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Robotic Arm Controller

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Abstract-*This paper has design and development of a robotic arm manipulator using Internet of things with low cost. The robotic arm has controlled bywirelessly is very helpful for broad range of applications which ranging from medical fields, automations in industries. With the popularity and widespread use of internet, it becomes an easy task for anyone to control and monitor the robots from a remote end. In this project, a robotic arm is designed to be controlled by an authorized person at any time and from any place using the web technology. With a web server, it becomes easy to control devices from a remote site. A web server is set up on the hardware side of Robotic Arm. From the client side, the control signals are sent over internet medium to a remote end to control the roboticarm.*

Keywords: *Human interface, Tele-robotics, Dual- arm manipulation, Robotics, IOT, Remote end, Internet.*

I. INTRODUCTION

New generation Robots have found applications in areas of work which are dangerous and hostile for humans. Due to this remote access, control and monitoring of Robotic systems have been an area of focus. Remote Sensing and Control in Robotics have found applications in areas like Remote Surgery in the world of medicine, Robots working in radioactive environments, undersea explorations, Space and Military [1]. With the growing awareness, popularity and its enormous technological growth, the Internet has proved to be the future of distributed systems. It is now possible to conceive and develop distributed systems that could be controlled and monitored across the globe through the Web Browser [2-3]. With advances in microprocessor technologies, miniaturization has enabled a high degree of intelligence to be integrated into systems. This has allowed integrating technologies like the Java NM, the TCP/IP protocol to enable Ethernet connectivity and serial protocols to talk to serialdevices.

II. DESIGN ANDIMPLEMENTATION

This paper mainly focuses on building a framework for embedded Java ingrained into intelligent microcontrollers. This takes a verydistributed and pluggable approach of building web components which are user friendly through the development of dynamic web pages. This enables the application to be deployed on a centralized http server located at one location and invoked through the Web Browser from another part of the globe [4]. This paper also makes use of the technologies like web services and Java communication APIs that gives us the ability to develop a Secure (through the use of Authentication), Generic (through the use of web services), Platform Independence (as Java by its nature can be deployed and run on any platform), Scalability (Complex algorithms and core functionality of the control system built in the form of a Web Service), Pluggability (The architecture by its design is loosely coupled which gives us the flexibility of plugging in/out components) architecture that could be used for other applications besides Tele-robotics over Internet [5].

A.SystemDesign

Tele-Robotic Arm setup is connected via Ethernet Module in the client side while the control software runs in the control server side [6]. Control server side uses Tera-term pro software to connect to the hardware IP address. Commands are sent and received in the Terminal software once the robotic arm IP is registered in the software. The S2E module transfers the data to and fro from the arm hardware from serial to Ethernet side. Obtained data from the Ethernet is processed by Nuvoton microcontroller and converted into arm co-ordinates. According to the calculated co-ordinates microcontroller send the control signal to the L293 motor driver unit. The value for X and Y axis are sends to the motor driver. Then the motor rotates to set position according to the command received. Remote programming combined with an advanced multimedia user interface. Allows only authenticated users to exhibit physical motions of the Robotic Arm. Lets the operator manipulate remote environment by using multiple ways of interaction. Rather than using sensor control, the developed system uses multi-mode GUI & command interfacecontrol.

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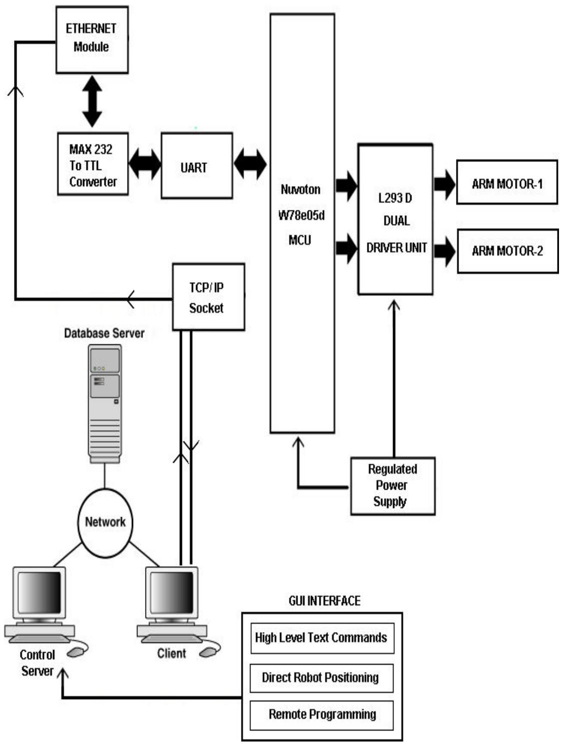

Figure-1: System Design of Tele-robotic

Today's Internet provides a convenient way for to develop an integrated network environment for the different variety of applications such as different robotic systems. The system has a standard network protocol and an interactive human-machine interface using a Web browser. Although the Internet provides a cheap and readily available communication channel for tele-operations, which influence the performance of the Internet-based tele-roboticsystems.

