ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 2, February 2018

A Review Paper on Guidance Navigation and Obstacle Avoidance for Wheeled Mobile Robot Using Lab VIEW

[1] Priyanka Bhanudas Aghadate, [2]Aarti Wadhekar
[2] Assistant Professor, [1][2] DIEMS Aurangabad.

Abstract: **-- This project represents the system to navigate the vehicle with an ultrasonic sensor and National Instrument myRIO real time controller. The previously developed navigation system was developed using MATLAB based model running on a minicomputer that interface with encoders and motors through specialty control board. This embedded hardware device use for real-time implementation performing the task like detecting obstacle distance using the sensor. LabVIEW is graphical programming code was specially developed to control motor with PWM signal based on sensor feedback and to calculate algoritham perfectly. It has a wide range of applications areas which comprises Agricultuaral monitoring, Military applications. Based on this the LabVIEW and the myRIO solution is found to be user-friendly and very effective for the purpose of real-time implementation of GNC algorithm. This project also develops efficiency in navigation.**

Keywords— NI myRIO, Lab VIEW, Navigation, Path planning, Obstacle avoidance.

I. INTRODUCTION

This system designed and implements the guidance navigation system for a four wheeled mobile robot with ultrasonic sonar sensors and a National Instruments myRIO realtime controller. For controlling the motors LabVIEW code was developed with PWM signals based On sensors feedback. Previously developed navigation system has two electric motor driving the tracks on each side. Also it has two encoders for providing speed to the drive wheels. The Guidance Navigation for ground vehicle benifits increasing importance in various growing application areas.The specific focus of this research is on use of LabVIEW to create GNC (Guidance Navigation & Control) algorithm and use of MYRIO board to run the labview flow diagram real time on ground vehicle. This embedded hardware device use for real time implementation like performing task like detecting obstacle distance using sensor detecting obstacle distance using sensor. The platform used for designing the GNC algorithm should be userfriendly and have faster real time data collection and interpretation so that the system is faster and quicker in generating response. The main motivation of this research effort is to investigate and experiments alternative programming and hardware development environments for the real time implementation of the system. The vehicle systems and their application range has been expanding over the years.This is also designed in the manner that it can be monitored anywhere through internet.This system can be implemented for further use as we can also update this robot to work as a vehicle which carries load in industries, laboratories and factories. It can also be used physically by disabled populace, where they will be proficient to control the movement of the vehicle with just their hand gestures without others assistance.

II. SYSTEM DEVELOPMENT

This project investigates the use of the NI myRIO/LabVIEW platform for Guidance Navigation of vehicles. The requirements of the components will form the basis of the desired project outcome. The robot is mainly contains of three major parts for development software algorithm and architecture design, vision system design, and hardware system design.The project would require basic electrical knowledge, mechanical knowledge and software programming to build the required robot. The key robotics application focus areas are

- Obstacle avoidance
- Object handling
- Navigation

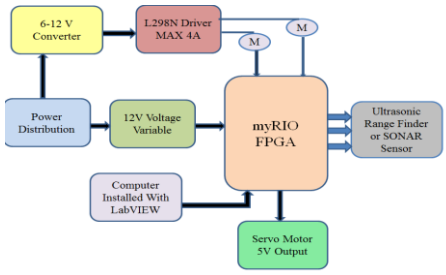


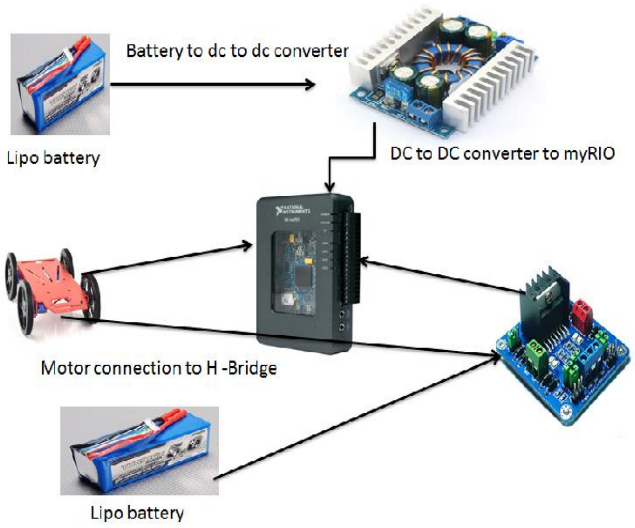
Fig 2.1 Block Diagram

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 2, February 2018

III. WORKING

Figure below shows the electrical diagram of the entire system.It includes two LiPo batteries to power the vehicle's motors and one LiPo battery with DC to DC convertor to power the myRIO. A myRIO board is used for real time implementation of the GNC algorithm through LabVIEW. The vehicle's motors are connected to myRIO through an H Bridge. The encoders are connected directly to the myRIO for data acquisition.



