ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 2, Issue 1, January 2013

UNMANNED MULTI-FUNCTIONAL ROBOT USING ZIGBEE ADOPTER NETWORK FOR DEFENSE APPLICATION

Premkumar .M

Abstract - Most of the military organization now takes the help of robots to carry out many risky jobs that cannot be done by the soldier. These robots used in military are usually employed with the integrated system, including video screens, sensors, gripper and cameras. The military robots also have different shapes according to the purposes of each robot. Here the new system is proposed with the help of low power Zigbee wireless sensor network to trace out the intruders (unknown persons) and the robot will take the necessary action automatically. Thus the proposed system, an Intelligent Unmanned Robot (IUR) using Zigbee saves human live and reduces manual error in defense side. This is specially designed robotic system to save human life and protect the country from enemies.

Keywords – Military robot, Zigbee Wireless network, Intelligent Unmanned Robot (IUR).

I. INTRODUCTION

For the last few decades, robots are becoming very popular and common in military organizations. There are many advantages of these robots as compare to human soldier. One of the most important things about these robots is that they have the capability to perform missions remotely in the field, without any actual danger to human lives (5). This shows a great impact of military robots. These robots are sturdier and more capable of with-standing damage than human. Therefore they give greater chances of success in dangerous environment. Whenever, a robot is shot down, the military simply roll out a new one. But one should not forget about the certain effects and impact of military robots. In 2009, academics & technical professionals held a conference and discussed the impact of the speculative possibility that robots and computers could become self- sustaining and able to make their own decisions (1). They also bring forward the possibility and the range to which computers & robots might be able to achieve any scale of autonomy, and to what extent they could utilize such abilities to possibly cause any threat or danger. They briefly discuss about the effects of military robots.

Experts have also jotted that some robots have acquired several forms of semi-autonomy, which includes the ability to find power sources on their own and the ability to select target to attack independently. They also noted that some computer viruses can avoid elimination (4). Besides this, they also considered self-awareness as depicted in science-fiction is probably unlikely, but that there were other potential hazards and pitfalls. Some experts and academics have questioned the use of robots for military

PREMKUMAR .M: *Assistant professor in Department of Electrical & Electronics Engineering, KPR Institute of Engineering & Technology, (KPRIET), Coimbatore-641103, India.*

combat, especially when such robots are given some degree of autonomous functions. We have also seen a great development in military robots when compare to military robots in earlier time. At present, different military robots are utilized by many military organizations.

Military robot is a robot that can perform a task given such as locomotion, sensing, localization, and motion planning without a control from the human during the task in progress. The military robot is the autonomous robot that consist wireless camera that human able to monitor via computer as a spy. Today wireless system have been widely used by many company because wireless can save cost of wiring, easy to install, occupy lesser space, easy for maintenance and more reliable. There are four types of wireless communications, Infrared, Bluetooth and Radio Frequency & Zigbee. Zigbee normally is chosen for the wireless military robot because it has large connectivity range and it is more reliable that other wireless communication system.

In this proposed system, such a military robot is designed to detect the unknown person in border area, gag leakage detection, bomb detection and diffusion. Zigbee wireless sensor network is used to send the data's to the host system wirelessly. All these functions are done automatically or manually with the help of Labview software which is to be installed in host system.

II. SYSTEM ANALYSIS

In proposed system, the communication can be done with the help of the Zigbee wireless communication network. In this system, the robot is monitored using the CMOS camera. The entire control is resided with the microcontroller. In addition to this, bomb detection, bomb diffusion, gas leakage detection, live human body detection and pressure gun are included. In this, the robot can move through the rugged surfaces also. The control of the robot from remote location is done with a computer. The information to the computer is carried out by the advanced technology named Zigbee Technology. When control signal is given from computer it is transmitted with the help of Zigbee. Video receiver receives the video signals from camera. The system also contains temperature detection which is being carried out by detecting environmental temperature.

