

Ni Myrio Based Smart Robot With Authentication Switch

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Abstract: This project represents the Robot system to navigate the vehicle by using the Ultrasonic sensor and Camera which are controlled by NI MyRIO which is a real-time processor. As this device is an Embedded hardware-based system we can control and monitor the real-time sensors and communication modules data. NI MyRIO has Xilinx 7010 ZYNQ FPGA module which processes the signals quickly and accurately [1]. NI LabVIEW is a graphical programmable tool where we can implement and design the VI's easily and it is also user-friendly. The Robot can be controlled using a mobile with NI Data Dashboard [7], Bluetooth applications, and Laptop with NI LabVIEW. This algorithm consists of an Authentication switch and security code to enable the communication channel between NI MyRIO and Bluetooth application. In order to control it with the laptop keyboard, we should ON the button so that the keyboard control is empowered and Bluetooth control is debilitated. The MyRIO allows Wi-Fi communication between Robot and the host computer. It is mounted with a USB camera module for detection of objects and also to send the captured images to Email [7]. HC-SR04 is an Ultrasonic sensor used to measure the distance and to navigate the robot to move in another direction [5] [6].

Index Terms: NI LabVIEW, NI MyRIO, NI Data Dashboard, Robot, Sensors, mobile Robotics, Email, Bluetooth.

I. INTRODUCTION

This Smart Robot is a type of four-wheeled mobile robot [2] mounted with Ultrasonic sensor, Camera and NI MyRIO. The Robot movement and speed of the Robot can be controlled with PWM signals which are generated by NI MyRIO depending on the Duty cycle. By using onboard Accelerometer, we can find the robot axis used to move the servo direction depending on the axis. Servo motor [3] is also used to turn the camera. As this is a Smart Robot it consists of some sensors like DHT-11, LDR, Voltmeter, and Ultrasonic sensor [4]. These are used to measure Temperature, Humidity, Light intensity, Voltage, Distance respectively and also, we can monitor the sensors data on mobile with NI Data Dashboard and on Laptop with NI LabVIEW. This algorithm uses Authentication Switch and security code which can be accessed by the user in order to control the robot with other devices like Bluetooth. This switch can be empowered only from mobile and laptop with NI Data Dashboard, NI LabVIEW respectively. This is mounted with a camera so that we can observe the surroundings of the robot. By using the NI Vision Assistant Library, we can capture the images and access the live

Revised Manuscript Received on April 07, 2019.

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streaming in the laptop. This algorithm will process the captured images and it will send them to Email [7].

II. METHODOLOGY

This smart robot algorithm is designed with NI LabVIEW. This algorithm consists of a robot control Algorithm to move in a direction which is controlled by the user. This robot can be controlled with Laptop keyboard and other Bluetooth devices. The smart robot consists of several Sensors, Controllers and Communication Modules they are NI MyRIO, NI Data Dashboard, USB Camera module, HC-SR04, Servomotor, DHT-11, Voltmeter, LDR, L298N Motor Driver Module, DC Motors. The USB Camera module for the detection of objects. HC-SR04 is an Ultrasonic sensor to measure the distance and to navigate Robot to move in another direction. DHT-11 to monitor Temperature and Humidity of the robot and its surroundings. Servo is used to rotate the camera and Ultrasonic sensor modules in the direction of Robot movement. This Robot consists of sensors modules which are communicating with the processor via I2C protocol.

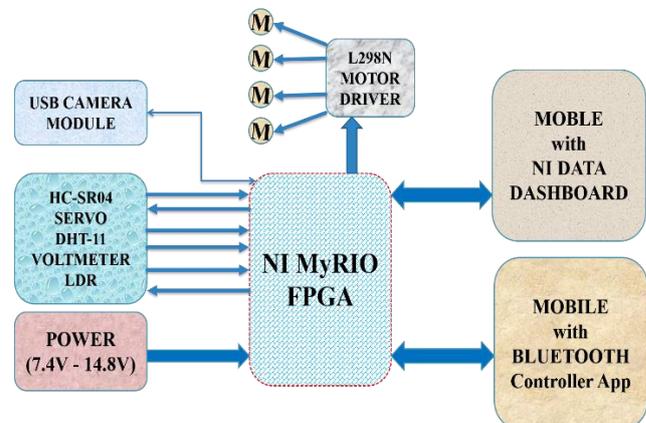


Fig. 1. Block Diagram

III. SOFTWARE SPECIFICATIONS & ARCHITECTURE

A. NI LabView:

NI LabVIEW means Laboratory Virtual Instrument Engineering Workbench. This is a virtual design platform from National Instruments. It is a graphical plan stage where clients can create a block diagram to perform any type of measurement, Instrumentation and Control Systems. It is a very easy to understand compatible with several embedded

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programmable devices like RoboRIO, sbRIO, CompactRIO, MyRIO and different Robotics module for constant equipment execution. LabVIEW has numerous in-manufactured modules which have obstructs for graphical structure, investigation, and representation of information.



