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Labview Based Surveillance Rover in Military Applications

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ABSTRACT:With the reference of NASA's MARS Curiosity Rover, this project is meant for a low cost, lightweight and small size unmanned ground vehicle (UGV) which is controlled by NI-myRIO a hardware component of National Instruments can be used for surveying and determining the natural conditions for the place. This motors which are to be connected with the help of NI-myRIO through NI-LabVIEW software. NI-myRIO with Analog and Digital signal Ports. The myRIO provide the necessary voltage and current to give a minimum/high voltage dc or ac circuit.Unmanned Guided Vehicles (UGV) is emerging technology in current situation. UGV is used as advanced technology to help in the process of automations such as monitoring purpose and military applications.The rover provides the image of the place by wireless camera. The gas sensor used to detect the gas in particular place.

KEYWORDS*:* Rover, Camera, Lab View, Gas Sensor, myRIO

I.INTRODUCTION

A rover is an unmanned ground vehicle that can explore surface of various hazardous places like deserts, hill stations and snow lands .Abbreviation of rover is remotely operated video enhanced receiver. They usually happening at the planetary surface on a launder-style rover used to find out information by collecting dust, rocks and take pictures. Rover withstands varieties of acceleration, any temperatures, pressure, dust, corrosion, cosmic rays, remaining functional without repair for some period of time.

The Chang'e-3 (CE-3) lander and rover mission to the Moon was an intermediate step in China's lunar exploration program, which will be followed by a sample return mission. The lander was equipped with a number of remote-sensing instruments including a pair of cameras (Landing Camera and Terrain Camera) for recording the landing process and surveying terrain, an extreme ultraviolet camera for monitoring activities in the Earth's plasmasphere, and a first-ever Moon-based ultraviolet telescope for astronomical observations. The Yutu rover successfully carried out close-up observations with the Panoramic Camera, mineralogical investigations with the VIS-NIR imaging spectrometer, study of elemental abundances with the active particle-induced X-ray spectrometer, and pioneering measurements of the Lunar Subsurface with Lunar Penetrating Radar. This special issue provides a collection of key information on the instrumental designs, calibration methods and data processing procedures used by these experiments with a perspective of facilitating further analyses of scientific data from CE-3 in preparation for future missions [1].

Future NASSA planetary missions require batteries that can operate at maximum temperature, long distance travel. The aerospace rechargeable battery systems, such as Ni-Cd, Ni-H, and Ag-Zn, are small in size and distance coverage is high. Lithium rechargeable battery is used in rover. The 2003 Mars Exploration Rover mission plans to deploy twin rovers onto Mars, with the objectives of understanding its geology, climate conditions and possibility of life on Mars. The spacecraft contain various batteries, i.e., primary batteries on the lander, thermal batteries on the back shell and rechargeable batteries on the Rovers. Significant among them are the Li ion rechargeable batteries, which are being utilized for the first time in a major NASA mission. The selection of the Li ion battery has been dictated by various factors, including mass and volume constraints, cycle life, and its ability to operate well at sub-zero temperatures down to -30°c, at moderate rates. This paper describes the selection criteria, design and performance of the three battery systems on 2003 MER mission [2].

Automated Guided Vehicles (AGV) is emerging technology in many fields. These vehicles are used as advanced technology to help in the process of automations such as wild animal monitoring, military, mobile transportation and

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underwater exploration. There are various methods of path planning which are Global and Local Path Finding. in this paper GPS connectivity mapping is done with the help of myRIO device and android mobile. Collision avoidance is done with the help of Ultrasonic sensor which is integrated with labVIEW for controlling and feedback operation. The objective of this paper is to design a prototype using myRIO device and labVIEW software that will provide exact location and condition of AGV. Here we are developing an inexpensive, mobile and intelligent AGV prototype that will be interfaced with labVIEW and with the help of a device called as Ni-myRIO [3].