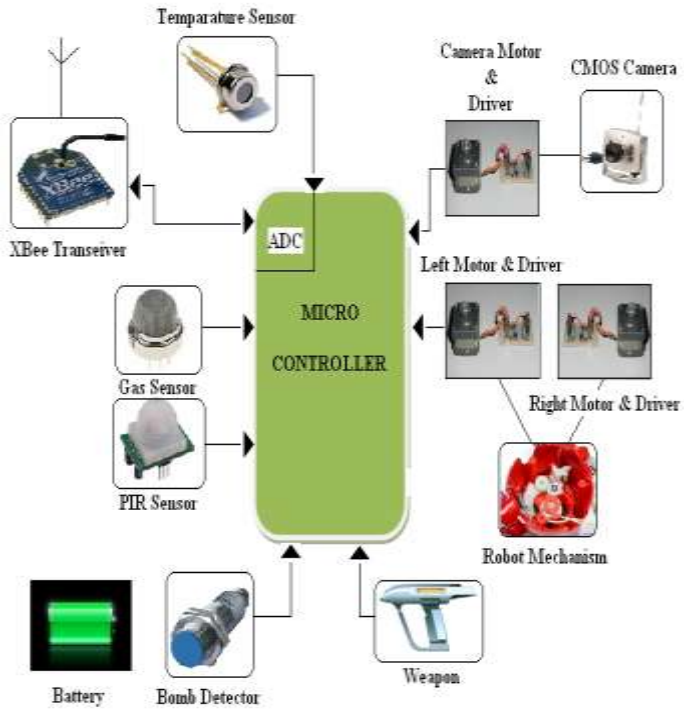

Fig. 1. Block Diagram of Robot Section

In ROBOT section, the sensors like temperature, moisture and metal detector. It is used for sense

changes in surface and atmosphere. Temperature sensor and moisture sensor signal is converted using ADC and sends signal to the microcontroller. There are three motor drivers are used in the robot section. They are the first two motor drivers are used to control the movement of the robot motor. The second motor driver is used to control for the Camera movement in robot. The 12V battery supply is given to the motors for moving the robot and also the supply is given to camera.

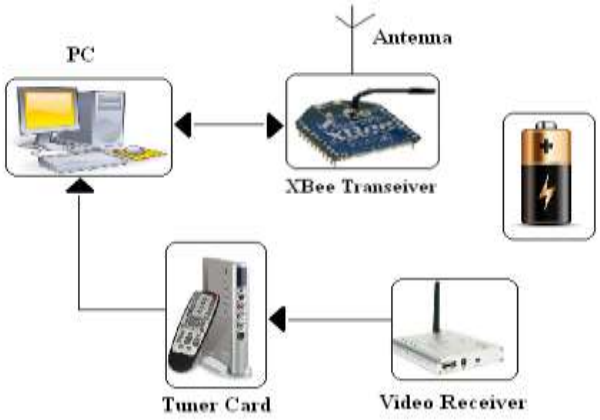

Fig. 2. Block Diagram of Controller Section

The PIC Microcontroller is the main part of this project. It is programmed to control the motor driver and camera control motor. The RS232 is used to interface of PC and PIC microcontroller. Using software's can monitor in PC. The software's are visual basic and LabVIEW. Power supply for microcontroller is 5V.

III. HARDWARE SPECIFICATION

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction.

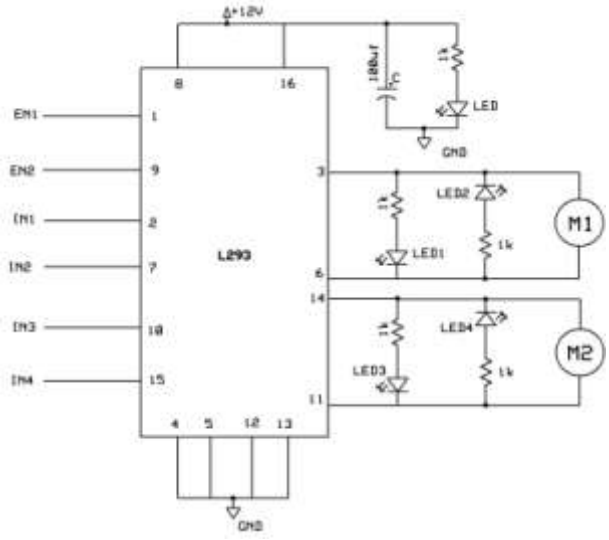

Fig.3. Motor Driver section

The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

RS-232 is simple, universal, well understood and supportive. The serial port transmits a '1' as -3 to -25 volts and a '0' as +3 to +25 volts. Devices which use serial cables for their communication are split into two categories. These are DCE (data communications equipment) and DTE (data terminal equipment.) Data communications equipment is devices such as the modem, TA adapter, plotter etc while data terminal equipment is your computer or terminal.