Electrical Diagram of the Whole System

IV. HARDWARE SPECIFICATIONS

For driving the UGV with myRIO, communication with sensors and actuators should be established, specifically with electric motors and encoders in this project.As the first step, myRIO connection is established with various components available from NI as the mechatronics kit. This is done to familiarize with the procedure on the LabVIEW side and the hardware side to read from sensors and control actuators.
The following describes these attempts.

A] Servo motor

A servo motor is a rotary actuator which allows control of angular position, velocity and acceleration of a rotating shaft. It includes a DC motor,gearbox potentiometer and a controller. The servo motor requires 5V power supply and a single PWM signal which is connected to the myRIO.

B] IR Range Finder

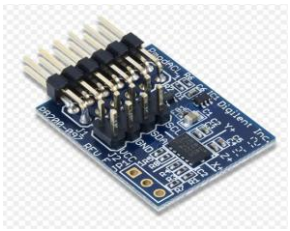
An Infra-red Range Finder is a sensor that uses a beam of reacted infrared light to sense the distance between the reacted surface and the sensor by the process of triangulation.

C] Sonic Range Finder

Sonic Range Finder, also known as the sonar, is a small range finder. It provides accurate reading of obstacles upto 6m distance.

D] Accelerometer

Accelerometer is an instrument that measures the acceleration of a vehicle, aircraft or ship. The accelerometer in the mechatronics kit has I2C bus communication with myRIO.

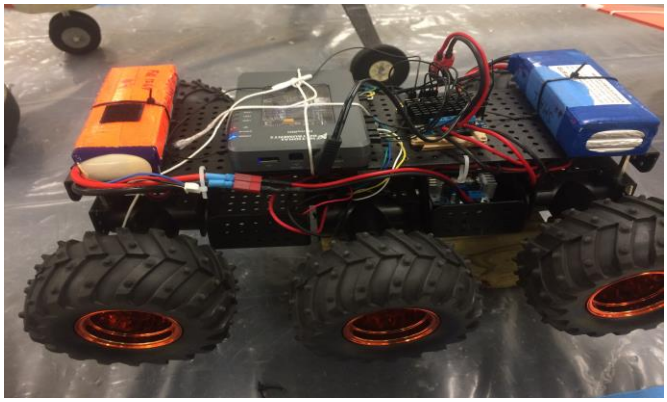


E] Vehicle Platform

This system requires all four wheeled robot chassis.

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 5, Issue 2, February 2018



Implementation of the System

V. SOFTWARE SPECIFICATION

A] LabVIEW

LabVIEW (short for Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a visual programming language from National Instruments. LabVIEW is a design platform or a environment as a visual programming language from National Instruments.It is a graphical design platform wherein users can create a flow diagram to perform any type of mathematical,control system,measurement and data acquisition operation.It is compatible with various embedded system devices like CompactRIO, myRIO,Robotics module for real time hardware implementation LabVIEW has many inbuilt modules which has blocks for design,analysis and visualization of data.The GNC algorithm can be implemented in LabVIEW with various user friendly blocks that can be used for programming any mathematical and logical expression.Some uses of LabVIEW are listed as :

1. Instrument Control
2. Automation Industry
3. Data Acquisition
4. Embedded Control systems

B] myRIO

NI myRIO is a portable embedded hardware device that uses LabVIEW to allow the real time implementation of guidance, navigation and control algorithms, and to enable the interfacing the algorithms with actual sensors and actuators.myRIO board has onboard accelerometer, LED, push button and WiFi for wireless connection. The myRIO device will act as the processing unit for the robot which needs to handle the majority of processing on the robot as required by the competition rules. Its interfaces include two sets of Expansion Ports (MXP) and a Mini System Port (MSP) which contain an analog input channels, six analog output channels and forty digital I/O channels as well as audio and power output. It can connect to a host computer via USB or wireless 802.11bgn which is very convenient as it can be programmed and controlled wirelessly.

