Labview Controlled Robotic ARM

Eshwar Punna, Ravi Kumar Nenavath, Basha Maloth

***Abstract*— Demand for industrial robots has increased dramatically in the manufacturing sector, and helped to overcome labor shortage. The recently rapid increase in research and development in Robotic technology has led to a gap between education and industry. In this paper we design a Prototype Industrial Pick and Place Robotic ARM controlled by LabVIEW software. The Project setup consists of Robot with four wheels, Robotic ARM, Controller Board, Zigbee Module and Graphical user interface(GUI) developed by Labview. The purpose of this project is to design a robot, which senses presence of object and picks it with its robotic arm, and places it on destination.**

***Index Terms*—Robotic ARM, Robotic Technology, Labview**

I. Introduction

Robot is an integral part in automating the flexible manufacturing system that one greatly in demand these days. Robots are now more than a machine, as robots have become the solution of the future as cost labor wages and customers demand.

Robot and automation is employed in order to replace human to perform those tasks that are routine, dangerous, dull and in a hazardous area. In a world of advanced Technology today. Automation greatly increases production capability. Improve product quality and lower production cost. It takes just a few people to program or monitor the computer and carry out routine maintenance.

There is a huge demand for Robotics Education and unfortunately it is such an expensive product that many students do not get an opportunity to get exposed to it. In this paper we designed a Pick and place Robotic arm with reasonable cost and we can setup this type of projects in colleges to teach industrial oriented robotic technology.

The controller of this Project is low-power Atmel 8-bit AVR RISC-based microcontroller combines 8KB of programmable flash memory, 1KB of SRAM, 512K EEPROM, and a 6 or 8 channel 10-bit A/D converter. The device supports throughput of 16 MIPS at 16 MHz and operates between 2.7-5.5 volts. The IDE of Atmega8 controller is WinAVR it's important to note winavr is collection of tools. Programmers Notepad is text Editor/IDE for compiler.

Manuscript received July, 2015.

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II. Block Diagram

Figure 1 & 2 shows the block diagram of Labview controlled Robotic ARM. It consists of Power Supply microcontroller, Zigbee modules, Robot and Robotic ARM.

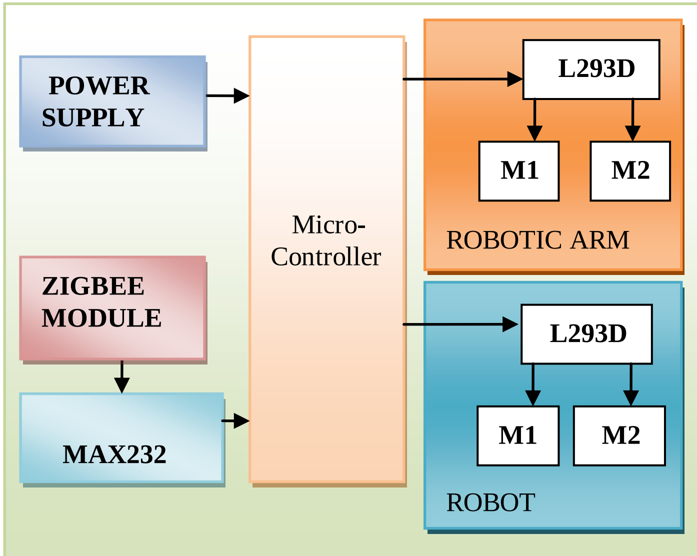

Figure 1: Receiver section

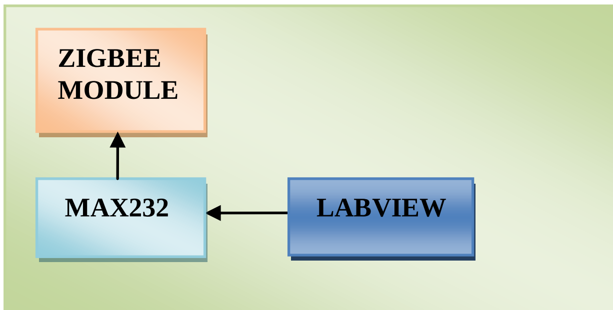

Figure 2: Transmitter Section

In this project we develop a robot using wireless communication i.e. from Control section (acts as transmitter) we are sending the control signals using graphical user interface (GUI) from Labview software, then the robot receives (acts as receiver) the signals. According to the signals being received the direction of the robot is controlled. One of the major and most commonly performed works is picking and placing of jobs from source to destination. For this purpose, 'pick and place robot' may be used. The pick and place robot is a system that detects the object, picks that object from source location and places at desired location. This project is designed around a Microcontroller which forms the control unit of the project.