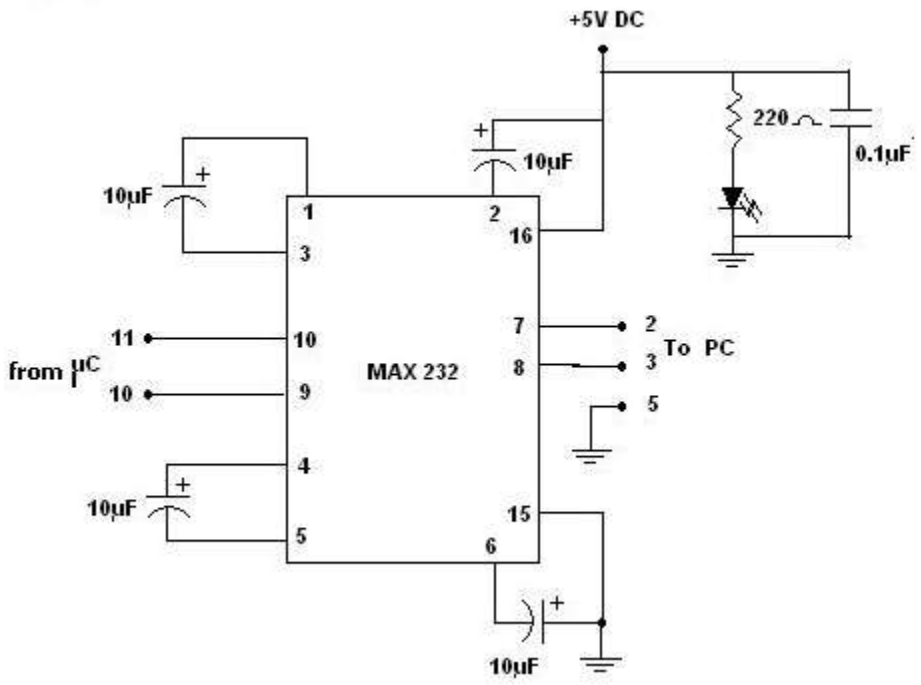

Fig. 4. Circuit diagram of level converter Max232

In a robot section gas sensor senses the gas leakage. PIR sensor senses the heat radiated from the human body. Metal detector used to detect bombs. These signals are given to microcontroller. Temperature sensor senses the ambiance temperature. Moisture sensor senses the ambiance moisture. These signals are given to the microcontroller in the ADC port. Microcontroller is programmed to analyze the signals and it sends these data to Zigbee transceiver through level converter. Level converter is an interfacing unit between microcontroller and Zigbee. Zigbee transceiver now acts as a transmitter and transmits the data. Camera transmitter also transmits the video captured by camera.

Zigbee transceiver in a robot receives the data and it is given to the computer where the customized LabVIEW program is developed for monitoring the data from robot and keys for controlling robot. When control signal is given from computer it is transmitted with the help of Zigbee. Video receiver receives the video signals from camera. In a robot section, ZigBee transceiver now acts as a receiver which receives control signals. This control signal is given to the microcontroller. Microcontroller is programmed to control the motor controllers depending upon the direction of movement. When the control signal is received to activate the weapon it activates the weapon.

Gas sensor is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG (composed of mostly propane and butane) concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an

analog resistance. The drive circuit is very simple; all you need to do is power the heater coil with 5V, add a load resistance, and connect the output to an ADC. This sensor comes in a package similar to our MQ-3 alcohol sensor.

IV. SOFTWARE SPECIFICATION

LabVIEW (Short For Laboratory Virtual Instrumentation Engineering Workbench) is a Platform and Development Environment for a Visual Programming Language from National Instruments. The Graphical Language is Named "G". The Latest Version of LabVIEW is Version 10.0.0.4032, Released in February Of 2010.