Motors are the necessary machines in the production of Robots and many Automation and Electrical, Electronic and Mechanical devices. This article deals with motors which are to be interfaced with the help of Ni-myRIO through Ni-labVIEW software. Ni-myRIO has inbuilt analog and digital signal ports which provide necessary voltage and current to drive or to give excitation to a medium/high voltage dc or ac circuit. Relay Circuits require 5V signal from Ni-myRIO to provide 12V input for the DC motor. When Ni-myRIO is interfaced with motors and PC installed with LabVIEW 2014, then with the help of PC or a Smartphone one can control the movements of the DC Motor [4]

The recently approved ExoMars rover is the first element of the ESA aurora programmed and is slated deliver the Pasteur exobiology payload to Mars by 2013. The 0.7 kg panoramic camera will provide multispectral stereo images with 65° field-of-view 1.1 milliradian/pixel and high resolution 85 micro rad/pixel monoscopic “zoom” images with 5° field-of-view. The stereo Wide Angle Camera (WAC) is based on beagle 2 stereo camera system heritage. The Panoramic camera instrument is designed to fulfil the digital terrain mapping requirements of the mission as well as providing multispectral geological imaging, colour and stereo panoramic images and water vapour abundance and dust optical depth measurements. It can also be used for high resolution imaging of inaccessible locations on crater walls and to observe retrieved subsurface samples before ingestion into the rest of the Pasteur payload [5]

II.BLOCK DIAGRAM

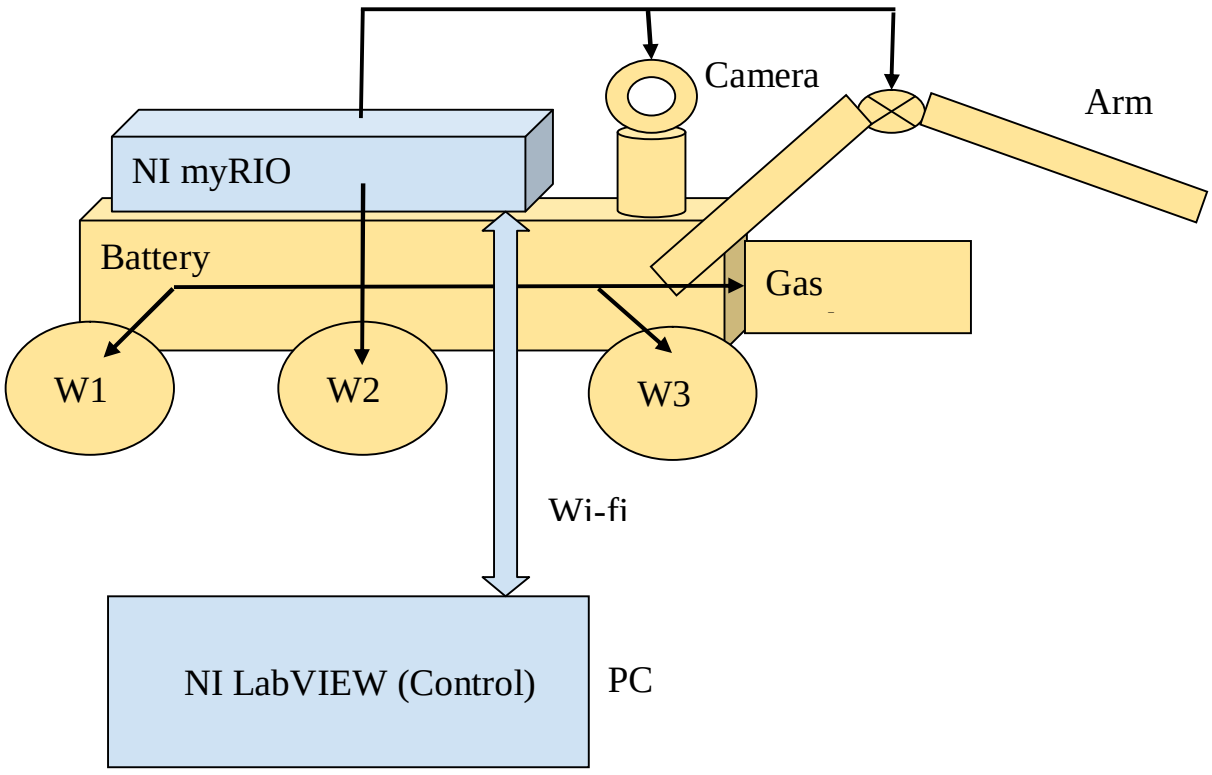

Fig.1 Block diagram of rover

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The Fig 1 shows the block diagram of rover, it consists of 3 modules that are display module, gas sensing module, wheels configuration. Here the NI-myRIO is used as the interfacing component between computer and rover .Since the myRIO get supply through battery. The wheel motors is used for the movement of the rover. Then the driver circuit is available for the movement of motors. The gas sensor MQ-135 is used to detect presence of atmospheric gas for the survival of living things in that place, which will now detect only the presence of CO2 .The image captured from camera will be acquired by personal computer through TV card .This Rover can be switched over between auto mode and as well as manual mode.

