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Hand Gesture Controlled Robot Using Lab view

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Abstract

This research article is about controlling a robot wirelessly with the help of hand gestures through the latest real-time environment software tool i.e. Lab VIEW. A robot is simply a machine that can carry a complex series of actions automatically with or without human intervention. Range in wireless communication is not only higher but it also has a high life expectancy. A wireless robot can be controlled through a remote controller. But instead of carrying a remote, hand gesture can be used to control a robot. The movement of hands can move a wireless robot in any desired direction. To make all this happen one needs to know is programming. Without a programming hand gesture controlled robot cannot be built. But lab VIEW software uses a circuit diagram instead of programming to build and control a robot. It is a very simple software that uses graphical language instead of a programming language such as python, java etc. A person only has to draw a circuit in this software. It provides high accuracy and high efficiency. It makes the process of building a robot very easy and less time-consuming

Keywords: *LabVIEW, Hand Gesture, MyRIO, semi-Autonomous Robot.*

I. INTRODUCTION

For many people a robot is a machine that has the ability to imitate the actions of almost every living being. They are like cyborgs in movies like Real steel, Terminator and Star-wars. However these kinds of the robot can only exist in sci-fi movies, they cannot perform that much accurately because of the limits in today's technology. The types of robots that are encountered most often are robots that do work which are risky, repetitive, troublesome, or burdensome. These robots can be found in the auto, medical, manufacturing and space industries.

A Robot can be defined as a mechanical system that contains hardware components like control systems, power supplies, sensors, manipulators and programming language like C, C++, java i.e. software all working together to perform a specific task. Scheming, constructing, coding and checking or verifying, the robot is a combination of all the methods and concepts that are applied in mechanical, electrical and structural engineering. The subjects like mathematics computing, biology and chemistry might also be involved. To build a proper robot a person should know the basics of all the above subjects. The essential characteristics of a robot are Sensing, Movement, Energy and Intelligence. Mainly Robots are classified as Autonomous robots and Semi-autonomous robots. An autonomous robot performs particular behavior or task without external influence i.e. human controlling. It has its own intelligence. A Semi-autonomous robot is controlled by humans. It doesn't have its own artificial intelligence.

A robot can be controlled by humans through 2 different ways Wired communication and Wireless

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communication. Wire communication is not used in many applications due to lack of mobility, expensive and time-consuming. These limitations are not in wireless communication. Wireless Communication systems use open space as the medium for transmitting signals. Because of this, there is a huge chance that radio signals from one wireless communication system or network might interfere with other signals. One of the main concerns of wireless communication is the Security of the data. Since the signals are transmitted in open space, it is possible that an intruder can obstruct the signals and replicate sensitive information. Continuous vulnerability to any type of radiation can be dangerous. Even though the levels of RF energy that can cause the damage are not accurately confirmed, it is advised to keep away as much as possible from RF radiation. Robots can be classified into two types: Automatic robots are used to sense line or edge and remote-controlled types, gesture is used to control entire robot. Undoubtedly, robot functioning and output are more useful when these are communicate with human gesture. A "Gesture" is type of communication to the machine like non-verbal communication to the person's. This type of communication shows in two ways. Machine can understand human actions by image processing or hand movement. In order to control a robot a control system is needed. Some of the most commonly used control systems are touch-controlled, motion-controlled and voice recognition. One of most commonly implemented technique is hand gesture which controlled the robot. Instead of using a typical radio circuit controller with buttons or a joystick, the gestures of the hand movements are typically used to control the robot movement. Gesture recognition features: High accuracy, less time delay and more stability to control a device. Hand Gesture recognition applications are shown in below fig.1.