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III. Power supply

There are several ways to power a robot. Some large robots use internal combustion engines to generate electricity or to power hydraulic or pneumatic actuators.

For a small robot, however, battery power offers a number of advantages, since batteries are cheap, relatively safe, small, and easy to use. Also, motors convert electrical power into mechanical power with relatively high efficiency. Many different types of batteries exist, each with its own tradeoff. Typical DC motors may operate on as few as 1.5 Volts, or up to 100 Volts or more. Robot cists often use motors that operate on 6, 12, or 24 volts because batteries are typically available with these values. The terms *battery* and *cell* are often used interchangeably, but they have different meanings. Technically, a cell is a unit housing a single chemical reaction that produces electricity, while a battery is a bank or collection of cells connected together.

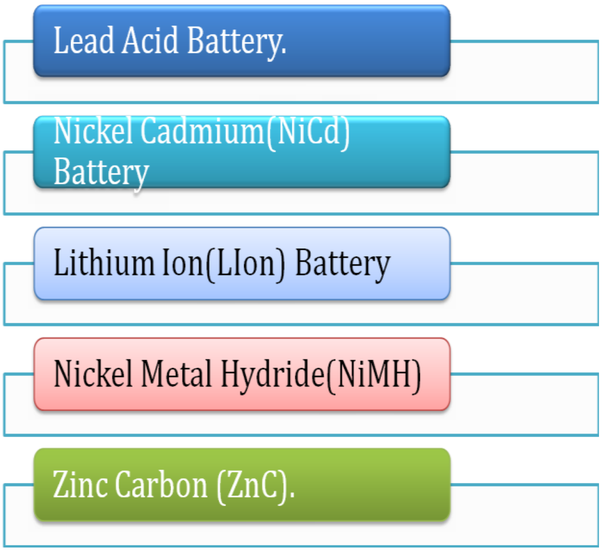

Figure 3: Battery Types

There are thousands of different battery types, many of which have highly specialized functions. Figure 3 shows few battery types and we used below figure 4 and 5 batteries to our robot. The batteries are available in market with low cost.

Figure 4: Zinc Carbon (ZnC)

Figure 5: Lead Acid Battery

IV. Actuators

An actuator is a type of motor that is responsible for moving or controlling a mechanism or system. It is operated by a source of energy, typically electric current, hydraulic fluid pressure, or pneumatic pressure, and converts that energy into motion. An actuator is the mechanism by which a control system acts upon an environment. The control system can be simple (a fixed mechanical or electronic system), software-based (e.g. a printer driver, robot control system), a human, or any other input.

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line.

DC-motors are very easy to use, but like most other motors their usefulness for robotics is very dependent on the gearing available. DC-motors are made much more effective if they have an efficient gear ratio for a particular task. If your priority is to have a fast spinning motor and torque is of little concern a low gearing or even no gearing may be what you need; however, most motors used in robots need torque over top speed so a motor with a high gear ratio could be more useful.

In this Project We are using the 60 rpm (Figure 6) DC motors

Figure 6: 60 rpm DC Motor

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V. MICROCONTROLLER

AVR microcontrollers are available in three categories:

1. Tiny AVR – Less memory, small size, suitable only for simpler applications
2. Mega AVR – These are the most popular ones having good amount of memory (upto 256 KB), higher number of inbuilt peripherals and suitable for moderate to complex applications.
3. Xmega AVR – Used commercially for complex applications, which require large program memory and high speed.

