

Servo controlled tele-robotic arm with electric grippers using internet of things

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Abstract - Tele-robotic is a term referring the control of a robot from a remote operable unit. Controlling of a robotic arm through wireless is very useful for wide varieties of applications like industrial and medical fields. With the widespread usage of internet controlling of robots from a remote end has become an easy task for everyone. This project proposes a robotic arm which is designed for control by a user at any time and from any place using the internet web technology. An internet of things server is set with the hardware side of robotic arm. The control signals are sent from client side through internet medium to a remote end to end control of robotic arm. Design of open-ended unmanned control architecture for robotic arm via the internet is developed. An attempt is done for development of a prototype framework which is scalable, pluggable, independent, generic type and in interoperable manner using web connectivity. The internet based tele-operations of robotics find great usage in applications that are risky, dangerous, and inaccessible to humans in the areas of work regardless of their geographical locations. Due to the growth of awareness in technical support, data transmission protocols, and low cost with ease of use in which the Internet has proven the most suitable infrastructure for worldwide information exchange and access.

Keywords: Tele-robotics, Arm manipulation, Robotics, IOT, Human interface, Remote end, Internet of things.

I. INTRODUCTION

Robots in new generations have found applications in work areas that are dangerous and insecure for humans. Due to this advantage of remote access control and monitoring, robotics systems became area of focus. Remote Sensing Control techniques in robotics have found much more applications in areas as such of remote Surgery in medicine world. Robots are working in risky environments like radioactive materials, under sea explorations, military and aero space applications. Due to the popularity and growing awareness and enormous growth in technology, the Internet of things has proved to be the future of global networked control. Now it has become possible to develop and progress distributed control systems that could be monitored and accessed across the globe using a web browser [1].

The internet over the years has matured leaps and bounds and is now a conceivable to think future of Tele-Robotics to be controlled and monitored over the Internet via the http protocol. Advancements in microprocessor technology, miniaturization has allowed a high degree of intelligence in embedded systems. Integrating technologies like the Java NM, the TCP/IP protocol has enabled serial communication and Ethernet connectivity protocols to talk to user devices [2]. Due to this technology advancement now we are in a position to build more system networked which collaborate with each other using various protocols like TCP/IP, RS232, HTTP, etc. This enables us to build independent, distributed, scalable, platform reusable applications that could be built once and run everywhere. It is now has become possible to build web applications that can communicate with other Java technology components like Web Services via the https web protocol[3]. This gives us the capabilities to build systems robot control intelligent systems through Web applications and other components like the serial communication channels.

II. DESIGN AND IMPLEMENTATION

This paper mainly focuses on building a framework for embedded Ethernet controllers grained into intelligence of microcontrollers. This takes us to a very distributed and pluggable approach in building web based components which were user friendly through the development of dynamic web servers. This enables the application to be deployed in a centralized https server located at single location and accessed through any web browser from another part of our globe [4], [5]. This system also makes use of the technologies like web based services and IPV6 communication APIs that gives us the ability to develop a Secure authentication system, generically through the use of web services, platform Independence as Java by its ability can be employed and run on any kind of platform, Scalability of complex algorithms and core functionality of the control system is built in the form of a web services, pluggable. The architecture by its own designed to be easily coupled which gives us the flexibility of plugging in/out. Also components of architecture that could be used for other applications besides Tele-robotics over internet are feasible [6].

a) System Design

Tele-Robotic arm mechanism is setup and connected via an Ethernet module at the client side. The control software runs from the control server side. Control server side uses the Tera-term pro software to connect at the hardware IP address. Commands are sent and received in the Terminal

software after the robotic arm IP address is registered in the software. The S2E module transfers the data from the arm hardware from serial port to Ethernet side. Data obtained from the Ethernet is processed by Nuvoton microcontroller and converted into co-ordinates values of arm.