B.Robotic ARMDesign

During the project development, different configurations were tested in different environments. The aim is to develop a more reliable system framework that can be used in the real world.

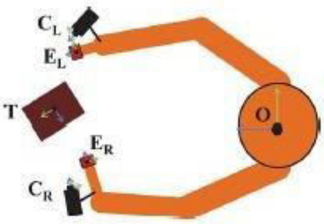

Figure-2: Robot Dual Arm Schematic

It is primarily addresses coordinated, task- based control methods for a dual-arm industrial robot. Since there is a large body of work on single-arm robotics, we narrow our scope of related work to only dual- or multi-arm robots. For autonomousoperations, tasks for Dual-arm robots are often pre- solved planning with known geometry information we present a tele-robotics framework for human- directed dual-arm manipulation[7].

C.Gripper ForceSensing

It is appropriate, for the gripper joint, to use a force sensor to measure the amount of force the slave is exerting on an object in its grip. Once the force data is accessible by the coordinator program it could be displayed to the user through the GUI of the coordinator program, or it could be employed to drive a motor attached to the gripper joint of the master unit thereby giving the user a sense of how much force is applied to an object [7]. Figure shows the transient response of the sensor when subjected to a step load of 300gm (from 100gm to 400gm). The settling time is approximately 500ms, which is acceptable for the intended applications of the system. The force sensor, which is essentially a variable resistor, is used to change the gain of an inverting high-gain operational amplifier, as shown in Figure 3. When using another sensor with a different sensitivity, the amplifier gain may need to be changed [8]. This is achieved by varying the potentiometer R2.

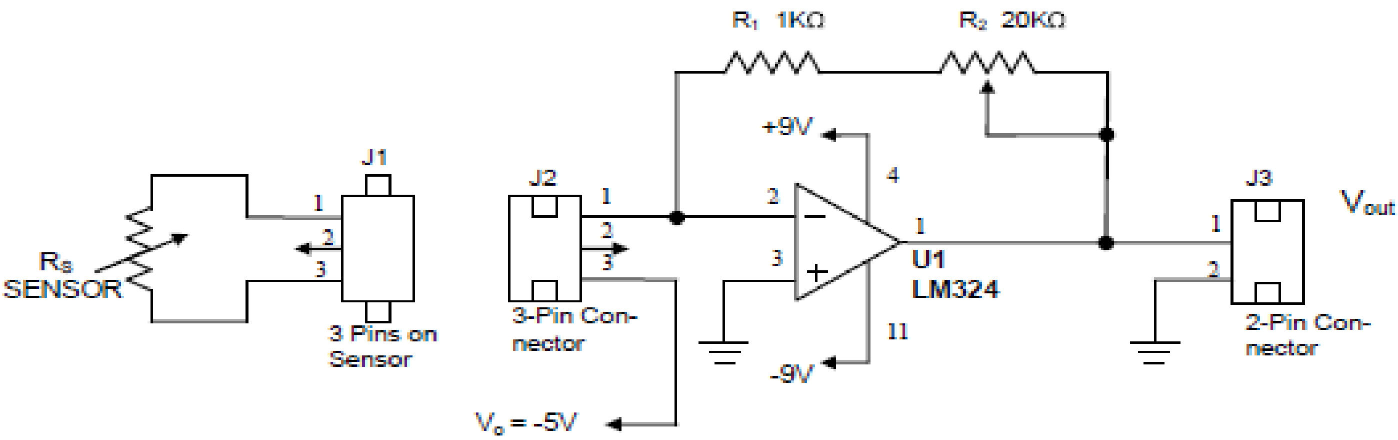

Figure-3: Amplifier circuit for force sensor output

III. REQUIREMENTS AND METRICS FOR HARDWARE

A.Serial-To-Ethernet (S2E)Module

S2E module accelerates the product development by providing ready-to-run hardware and comprehensive documentation. The compact design is based on the TEXAS microcontroller, a highly integrated ARM® Cortex TM –M3 microcontroller with integrated 10/100 Ethernet MAC and PHY, 50- MHz performance, and ample single cycle on-chip Flash and SRAM memory for efficient network traffic handling. The S2E module includes one 10/100 Ethernet port, two serial ports and 10-bit,3-channel ADC with flexibility that includes both RS-232 and CMOS/TTL level signalling, flow control, and hardware support for both synchronous and asynchronous serial communication.

B.Proteus 7Professional

This is the simulation software for project. This provides combines mixed mode circuit simulation, micro-processor models and interactive component models to allow the simulation of complete micro-controller based designs. Virtual Terminal is a tool in Proteus, which is used to view data coming from Serial Port (DB9) and also used to send the data to the Serial Port. In windows XP, there's a built in tool named Hyper Terminal, which is also used for the same purpose but in windows 7 there's no such tool so for windows 7 users this virtual terminal is quite a greatcomfort.

IV. RESULTANALYSIS

In this paper we have got the output from proteus simulation software. This software is used for mainly for all embedded based design. First of all we will draw schematic in schematic page after drawn schematic and to upload source program to microcontroller by using source program.