Fig. 2. NI LabVIEW 2017

B. NI Data Dashboard:

NI Data Dashboard is A mobile application from national instruments. We can control the application using this data dashboard by sharing variables to the application. In order to control any application firstly we want to create a shared variable and then we should assign the data type for that variable in order to communicate with Hardware and application.

C. NI Vision Assistant:

NI Vision Assistant is a platform mainly used for prototyping and testing image processing applications. This tool is used to prototype any image processing applications in order to build the custom algorithm. We can create a LabVIEW VI which is used to process the acquired images in NI Vision Assistant.

IV. HARDWARE SPECIFICATIONS & ARCHITECTURE

A. NI MyRIO 1900:

NI MyRIO is a portable embedded hardware device that uses LabVIEW to allow the real-time implementation of the smart robot and sensor algorithms and to enable the interfacing the algorithms with actual sensors and actuators. MyRIO consists of an onboard accelerometer, LEDs, push button and Wi-Fi for wireless communication.



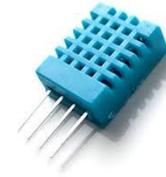
B. Ultrasonic Sensor:

HC-SR04 is an Ultrasonic Sensor module which is majorly used in Distance measurement. It emits continuous sound waves having 40 KHz of frequency which travels in the air medium when there is an object in its path it hits to object and travels back.



C. DHT11:

DHT11 is commonly used to measure the Temperature and humidity. As this sensor has a dedicated NTC to measure temperature and humidity and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is easy to interface with other microcontrollers and microprocessors. This sensor can measure the temperature range from 0°C to 50°C and humidity range from 20% to 90% with a variation of $\pm 1^\circ\text{C}$ and $\pm 1\%$.



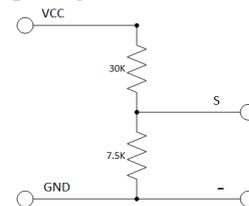
D. LDR:

LDR is a Light sensor or a photoelectric device that converts light energy into an electrical. It detects the Light Intensity of the surroundings and based on that it produces the output.



E. Voltmeter:

The voltmeter circuit is a simple sensor it quantifies the voltage of the battery and changes over it into an analog signal given to the analog pin of MyRIO using a simple voltage divider circuit comprising 2 resistors.



F. Servo motor:

The SG-90 Servo motor consists of 3-pins which are connected to MyRIO. First pin is connected to GND, second pin to +5V and Third pin is connected to PWM pin in MyRIO. The PWM signal is generated by MyRIO based on the Duty Cycle.



V. RESULTS

A. Authentication algorithm:

The smart robot consists of an Authentication Switch and an Authentication Key. This Algorithm helps to keep the robot communication safe from Unauthorized Transmitters. By using NI Data Dashboard and NI LabVIEW this Authentication algorithm is created. In order to communicate with the robot, we want to type the Authentication Key in NI Data Dashboard. So, that we can control the robot with the Bluetooth model.



Fig. 3. Front Panel of Authentication algorithm

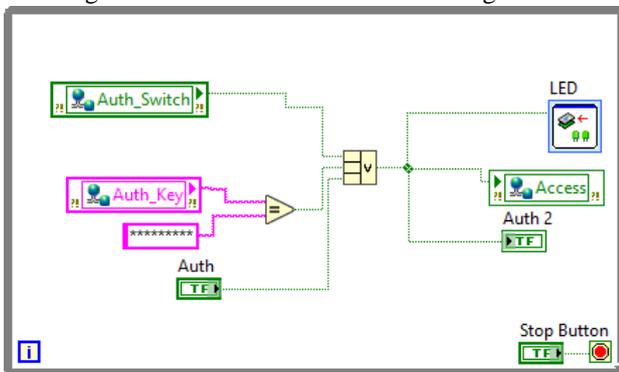


Fig. 4. Block Diagram Panel of Authentication algorithm

B. Algorithm Control VI:

This algorithm control VI is used to monitor and control the data from all the sensors. We can send the captured images, Access alerts and sensor data to an email by using this algorithm. If the Ultrasonic Control button is enabled then the robot can move autonomously without any user commands. If any control is enabled then the indicators will be ON.