A. Ni myRIO

MyRIO is a real time embedded evaluation board made by National instruments myRIO with LABVIEW allows for fast and easy integration into remote embedded applications. With its on-board devices, seamless software experience provides an affordable tool that helps students and it provides educators with an embedded, Wi-Fi-enabled solution to deliver an engaging approach to learning controls, investigating mechatronics, and designing imaginative capstone projects.

Fig.2 myRIO

Fig.2 shows the myRIO, the word “RIO” stands for Reconfigurable Input Output. NI-myRIO is one of the best products of National Instruments which can able to do the process of Image Processing programs, Hardware interfacing programs such as motors, gears and levers etc. NI-myRIO has Xilinx which is thereby a combination of Dual Core ARM Cortex A-9 Processor and FPGA embedded on it. It has Integrated WIFI, Analog I/O ports and Digital I/O ports and many others as described in the following figure.

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B. Personal Computer with NI-LabVIEW

Fig. 3: Personal Computer Installed With LabVIEW

Fig.3 shows the personal computer installed with LabVIEW. One can be able to control the motor using either a desktop or laptop computers with NI-LabVIEW software installed in it. In recent times National Instruments introduced latest version of LabVIEW software i.e. NI-LabVIEW 2014. The latest upgraded version has more additional features and advanced technologies such as NI-myRIO driver software, vision and motion and robotics toolkit etc.

C. Motor driver IC L293D

L293D is a typical motor driver or motor driver IC which allows DC motor to drive on either direction. L293D is a 16 Pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC. Dual H-bridge motor driver integrated circuit (IC). The L293D can drive small and quite big motors as well. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction. Hence, H-bridge IC is idle for driving a DC motors. In a single L293D chip, there are two H-bridge circuits inside the IC which can rotate two DC motors independently. Due to itssize it is very much used in robotic applications for controlling DC motors.

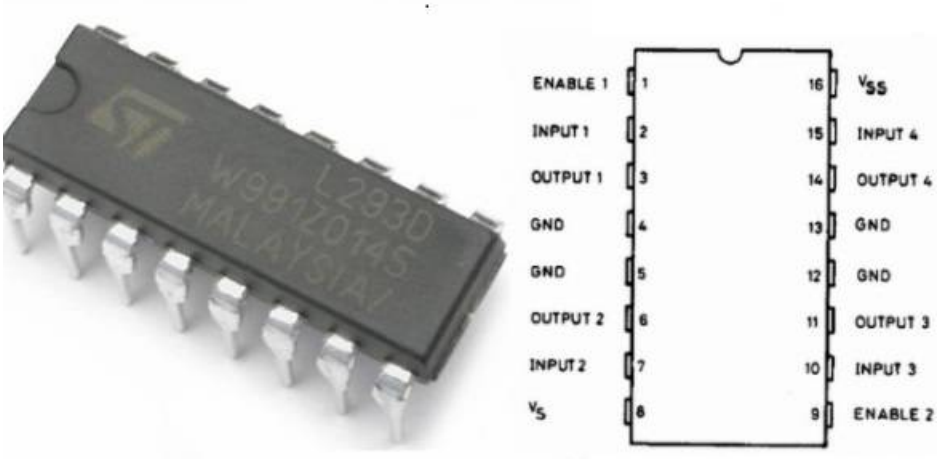

Fig.4 Pin diagram of IC L293D

The Fig 4 shows the basic pin diagram for the motor driver circuit. The driver circuit used here is L293D IC, we use of 16 pins in configuration, the 16 pins are input pin, output pin, ground and power supply.

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E. DC gear motor

Geared DC motors can be defined as an extension of DC motor. A geared DC motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as rpm. The DC motor works over a fair range of voltage. The higher the input voltage more is the rpm (rotation per minute) of the robot. For example, if the motor works in the range of 6-12V, it will have the least rpm at 6V and maximum at 12. In terms of voltage, we can put the equation as:

$$RPM=K1*V \quad (1)$$

where,
K1=induced voltage constant
V=voltage applied.