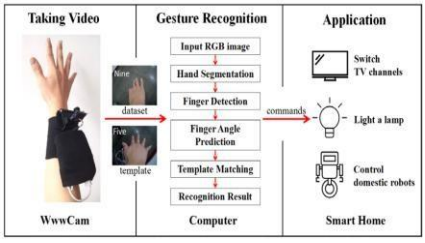

Fig 1. Hand Gesture recognition applications

II. LITERATURE OVERVIEW COMPONENTS

Wireless robot technology is mainly used for building control and data acquisition. A semi-autonomous robot can establish wireless communication with the help of remote control. The aim of this system is to build a wireless robot using Arduino which can detect hurdles, chemicals and flames and the robot can be controlled by a remote controller through the RF module. The detected information can pass through RF to the operator and will brighten a LED [1]. To receive radio signals an antenna must be used for transmitting and receiving data [2]. Accelerometer is fixed on hand, when had movement occur which change the accelerometer position, this accelerometer position generate a command signal to the receiver robot [3]. Robots are built in such a way so that they can perform tasks which cannot do by humans. In rescue operations these types of robots are used because these are followed human instructions [4]. Gesture technology can be studied in many fields and technologies also. Many types of mathematical equations are derived for simple hand and face movements. These are mainly used in automotive automobile sector, Electronics controlled sector, gaming sector and unlock Smartphone [5]. The robot can move in any direction and even make 360^0 rotation. The logic given by the sensor will be accepted by the receiver, due to this required movement occurs in robot [6]. With the help of the vision assistant in LabVIEW many real-time image, data and digital signal are processed [7]. Radio frequency links are used to control the driving system in cars [8]. The LabVIEW software from National Instruments is used to develop a virtual plant laboratory, in which the mathematical model of a system is implemented through transfer functions, discretization and recurrence relation. The results of the project reflect that LabVIEW Arduino is a viable and reliable tool for the implementation of virtual plants for laboratory practices from linear mathematical models, offering the possibility to

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implement a large number of virtual applications for the development of practical with external control hardware [9].

III. PROPOSED SYSTEM

In order to control a robot a control system is needed. Voice identification, motion-controlled and touch-controlled are commonly used system in real time control systems. One of the most regularly used motion-controlled robots is a Hand Gesture Controlled Robot. Basic block diagram of proposed robot system using LabVIEW shown in fig.2.

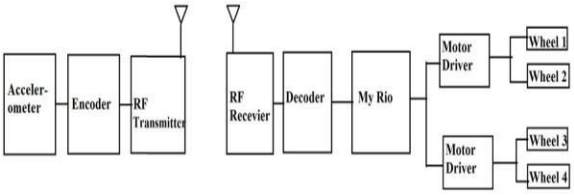

Fig 2. Block Diagram of proposed robot systemusing Lab VIEW

IV. COMPONENTS DESCRIPTION

Accelerometer, Encoder, Decoder, RF 433 Transmitter and Receiver Module, Voltage Motor Driver and MyRIO Tool are the major components of gesture-controlled systems.

A. Accelerometer

ADXL335 is a type of accelerometer sensor provides analog signal data while tilting in X, Y and Z direction. This position values are depends on used sensor in meter. This accelerometer pin diagram is shown in fig.3. ADXL335 gives ±3g range of measurement. The types of sensors have capability of measure gravitational force for statically acceleration. By shock or vibration these meters gives dynamic acceleration.

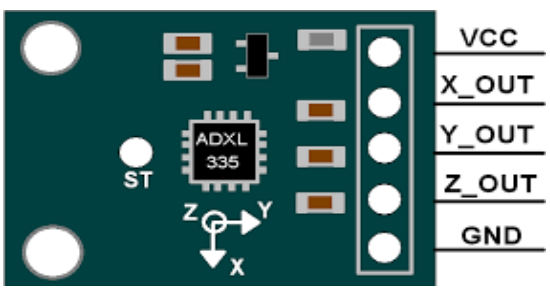

Fig 3. Accelerometer ADXL335

B. Encoder and Decoder

HT12E is a series encoder. It can encode 12 parallel bit data into serial bits. This is operated for 433MHz RF signal. It has a total of 18 pins and the 17th pin is connected to the pin data of the transmitter module. It will work on a 5V power supply to which 18 number pin is connected. HT12E can convert 12 bit parallel data into a serial output that can be transmitted with the help of an RF transmitter. This 12-bit input parallel data is divided into 4 data bits and 8 address bits. The encoder and decoder pin diagram is shown in fig.4.

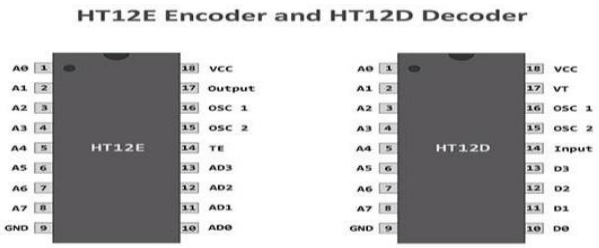

Fig 4. Encoder HT12E and Decoder HT12D

8-bit security code can be provided by using 8 address bits for 4-bit data and which can further be used to multiple address receivers by using the same transmitter. It is commonly used in radio frequency (RF) wireless applications.