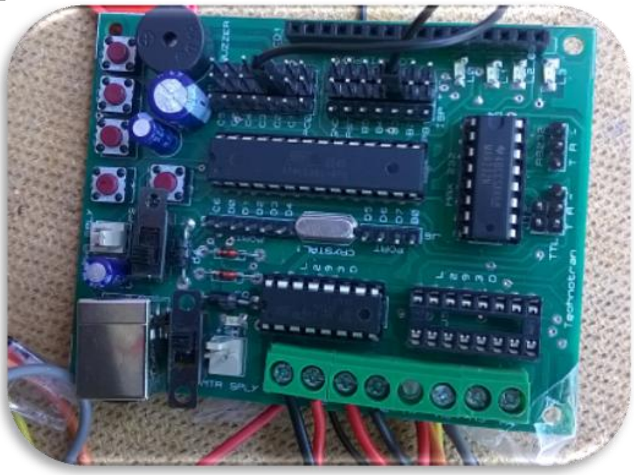

Figure 7: Atmega 8 Robotic Board

Figure 6 Atmega8 Robotic board with the following features: Built with popular Atmel's AVR Microcontroller, On-board LCD interface option (it can also be used for any other general purpose application), On-board Motor Driver for connecting 4 DC motors, On-board regulated power supply PC interface through UART, On-board Buzzer Provision for external crystal connection, Exposed I/O pins, Exposed I/O pins for ADC and sensors with 5V/1A power supply, Exposed I/O pins sensors with dual power supply Five tact switches for external input and reset Four test surface mounted LEDs for status and debugging purpose Two supply indicator LEDs, Dual power supply through DC source (6V to 16V) or USB powered On board USB programmer , Dual or single power supply option, Exposed ISP pins for programming. This atmega 8 robotic board having on board two motor Drivers to control robot and robotic arm internally they are connected to micron roller pins.

The IDE is WinAVR having Mfile and Programmers Notepad tools

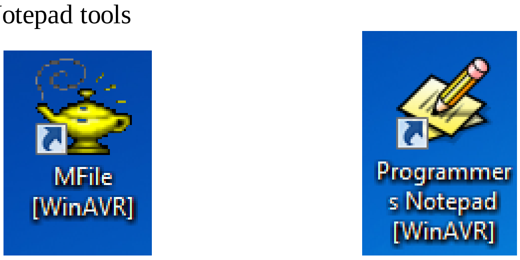

Figure 8: Mfile and Programmers Notepad tools

VI. ROBOTIC ARM

A **robotic arm** is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an articulated robot) or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand.

The robotic arm is one of the key developments in industrial robotics. Learn about the robotic arm, its technology and how robotic arms serve heavy industry.

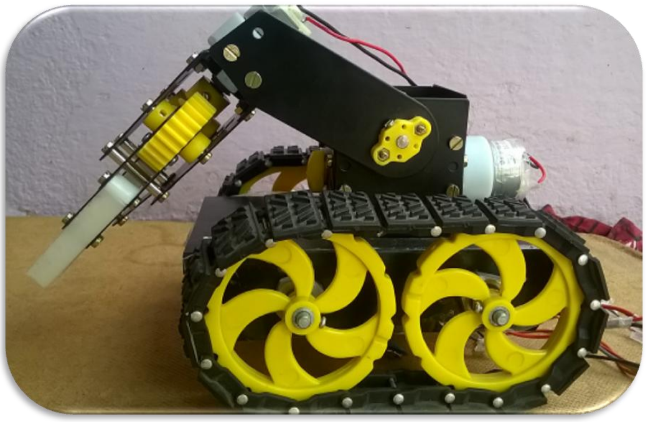

Figure 9: Robotic ARM

The end effector, or robotic hand, can be designed to perform any desired task such as welding, gripping, spinning etc., depending on the application. For example robot arms in automotive assembly lines perform a variety of tasks such as welding and parts rotation and placement during assembly. In some circumstances, close emulation of the human hand is desired, as in robots designed to conduct bomb disarmament and disposal

The robot arm is controlled by an atmega8 robotic circuit board. The controller circuit board is based on Atmel popular atmega8 microcontroller. The atmega8 robotic board will be connected to the serial port of Zigbee module in receiver Section. We will run this robotic arm by using a four wheel robot this robot moves forward, backward, left and right so we can travel any place for picking device we use gripper here for lifting that we use gripper stand.