VI. RESULT

The Guidance Navigation and Obstacle avoidance system implemented using myRIO & LabVIEW 2017.The Purpose of using this software is to develop real time application. LabVIEW and myRIO solution is found to be user friendly and very effective for the purpose of real time implementation of this algorithm.

VII. CONCLUSION

LabVIEW was adequate to build a block diagram representation of a GNC (Guidance, Navigation, and Control), originally developed in MATLAB/Simulink for a Ground Vehicle based on encoder readings and PWM (Pulse Width Modulation) signals controlling the speed of the electric motors driving the wheels. For the development and testing of this GNC algorithm in simulation before hardware implementation, a model of the mobile platform of the vehicle is also developed in LabVIEW.These two components were successfully used in simulating the closed-loop system. The real-time implementation of the GNC algorithm was successfully achieved using myRIO as the computing platform. This is successfully used for way point navigation of a skid-steered Ground Vehicle.The LabVIEW implementation easily follow Simulink implementation

except a few cases where LabVIEW does not have specific blocks and the equivalent blocks worked slightly differently. One of the main differences in implementations in LabVIEW and Simulink is the hierarchical structure that can be set up in Simulink using "subsystem" blocks while the whole GNC algorithm was put in one single level within a "control and simulation loop" in LabVIEW. Overall, LabVIEW was as easy as Simulink in building the block diagrams while LabVIEW has a clear advantage in terms of the graphical user interface it provides in the form of a "front panel". Further, it was seamless in running a LabVIEW algorithm in real time using myRIO as the computing platform and it was very easy to interface with the sensor and actuator.

ACKNOWLEDGEMENT

The authors wish to thank Dr. Ulhas Shiurkar, Director of the DIEMS, Aurangabad for technical support regarding the wireless sensors. The Authors are thankful to Dr. Rajesh Autee, HOD Department of Electronics and Telecommunication Engineering and Assistant Prof.Arti Wadhekar, DIEMS, Aurangabad for their guidance.

REFERRENCES

[1] Nacer Hacene, "Autonomas Navigation &Obstacle avoidance for wheeled mobile robot"International Journal of computer application,vol 81-N07,Nov 2011.

[2] Dhanasingarrajar,Kalaimagals,Muralidharan G“Autonomas vehicle navigation & Mapping system” International Journal of Innovative Engineering & technology,vol 3,special issue,march 2014.

[3] Chihjer Lin,Yen lin,Chen ,Shen kai yu “Path planning of mobile robot using real coded genetic algoritham based simulataneous Expolration”Second International Conference On Advance in computer science &Engineering CSE 2013.

[4] Leonimer Flavio demelo,Almiro franco “ Mobile robot indoor Autonomas Navigation with positon estimation using RF signal triangulation”Positioning 2013,published online February 2013.

[5] C.H.Umasankar,A S Surendra,M.Niharika“Gesture Controlled Robot using LabVIEW”IJRTI Vol 2,issue 6,ISSN 2456-3315.

[6] Bharathi G,Phanindra Reddy “Design & development of an intelligent path finding,survilance automated guided vehicle using NI MYRIO” International Journal Of Research in Engineering & Technology ISSN 2319-1103.

[7] A. Dogan, Unmanned vehicle system course notes," In Modeling Simulation of UGV with Simulink, GNC UGV, Parameter Estimate, August 2015.

[8] Joseph Campion,Future unmanned system design for reliable military operations," September 2012.

[9] P. Bhattacharya and M. L.Gavrilova “Global navigation problem for Global approaches”

[10] C.R.Gavhane,Unmanned ground vehicle," In Unmanned Ground Vehicle, Aug 2013.

[11] LabVIEW National Instruments,"Information about inbuilt modules in the software”[12] Getting Started national instruments," labview-basics specification of NI MYRIO”.

[13] E. Doering, Project guide," in NI myRIO Project Essentials Guide, April 2014.

[14] Ramirez cortes J M,Martinez Carbalido J “Tranigulation Alv based navigation system using robot vision and fuzzy control” Ingenieria Investigation technology,vol 12,Num 2011.

[14] M. H. Kim, Labview GNC," In Development of Guidance, Navigation and Control System Software for Autonomous Unmanned Vehicle Based on LabVIEW, June 2015.

[15]UGV Military Application," LabVIEW basics/environment”