C. RF 433 Transmitter and Receiver Module

An RF transmitter module is built on PCB and is being capable of transmitting data through radio waves and modulating that same wave to carry data. The RF433 transmitter and receiver modules pin diagram is shown in fig.5. Transmitter modules are attached with a microcontroller that provides data to the module which can be transmitted. Two types of RF receivers are used. First one is super heterodyne receivers and super-regenerative receivers. Super regenerative modules are designed for power purpose. Cost of this also less. It is used for received modulated data from carrier signal. Super heterodyne receivers are better than super-regenerative in terms

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of performance like accuracy and stability for higher temperature and power ranges.

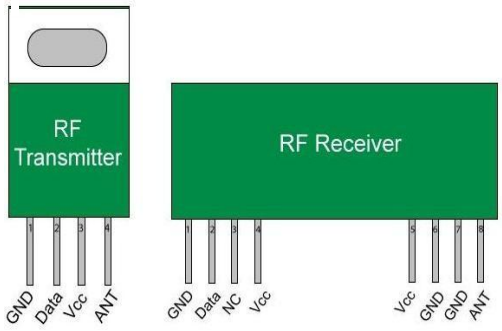

Fig 5. RF 433 Transmitters and Receiver

D. *Voltage Motor Driver*

L298N is dual H shaped Bridge motor driver controller. This IC runs two DC motors with same speed and direction at a time. The voltage motor driver diagram is shown in fig.6. These IC controllers' maximum voltages 5 to 35V with 2A as maximum current. The module has two screw blocks for the two DC motors, and another screw block for the Ground pin, the VCC for motor and another screw is a 5V pin which can either be an input or output which will depend on the voltage used at the two DC motors VCC. The modules consist of an onboard 5V regulator which can be either enabled or disabled using a small jumper. If the two DC motor supply voltage is 12V then we can enable the 5V regulator and make use of 5V pin as an output, for example for the input supply of any microcontroller. If the motor voltage is higher than 12V we must disable the jumper because to avoid cause damage to the onboard 5V regulator. When we disable the jumper, the 5V pin will be used as inputs and it should be connected to a 5V power supply in order to work IC properly.

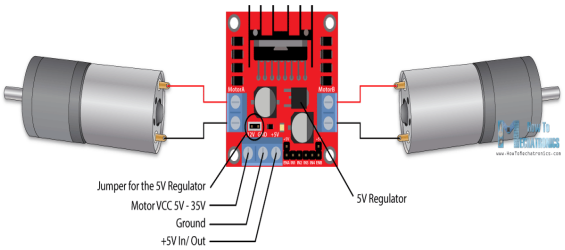

Fig 6. L298N Motor Driver

E. *MyRIO Tool*

MyRIO is a sort of microcontroller manufactured by National Instrument (NI) Company. That's the reason it is sometimes known as NI MyRIO. The MyRIO toolbox pin diagram shown in fig.7.We'll first understand what actually MyRio is. First of all what is RIO. RIO abbreviated from Re-configurable Input/output.

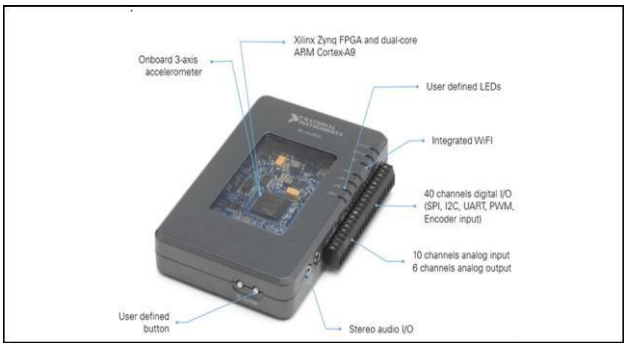

Fig 7. MyRIO Tool.

F. *LabVIEW Software*

LabVIEW stands for Laboratory Virtual Instrument Engineering Workbench, which is a software programming flat form in which we can write a program using a graphical way. It is a interactive type program for development of execution system designed mostly for people like scientists and engineers, who work in the program as part of their jobs. This software provides, improving the environment which works on computers running software like Windows, Mac OS X, Linux or any other platforms like Field Programmable Gate Arrays (FPGAs), Digital Signal Processors (DSPs), and microprocessors. This software is a very powerful graphical programming language. LabVIEW can increase our productivity by orders of magnitude. conventional programming languages that take weeks or months to write can be completed in hours using Lab VIEW because it is specifically designed to take analyze data, measurements, and present results. And because Lab VIEW has such a versatile graphical user interface that makes it so easy to program, it also works like ideal for presentation of ideas, simulations, teaching basic programming concepts and general programming. Lab VIEW offers more flexibility and