Fig.5 12v motor

Fig.5 shows the 12v motor, the working of the gear is interesting to know. It can be explained by the principle of conservation of angular momentum. The gear having smaller radius will cover more rpm than the one with larger radius. However, the larger gear will give more torque to the smaller gear than vice versa. The comparison of angular velocity between input gear (the one that transfer energy) to output gear gives the gear ratio. When multiple gears are connected together, conservation of energy is also followed. The direction in which the other gears rotate is always the opposite of the gear adjacent to it. In any DC motor, rpm and torque are inversely proportional. Hence, the gear having more torque will provide a lesser rpm and converse.

F. Wireless camera module

Wireless security cameras transmitter a video and audio signal to a wireless receiver through a radio band. Analog wireless is the transmission of audio and video signals using radio frequencies. Typically, analog wireless has a transmission range of around 300 feet (91 meters) in open space; walls, doors, and furniture will reduce this range. Analog wireless is found in three frequencies: 900 MHz, 2.4 GHz, and 5.8 GHz frequency. Most household routers, cordless phones, video games controllers, and microwaves operate on the 2.4GHz frequency and may cause interference with your wireless security camera. 900 MHz is known as Wi-Fi friendly because it will not interfere with the internet signal of your wireless network.

G. Gas sensor

Gas Sensor applies SnO2 which has a lower conductivity in the clear air as a gas-sensing material. In an atmosphere where there may be CO_2 gas, the conductivity of the gas sensor raises along with the concentration of the CO_2 gas increases. It performs a good detection to smoke and other harmful gas, especially sensitive to ammonia, sulfide and benzene steam. Its ability to detect various harmful gas and lower cost make MQ-135 an ideal choice of different applications of gas detection.

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Fig 6 Gas sensor MQ 135

The fig 6 shows the gas sensor, gas sensor used to detect the gas at present in the environment .The MQ 135 detects the CO2, LPG, CO, air quality sensor. In this project MQ 135 used to detects the CO2 in this present area.

H. LabVIEW

Laboratory virtual instrument engineering workbench is a system design platform and development environment for a visual programming language from National Instruments. The graphical language is named "G" (not to be confused with G-code). Originally released for the apple Macintosh in 1986, LABVIEW is commonly used for the data acquisition, instrument control & industrial automation on a variety of platforms including Microsoft windows, various versions of Unix, Linux and OS -X. The latest version of LABVIEW is LABVIEW - 2017 is released in May 2017.

III. DESIGN AND SIMULATION

The design and simulation represents the required programming that has been used in our work. The design consists of geared motor, acryllic sheet is used as suspension in this rover, an arm mechanism has been implanted by the servo motors. The camera used here will also work under the servo mechanism.

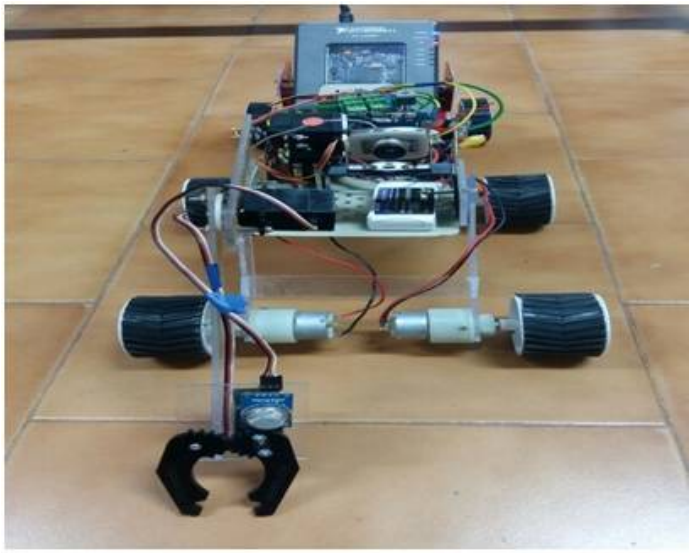

Fig .7 over all setup of the rover

The fig 7 shows the overall view of our rover system. The rover basically consists of hardware components like wheels, suspension system, and myRIO camera and gas sensor and driver circuit. The suspension has been used in order to

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avoid obstacles of up to 15cm height. The geared motor used here will be of high torque and low speed. The motor used here is DC geared motor of 15v.The wireless camera used for acquiring images and video from the particular area where the rover is used. The gas sensor is used to detect the gas samples in the particular area. The gas sensor output is displayed in chart with percentage. With the help of the camera sample place is detected and the sample can be picked up by the gripper. The gripper is been controlled by the LABVIEW program. The gripper has been programmed and the object is been picked up with the help of gripper.