The Programming Language used in LabVIEW, also referred to as G, is a Dataflow Programming Language. Execution is determined by the Structure of a Graphical Block Diagram (The LV-Source Code) on which the programmer connects different function nodes by drawing wires.

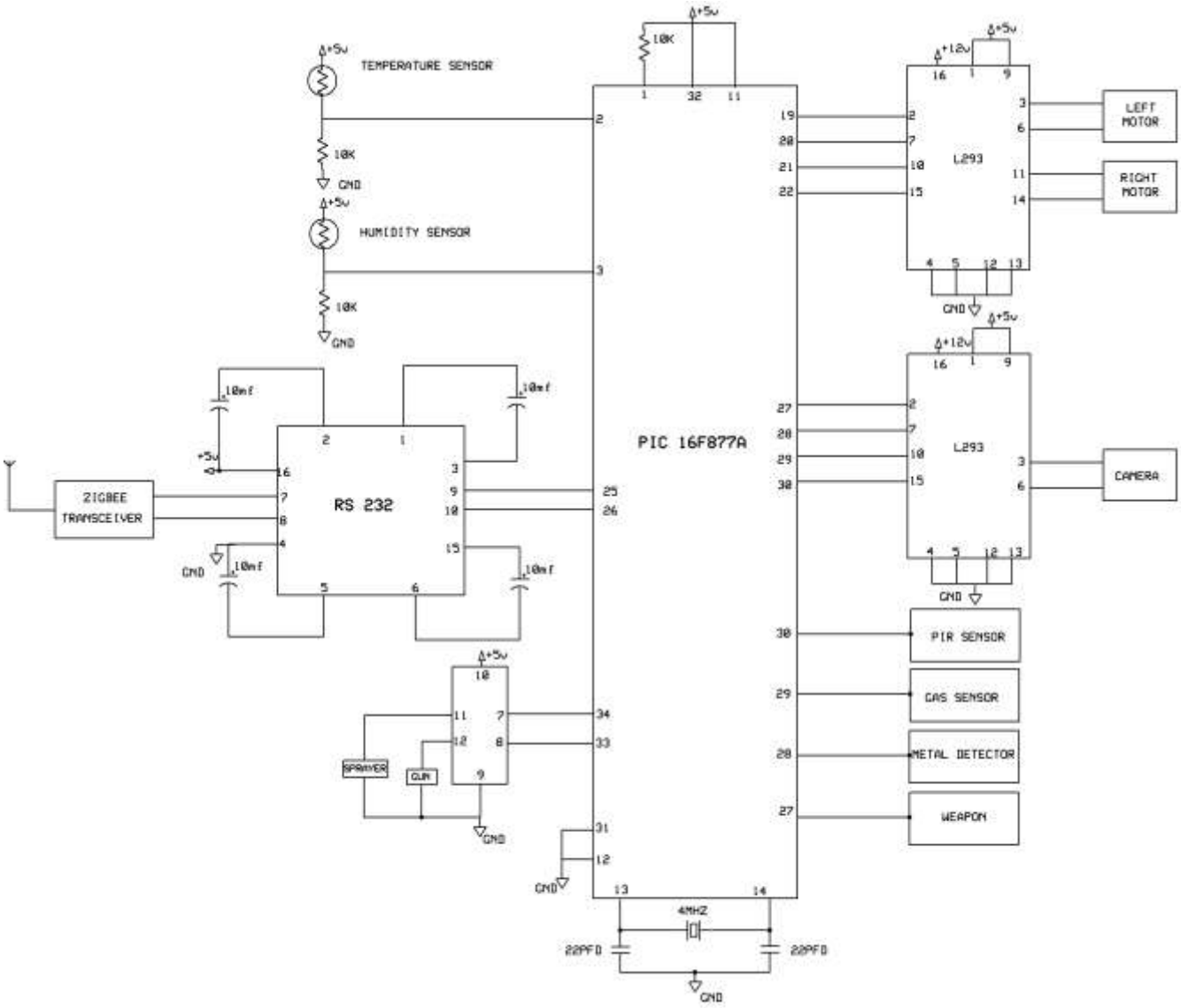

Fig. 5. Circuit Diagram of PIC Microcontroller Unit

These wires propagate variables and any node can execute as soon as all its input data become available. Since this might be the case for multiple nodes simultaneously, G is inherently capable of parallel execution.

