to transmit the accelerometer value. Based on tilting of accelerometer (ie.ADXL335) it shows different values for different directions. Using these values the robot can be controlled in several directions like forward, reverse, left, right and stop. To connect ADXL 335 with Arduino follows these connections:

VCC-3.3V

GND-GND

X_OUT-A0

Y_OUT-A1

Z_OUT-A2

Table 1. Accelerometer Values for X, Y and Z axis

Motion/Axis	X-axis	Y-axis	Z-axis
Stop	-	-	320-300
Forward	-	450-400	-
Reverse	-	310-280	-
Left	310-290	-	-
Right	450-440	-	-

2. NI-LabVIEW

After calibrating accelerometer values in Arduinoplatform, movement of robot is depends on LabVIEW. In this script Arduino is interfaced with LabVIEW with the help of Virtual Instrumentation Package Manager (VIPM).This is useful for interfacing other software platform with LabVIEW. Accelerometer value is read in Arduino and write in LabVIEW by using the tool VIPM.Based on the value the robot movement is controlled. The serial read data is in the form of string.

Here myRIO is configured with wireless with help of NI-MAX .Because it is useful for surveillance purpose. After configuring with wireless network connect myRIO with that wireless network. In my case the wireless network name is gesture. After connecting it we can communicate much better.

3.VI Package Manager (VIPM)

It is the method to download and manage LabVIEW add-ons and use for instant access. It uses and distributing LabVIEW add-on simple. By using this we can manage and share VIs .It is one of the package manager handles many versions of LabVIEW and also works on Windows, Mac and Linux OS.

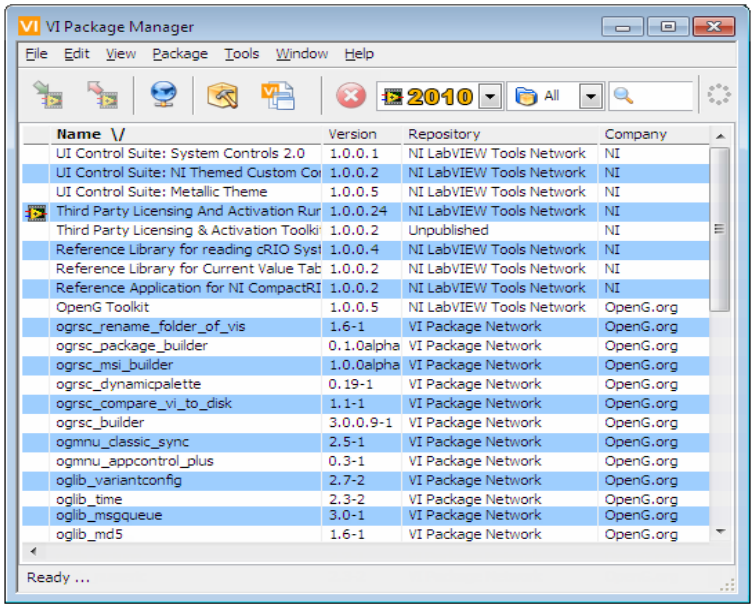

Figure 4. VIPM Add-ons

V. LabVIEW Implementation

In LabVIEW they have 3 main parts i) Front panel ii) Block Diagram iii) Icon and Connector Pane. The front panel which is used for purpose of displaying and controlling functions whereas block diagram has functions block is used for development of programs. Icon and Connector is used for connecting a VI with other VIs and SubVIs.

It is one of the window in LabVIEW which is used to indicate the input and output values. In this paper front panel consists waveform chart. Waveform chart is used for graphical representation of X, Y and Z values. The digital display is also provided in the front panel. The main important in front panel is that Arduino-LabVIEW serial data read/write that shown below Figure 5