VII. LABVIEW

LabVIEW is a highly productive development environment for creating custom applications that interact with real-world data or signals in fields such as science and engineering.

The net result of using a tool such as LabVIEW is that higher quality projects can be completed in less time with fewer people involved.

So productivity is the key benefit, but that is a broad and general statement. To understand what this really means, consider the reasons that have attracted engineers and

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scientists to the product since 1986. At the end of the day, engineers and scientists have a job to do – they have to get something done, they have to show the results of what they did, and they need tools that help them do that. Across different industries, the tools and components they need to succeed vary widely, and it can be a daunting challenge to find and use all these disparate items together. LabVIEW is unique because it makes this wide variety of tools available in a single environment, ensuring that compatibility is as simple as drawing wires between functions

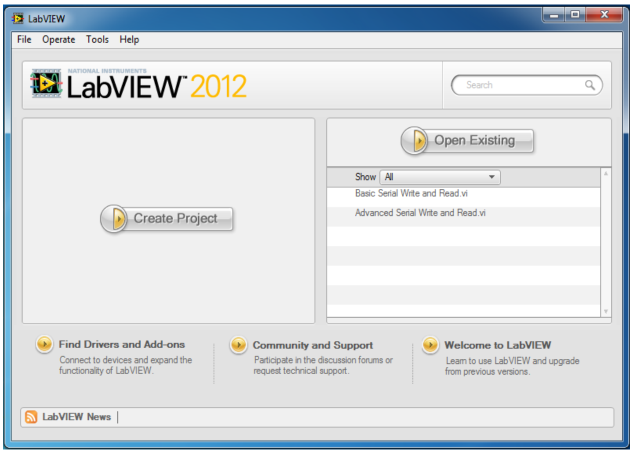

Figure 10: Labview

VIII. ZIGBEE

Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. The Zigbee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz. The 802.15.4 specification upon which the ZigBee stack operates gained ratification by the Institute of Electrical and Electronics Engineers (IEEE) in 2003. The specification is a packet-based radio protocol intended for low-cost, battery-operated devices. The protocol allows devices to communicate in a variety of network topologies and can have battery life lasting several years.

Figure 11: ZigBee

IX. RESULTS

Figure 11 shows the Labview VI of this project using this we can control Robotic arm and Robot Movements .We used four buttons in VI when we press up arrow button a command will send to controller section throw Zigbee Network. That command will instruct the Robot move forward. We used one horizontal slide and one vertical slide to control the robotic arm movements

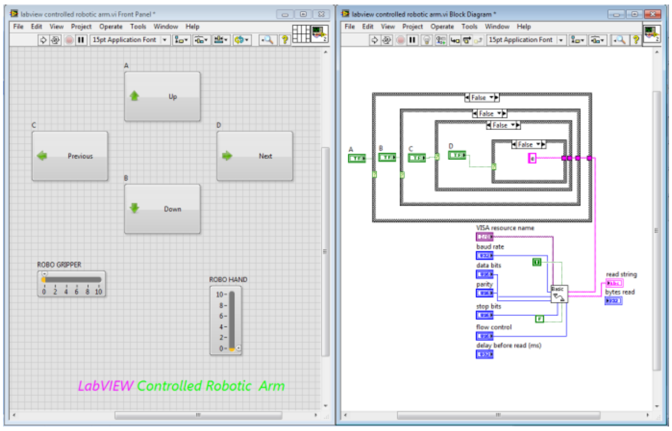

Figure 12: Labview VI

ACKNOWLEDGMENT

I convey my profound gratitude to the Principal Dr. M.V. Siva Prasad without whose blessings it would not have been possible for me to carry out this work.

I take the opportunity to offer sincere gratitude to our honorable Secretary/Correspondent Dr. P.Rajeshwar Reddy for his support and encouragement in completing my work.

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