LabVIEW ties the creation of user interfaces (called front panels) into the development cycle. LabVIEW programs/subroutines are called virtual instruments (VIS). Each VI has three components: a block diagram, a front panel, and a connector panel. The last is used to represent the VI in the block diagrams of other, calling vis. controls and indicators on the front panel allow an operator to input data into or extract data from a running virtual instrument. However, the front panel can also serve as a programmatic interface. Thus a virtual instrument can either be run as a program, with the front panel serving as a user interface, or, when dropped as a node onto the block diagram, the front panel defines the inputs and outputs for the given node through the connector pane. This implies each VI can be easily tested before being embedded as a subroutine into a larger program. The graphical approach also allows non-programmers to build programs simply by dragging and dropping virtual representations of lab equipment with which they are already familiar. The LabVIEW programming environment, with the included examples and the documentation, makes it simple to create small applications. This is a benefit on one side, but there is also a certain danger of underestimating the expertise needed for good quality "G" programming. For complex algorithms or large-scale code, it is important that the programmer possesses an extensive knowledge of the special LabVIEW syntax and the topology of its memory management. The most advanced LabVIEW development systems offer the possibility of building stand-alone applications. Furthermore, it is possible to create distributed applications, which communicate by a client/server scheme, and are therefore easier to implement due to the inherently parallel nature of g-code.

IV.1. PROCEDURE TO CREATE FRONT CONTROL PANEL

i. Launch LabVIEW from **Start » Programs » National Instruments LabVIEW 10**. Click **New VI** to open a new front panel.
ii. (Optional) Select **Window » Tile Left and Right** to display the front panel and block diagram side by side.
iii. 3. Display the block diagram by clicking it or by selecting **Window» Show Diagram**.
iv. Select the multiply and Add functions on the **Functions» Numeric** palette and place them on the block diagram. If the **Functions** palette is not visible, right-click an open area on the block diagram to display it.
v. Select the numeric constant on the **Functions» Numeric** palette and place two of them on the block diagram. When you first place the numeric constant, it is highlighted so you can type a value.
vi. With the help of the VISA interface, interface the hardware components in the LabVIEW.
vii. In the block diagram select the COM port. Enable RS232 in the front panel.
viii. Check whether the VISA block is open or not.
ix. Give the binary column push buttons as true or false according to the

requirement and select through the formula node.

x. The serial out is sent to the VISA WRITE to convert the binary value into the string as to give input to the Zigbee.

xi. The VISA READ is automatically communicated with the VISA WRITE and then according to the string value count the sensor trigger will be activated.