Fig.8 over all simulation of project

The fig 8 shows the overall simulation of the rover system. Here the front panel of the LABVIEW programming has been showed by which the whole rover system is been controlled. The rover is controlled by the pushbuttons in manual mode. The auto mode will be in time difference mode. The Boolean is used here in order to represent the direction of the rover system. The movements will be displayed based on the directions. The gripper movements are controlled by the manual mode and the camera directions can be controlled by the manual mode. The output of the gas sensor is given by the chart in percentage. The chart output is changed in every movements of the particular place.

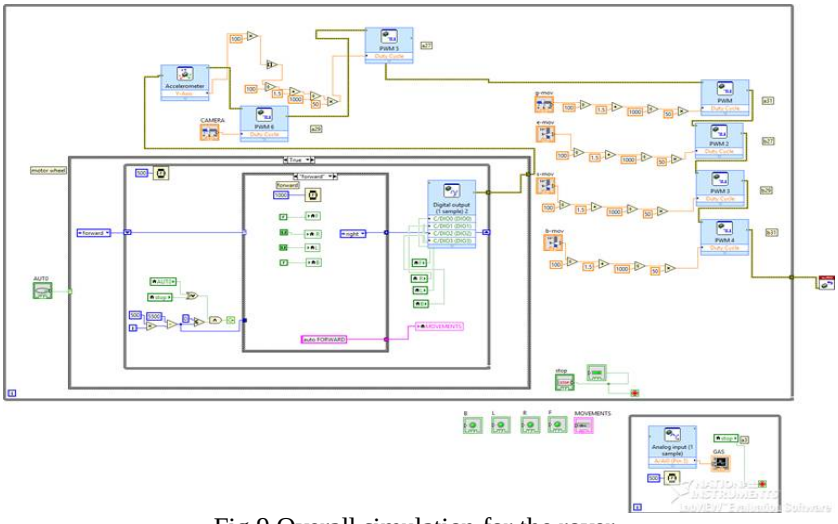

Fig.9 Overall simulation for the rover

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The fig9 shows the overall program for the Rover as well as the simulation for the gas sensor. In this program initially the motor control has been programmed. The motor consists of four directions they are forward, backward, left and right turn mechanism. The motor can be controlled by two methods they are manual mode and auto mode. The manual mode will be of remote controlling mechanism. The auto mode will not require any manual control instead they will be automatically control the directions. The gas sensor has been used here in order to sense the CO2 gas, LPG gas, etc. The gas sensors will consists of analogue input and also digital input, the while loop and case structure has used in the simulation. When the while loop gets ON, the program will go to the first case structure. There are two case structure available here, one is used for auto control second one is used for manual control. The servo motor angle will get changed when the accelerometer of the myRIO gets changed. There are four servomotors which have been used for the arm mechanism. The four mechanisms are body, shoulder, elbow and gripper. The four servo motors are used in the manual control. The gripper is used for the sample collection. The camera directions are based only on the servo mechanisms.

IV. RESULT AND ANALYSIS

In this project, our work has the capability of exploring any object in the celestial bodies. Top listed targets for the exploration rover such as Mars, Moon, Earth, and most inaccessible, most inhospitable, and most intriguing parts of other planets. It also has the nature of looking beneath small rocks in the surface to search for the trace of water stream. It can collect small piece of rock sample for further research works. It can detect the composition of various life indeed gases in the surfaces by incorporating gas sensors.