1. Front Panel

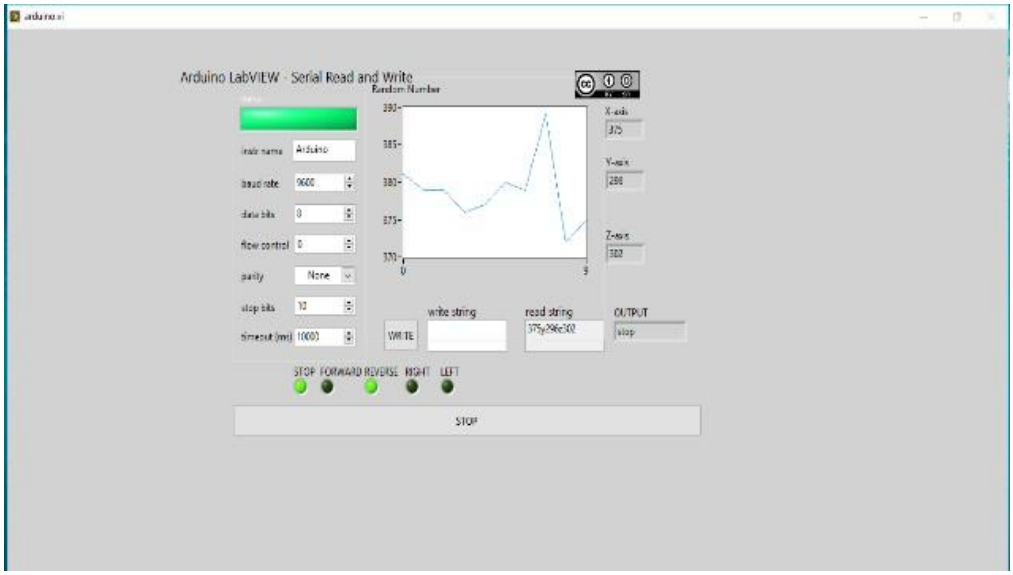

Figure 5 Arduino-LabVIEW serial Read Write

2. Block Diagram

In LabVIEW block diagram is used for the building of VI. In this article it has interfaced with VISA resource name (i.e. Arduino).By using this LabVIEW and Arduino is communicated. Also block diagram consists of calibrated values and corresponding axis for each directions. For example we consider stop condition as X-axis value .By using X-axis value it works. The values are shared through shared variable. Shared variable is that at that instant the values is shared by two VIs. Because of shared variable the motor is act by corresponding directions by the user.

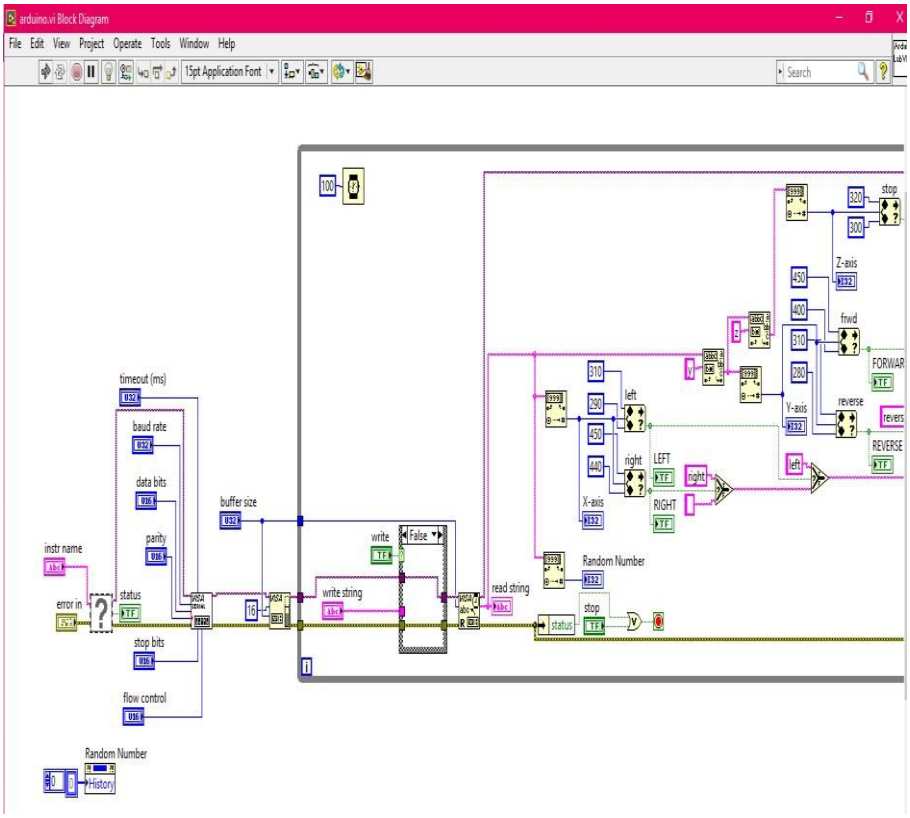

Figure 6.Block Diagram

VI. RESULT AND CONCLUSION

The Figure 7 shows that simulation result for forward diection.When the user gives forward motion in the ADXL335, the robot moves in the forward direction. If the forward motion means the output 0, output 2, output 3 will indicated in boolen. Normally it works on Boolean conditions. Based on our human hand gesture motion the robot is controlled in various directions. It can be used in small applications like picking an object and place in a locations, surveillance etc.

Table 1.Different Status

CONDITION/STATUS	OUTPUT 0	OUTPUT 1	OUTPUT 2	OUTPUT 3
STOP	0	0	0	0
FORWARD	1	0	1	1
BACKWARD	0	1	1	1
LEFT	1	0	1	0
RIGHT	1	0	0	1

Figure 7.Simulation Result

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