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reliability than standard laboratory instruments because it is a software-based tool. People, who are not the instrument manufacturer, can define instrument functionality. Our computer, hardware, and Lab VIEW tool comprise a completely configurable virtual instrument to complete our tasks. Using the Lab VIEW, we can create exactly what we need, when we need it, at a fraction of the cost of traditional instruments. When our needs change, in moments we can modify your virtual instrument. Lab VIEW tries to make our life as hassle-free. It has extensive libraries of functions and subroutines to help us with our programming tasks, without using any kind of pointers, memory allocation, and other arcane programming problems found in conventional programming languages. Lab VIEW also contains application-specific libraries of code for General Purpose Interface Bus (GPIB), data acquisition (DAQ), and serial instrument control, data presentation, data analysis, data storage, and communication over the Internet. The Analysis Library contains a multitude of useful functions, including signal processing, signal generation; statistics, filters, windows, linear algebra, regression, and array arithmetic. Because of Lab View's graphical nature, it is constitutionally a data presentation set. Output can appear in our required format. Graphs, Charts and user-defined graphics are available to output options. Lab View's programs are compactable platforms, so that we can write and then run it on a Windows machine without changing anything. You can find Lab VIEW applications improving its operations in N number of industries, engineering and many others.

V. METHODOLOGY

Developments of this program, the connection of all the components are explained step by step in below.

- Open Lab VIEW 2018 software. Give power supply to MyRIO and connect MyRIO to PC through Wi-Fi.
- Create a new project in MyRIO software. Two windows will appear i.e. Front panel and Block diagram panel.
- Build a circuit by using the front panel and get the output using both the front panel and block diagram panel.
- To make a circuit diagram of "Hand Gesture Controlled Robot" first right click on the front panel. Click on numeric and select numeric control. In the same way create 4 controls and drag them in the front panel.
- Numeric control is used to set threshold i.e. the minimum value above which an operation can execute.
- Now open block diagram panel, click right and select MyRIO. After that select Analog input and drag it to the diagram panel. Take two Analog inputs in the same panel.
- Analog input is used to get the information from the decoder. This information can be position (x, y) in the form of analog signals.
- Now from structures select case structures and create four case structures and drop them to block diagram panel.
- Case structure is generally a loop used to execute operations in the desired number of ways.
- Now inside case structure drop 8 digital outputs in each case that is taken from MyRIO options.
- Create bot movement logic for motor i.e. left, right, front and back movements.
- Compare the input analog signals with threshold values and give input to the four case structures.
- All these circuits should be placed inside while loop box. While the loop box can be found in the structure.
- Finally create a stop indicator by right-clicking on the while loop stop button and also create a delay by selecting time option.

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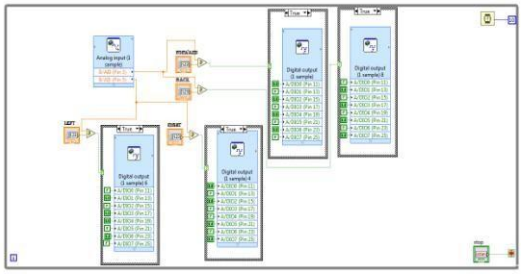

Fig 8. Circuit diagram of hand gesture controlled the robot

VI. RESULT AND DISCUSSION

The below picture is the Radio controlled car which is being programmed to move wirelessly where ever the user desires. The user controls the RC vehicle with the help of hand gestures. It means that if the user moves his hand in any direction then RC vehicle will move in that particular direction.

Fig 9. Radio Controlled Vehicle.

Lab VIEW is a tool that is playing a major role here by using graphical programming instead of other microcontrollers. Here Lab VIEW is replacing Arduino and other microcontrollers that required complex programming. Fig.10 and fig.11 are showing the results of the accelerometer in the form of an analog signal. Through the accelerometer sensor the directions of RC vehicle can be changed. The following figures are showing different voltage levels for different hand movements. According to those voltages we can set the threshold values.