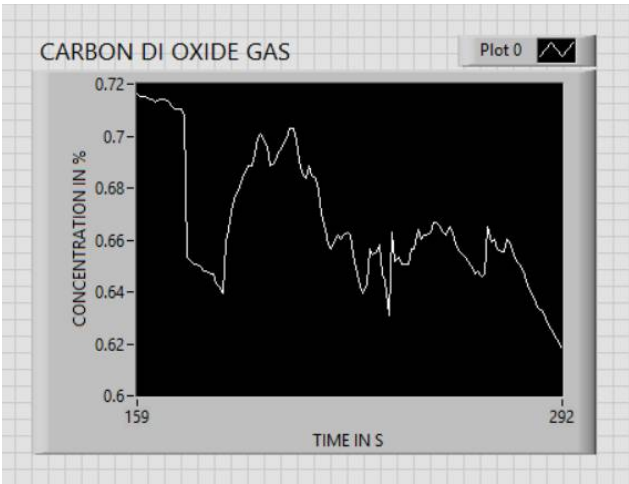

Fig 10 Output waveform of gas sensor

Fig10 shows the output waveform of gas sensor, the ideas of controlled surveillance robot have been successfully implemented. The robot has a wireless camera for surveillance purpose. The main idea behind the development of this project is to build a robot which will help many aspects. This kind of rover for surveillance proves to be cost efficient as it uses only Wi-Fi modules and driver circuits. The image processing is done remotely on Ni-LABVIEW environment. LABVIEWoffers high-level image processing applications. The scope for the future developments is literally limitless.

V. CONCLUSION

In this paper, the components and working of the rover is explained. That is the movement of arm and wheel of rover is controlled using Lab VIEW. The gas sensor output is displayed in chart with percentage. The every change in the gas detections is displayed. The rover connected with a rechargeable Li-Po battery. So, the distance coverage of rover will

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be increased .hence the concept of rover with high end suspension to be extended over for the purpose of surveillance in man-made disasters area, on board energy source, such as a radioactive module for enormous energy source, with high end camera, it can make an immaculate click of pictures of natures in various inaccessible areas and the Arm, will support the bomb squad for detection and disposal of intelligent bombs in an unmanned nature. It will reduce the cost of human life. The above plans will be implemented as a real time .this will be developed in our near future.

REFERENCES

[1] Wing-HuenIp, Jun Yan, Chun-Lai Li2 and Zi-Yuan Ouyang "The chang'e-3 lander and rover mission to the moon55" research in astronomy and astrophysics, vol. 14, pp. 12, 2014
[2] B. V. Ratnakumar, M. C. Smart, A. Kindler, H. Frank, R. Ewe and S. Surampudi Jet Propulsion Laboratory, California Institute Of Technology, Pasadena "Lithium batteries for aerospace applications: 2003 mars exploration rover" ,journal of power sourcesvolumes 119–121, pp. 4, 1 June 2003.
[3] Bharathi. G1, Phanindra Reddy, M.Tech Iv Sem, Dept Of Ece, Rymec Bellary Associate Professor, Dept Of Ece, Rymec Bellary "Design and development of an intelligent dynamic path finding/survivallence automated guided vehicle using ni-myRIO" international Journal of Research in Engineering and Technology ,volume: 04 ,Special Issue: 05 , May-2015.
[4] K. Mohamed Hussain, R. AllwynRajendranZepherin, M. Shantha Kumar, Ug Student, S. Abirami, Assistant Professor, Department Of Instrumentation And Control Engineering, Saranathan College Of Engineering Trichy. "Control and interfacing of motors with ni-labvioew using ni-myRIO" international journal for innovaoti[ve research in science & technology, volume o1 , issue 8 , January 2015
[5] Andrew D. Griffiths, Andrew J. Coates, Ralf Jaumann, HaraldMichaelis,GerhardPaar, David Barnes, Jean-Luc Josset and The Pancam Team "Context for the esaexomars rover: the panoramic camera instrument" International journal of astrobiology,vol 5,issue 3, pp 269-275, July 2006
[6] Rover Team "Characterization of the martian surface deposits by the mars pathfinder rover, sojournel" science, vol. 278, 5 December 1997
[7] D. F. Blake1 "Curiosity at gale crater, mars: characterization and analysis of the rocknest sand shadow"Science, vol 341, 27 September 2013
[8] Kaichang Di A , FengliangXu A , Jue Wang A , SanchitAgarwal A , EvgeniaBrodyagina A , Rongxing Li A, Larry Matthies B "Photogrammetric processing of rover imagery of the 2003 mars exploration rover mission" journal of photogrammetry &remote sensing, vol. 63, pg no.181–201, 2008
[9] AshiteyTrebi-Ollennu, P. Chris Leger, Eric T. Baumgartner and Robert G. Bonitz " Robotic arm in-situ operations for the mars exploration rovers osurface mission" systems, man and cybernetics, vol-12, 12 October. 2005