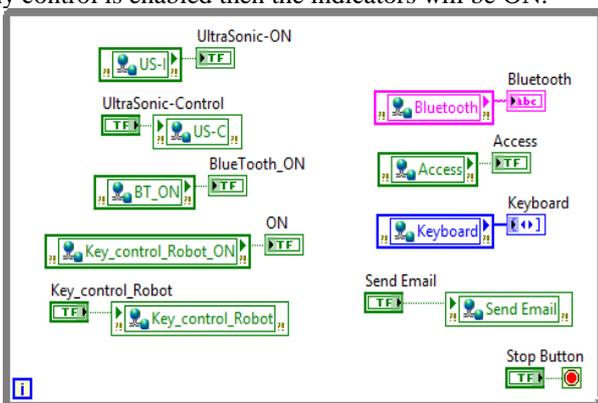


Fig. 5. Block Diagram Panel of Algorithm Control VI

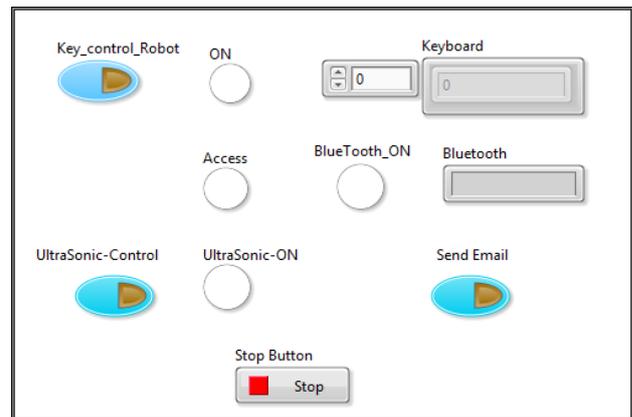


Fig. 6. Front Panel of Algorithm Control VI

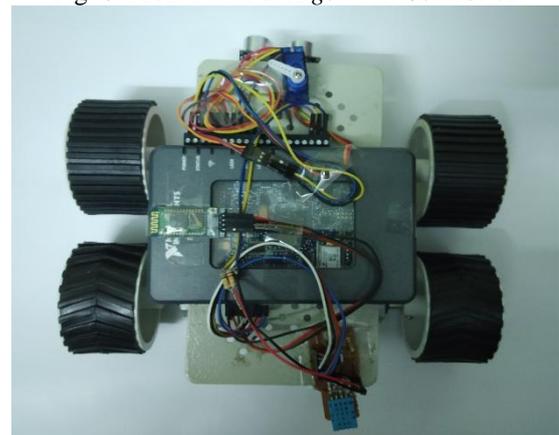


Fig. 7. Robot Design



Fig. 8. Camera View of robot

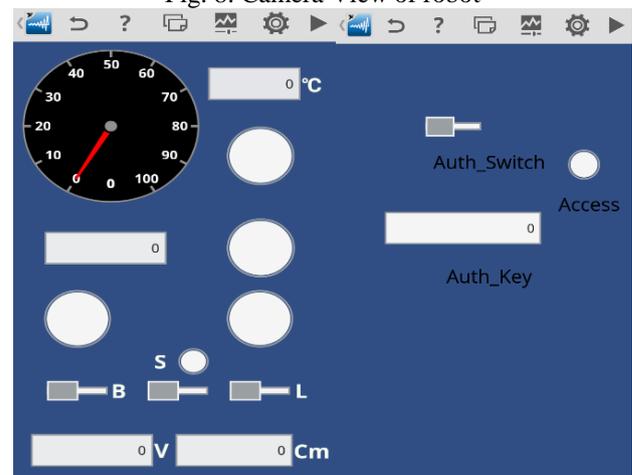


Fig. 9. Dashboard for Sensors and Authentication Algorithms in NI Data Dashboard

VI. CONCLUSION

National Instruments LabVIEW was used to build the block diagram model representation of Smart Robot. The PWM (Pulse Width Modulation) signals are used to control the two L298N motor drivers which will provide speed to the wheels to rotate. In order to control the motors of the robot, I developed a LabVIEW program with PWM signals which are also controlled by the sensors feedback. NI MyRIO has Xilinx 7010 ZYNQ FPGA module so that we can perform all the logical operations. For the real-time implementation of the smart robot, National Instruments MyRIO was used as it consists of on-Board Accelerometer by using that we can find the robot axis and it also consists on-board Wi-Fi so, that the robot can be monitored and controlled over the internet. The SMTP protocol is used in this algorithm to send Email from MyRIO. So, it will be very easy to program the Smart Robot Algorithm in NI LabVIEW and Hardware implementation on NI MyRIO. By utilizing NI MyRIO, the robot has played out its errand consummately as indicated by the structured program. This framework gives high precision for any robotic application.



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ACKNOWLEDGMENT

Primarily, I would like to thank Dr.K.R.R. Mohan Rao who is my supervising faculty for guiding me for this Smart Robot project at K L University. During this period, I have learned a lot about NI LabVIEW and NI MyRIO. He helped me to carry out the real-time experiments on NI MyRIO. I am highly obliged to National Instruments application manager for helping me throughout my project. Lastly, I am Notched to my family, teachers, and friends for their support and inspiration. I would also like to express sincere appreciation to my family and friends as they helped me to fulfill my objectives.

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