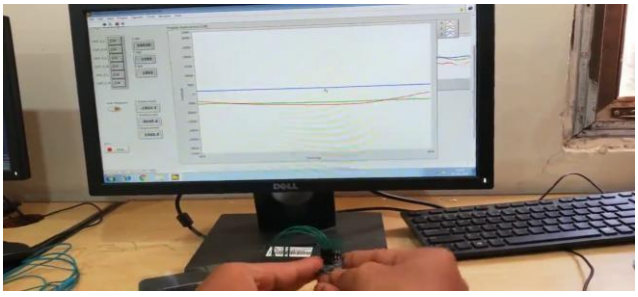

Fig 10. To move backward i.e. Y-axis

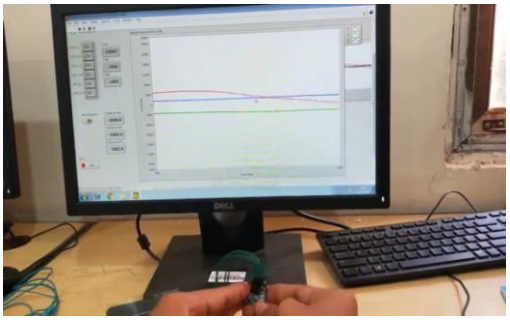

Fig 11. To move Forward i.e. Y-axis

VII. CONCLUSION

In this article hand gesture controlled robot is designed for semi-auto controlled machines. To design this type of robot user-friendly environment is most prefer. So LabVIEW provides this type of environment. Lab VIEW software tool provides high speed and less delay. It can easily perform on multiple platforms and can do multitasking. Once the code is generated it can run multiple times as the user desires It can make a connection between at least twelve channels which can be connected by twelve users and can run the operation simultaneously. This type of system is extended to implement in drones to deliver emergency medications to people living in rural areas. Hand gesture RC controlled drones which can also be used for wildlife photographers in the jungle. This concept can be used in moving heavy things in large scale industries. It can be used in the military to move Vehicles such as trucks and helicopters without any human intervention.

VIII. REFERENCES

[1] Chirag Jain, Reema Kadechkar, Sachin Chaturvedi, Susmita Pradhan, "Wireless controlled a robot using Arduino and RF module", International Journal of Technical Research and Applications e-ISSN: 2320-8163, Special Issue 39 (KCCEMSR), PP.24-26, March, 2016.

[2] Fahmida Ahmed, Shakh Md. Alimuzjaman Alim, Md. Shafiqul Islam, Kanti Bhusan Roy Kawshik, Shafiqul Islam, "433 MHz (Wireless RF) Communication between Two Arduino UNO", AJER, e-ISSN: 2320-0847, Volume-5, Issue-10, pp-358-362, 2016.

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ISSN: 0193 - 4120 Page No. 11432 - 11438

[3] Aquib Javed Khan, "Introduction to Wireless Gesture Controlled Robot", January, 2015.
[4] SwarnaPrabha Jena, Sworaj Kumar Nayak, Saroj Kumar Sahoo, Sibu Ranjan Sahoo, Saraswata Dash, Sunil Kumar Sahoo, "Accelerometer based gesture controlled robot using Arduino", ISRA, ISSN: 2277-9655, April, 2015.
[5] Chirag S. Budheliya, Rajesh K. Solanki, Harsh D. Acharya, Prashant P. Thanki, Jay dip K. Ravia, "Accelerometer-based gesture-controlled a robot with robotic arm", IJIRST, Volume 3, Issue 10, ISSN: 2349-6010, March, 2017.
[6] Rahul Ranjan Singh, Deepak Rasaily, Rishu Kumar, "Wireless controlled robot movement system designed using microcontroller", IJETT, Volume 32, Number 5, February, 2016.
[7] R. Gopalakrishnan, S. Abirami, P. Sathiya, "Gesture controlled a robot using Lab VIEW", International journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 5, May, 2016.
[8] Keshav Jha, Sai Phanindra Dinesh Kakarlamudi," Design and fabrication of radio controlled car", IJMET, Volume 6, Issue 8, Aug 2015.
[9] L. C. Meneses Silva, Walter S. Díaz, Bryan A. Pardo, David Herrera, "Virtual laboratory in Lab VIEW for control and supervision applications with Arduino", IJAER, ISSN 0973-4562 Volume 13, Number 23, 2018.
[10] Leo Louis," Working principle of Arduino and using it as a tool for study and research", IJCACS, Vol.1, No.2, and April 2016.
[11] Raghuraman Gopalan and B. Dariush, "Toward a vision-based hand gesture interface for robotic grasping", IEEE/RSJ, October, 2019.
[12] R.Gopalakrishnan, S. Abirami, P. Sathiya, "Controlling Robot using lab VIEW", IJIREEICE, Vol.4, Issue 5, ISSN 2321-2004, May 2016.
[13] Wu. Y, huang, T.vision, "Based gesture recognition" A review in: the 3rd gesture workshop, 1999.