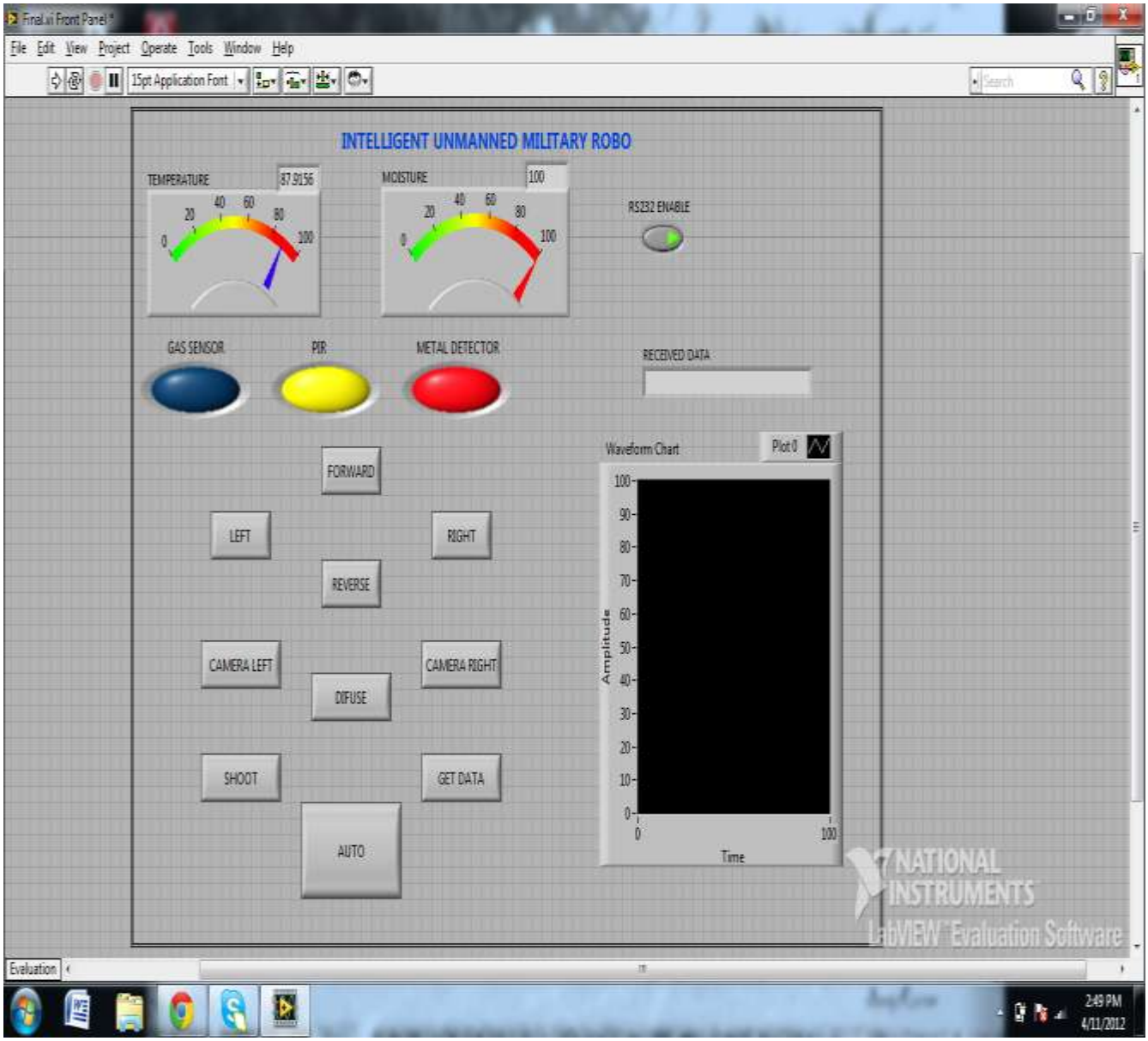

Fig. 6. Front panel of robot control

V.CONCLUSION

When we consider military robots today, there has been a huge development as compare to those robots used in earlier times. Today, military ground robots & unmanned vehicles are used worldwide. However, the significant growth of the

current military robots comes as the nature of combat changes in every region while the globally integrated enterprise replaces nationalistic dominance. It can be said that military robot automation of the defense process is the next wave of military evolution. This proposed system gives an exposure to design a simple robot that can be used to do multifunction in defense. Manual control is also employed to control the robot from the control room which is located far away from the border area. The system uses non-commercial Zigbee standard for wireless communication since this provides access to the as-yet unpublished specifications and permission to create products for market using the specifications. Our system is aimed towards the Zigbee technology up to 30 meters distance. In future we can increase the distance up to 100m distance. The proposed system is focusing on the welfare infantry to minimize the causalities to a great extent. This also helps on remote bomb detonation and diffusion.

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AUTHOR'S BIOGRAPHIES

Er.M.Premkumar completed his Bachelor of Engineering in Electrical & Electronic Engineering in Sri Ramakrishna Institute of Technology, (SRIT), Coimbatore -641103, India. He also completed his Master degree in Applied Electronics in Anna University of Technology, Coimbatore, India. The author has presented many Technical Papers in various National & International Conferences. Currently, he is working as an Assistant Professor in Electrical & Electronics Engineering. His field of interest is Embedded systems, Robotics, Electrical machines, Electrical drives & Control and Power electronics.