A.SchematicDesign

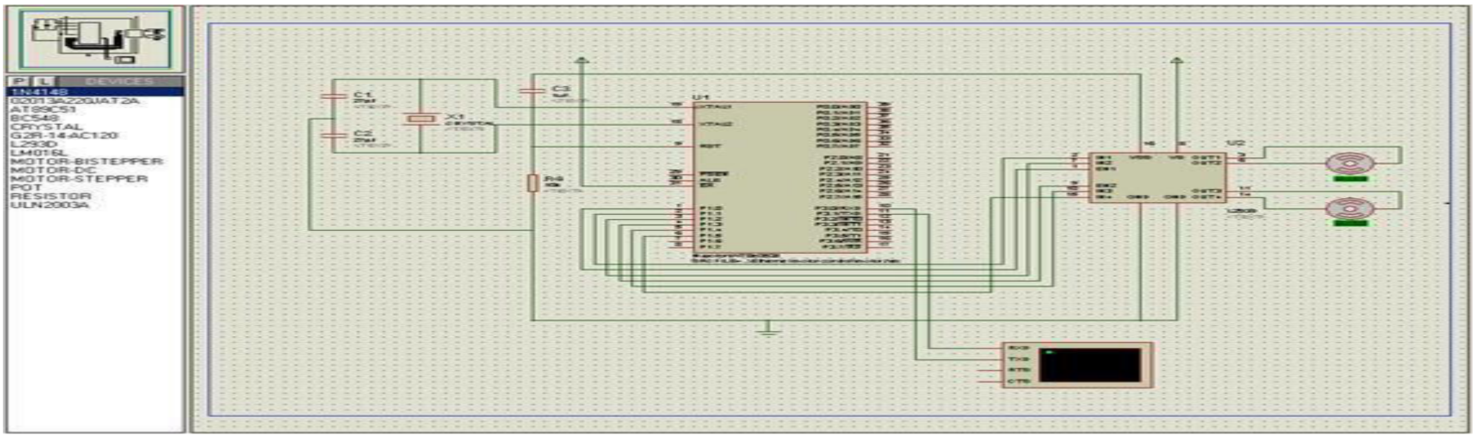

Figure-4: Schematic in Proteus

B.Execution - Input Commands & OutputResponse

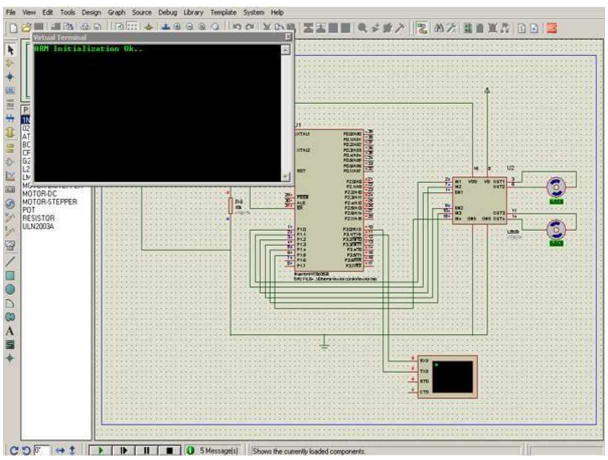

Figure-5:ExecutionResponse

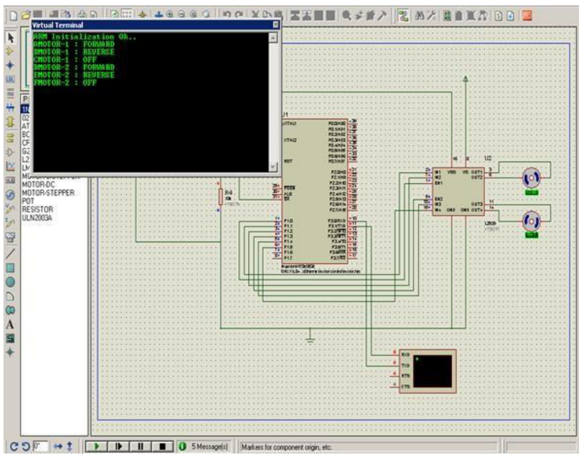

Figure-6: Input Commands &Output

Output executed by using virtual terminal and depending upon the input data the arm motor will be performed visually we will observed the position movement.

V. CONCLUSION

A simulation of the designed Robotic Control system was conducted through the Proteus software with the designed schematic for moving the Robot through a sequence of motions and performing an autonomous motion/task. The following conclusions are thereafter deduced. The user could define a numeric position for each of the Arm motors that constitute a physical position of the Robotic Arm and see it actually move to those coordinates thus making it easy for the user to define a set of positions to achieve a particular task. The user could enter valid range of positions and see the system prompt him for valid inputs. The virtual terminal allows the user to verify & control the motors and thus the Arm position in the terminal window.

VI. FUTURE WORK

The main focus on future enhancement is placed on how to control the robot with use of visual feedback and provide a high degree of local intelligence to handle the network and how to integrate multiple mobile robots into system to achieve redundancy and robustness. This will the way for other applications such as tele-training, tele- service, and tele-manufacturing.

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