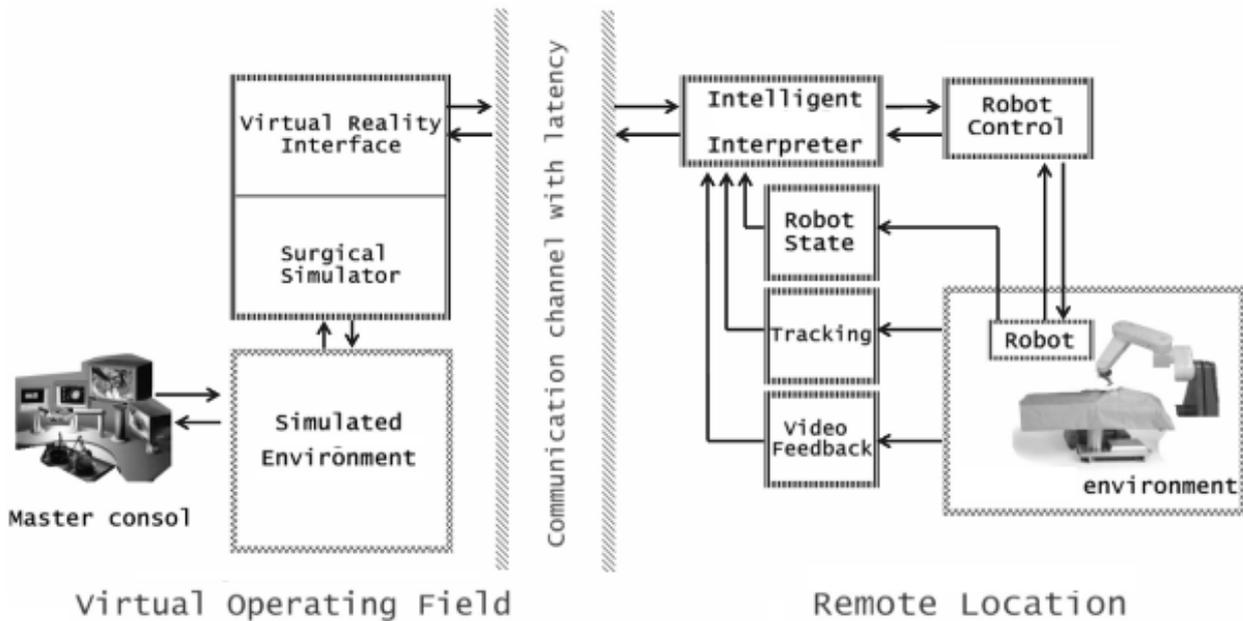


Figure 1: System Design of Tele-robotic Arm

According to the co-ordinates calculated using microcontroller, a control signal is send to control the L293 motor driver circuit. The X and Y axis values are sent to the motor driver unit from UART. Driver motor then rotates to the set position according to the received commands. Remote programming ability in achieved through an advanced multimedia user interface. This security allows only authenticated users to perform physical motions of the Robotic Arm. The operator can manipulate remote environment through all multiple ways of interaction. Rather than using sensor based control, the system developed uses command interface control and multi-mode GUI.

Nowadays Internet provides a comfortable way for to develop an integrated network environment for different variety of applications such as distant operated robotic systems. The system has a standard network communication protocol and an interactive human-machine interface using a Web browser [7]. The internet of things provides us a easily available, cheaper and ready to use safe communication medium for robotic tele-operations systems.

b) Robotic ARM Design

Different configurations were tested in different environments during development of the project. Our aim is to develop a system framework that is more reliable that can be used in real world applications.

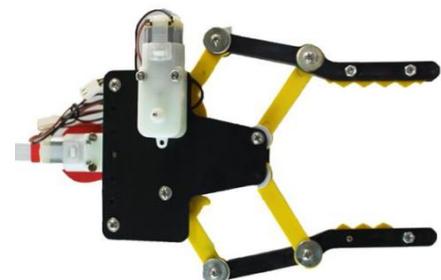


Figure 2: Robot Arm Schematic

It is primarily task-based control methods whose addresses are coordinated for an arm based industrial robot. Since there is a huge level of work on single-arm robotics, we reduce our scope of related work to only to multi-arm robots.

the input user data, arm motor will be perform visually we will then observe the movement position.



Figure 3: Robot Arm

- Can get the work done in seconds and faster compared to their human counterparts.
- Have the appropriate design and are flexible.
- More accurate operation.
- The safety of the working environment is increased and they never get tired actually.

For autonomous operations, tasks for robot arms are often preset in a planning with known geometrical information presented in a tele-robotics framework for directed human arm manipulation. The operator person provides input moving directives and data commands to control the system autonomously locating the object of interest maintaining force. It enables robots with multiple redundant arms that can tackle a broader range of many tasks than a single arm at the same time with increased complexity.

III. RESULT AND DISCUSSION

In this article we have got output using proteus simulation software. This software is mainly used for all embedded based system design. First of all we will draw circuits in the schematic page. After drawing schematic we upload source program to a microcontroller by using source program. The output is executed via the virtual terminal and depends upon

a) Schematic Design

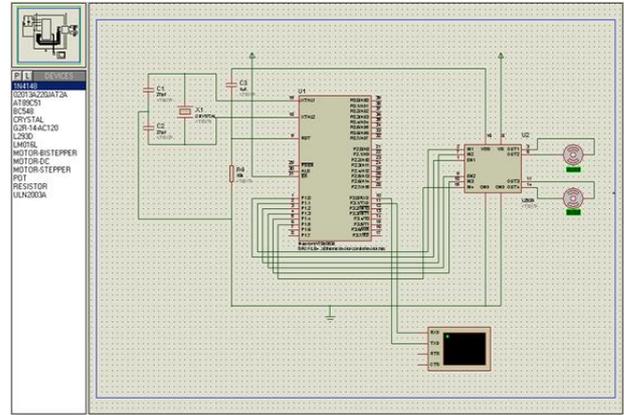


Figure 4: Schematic in Proteus

b) Input Commands & Output Response

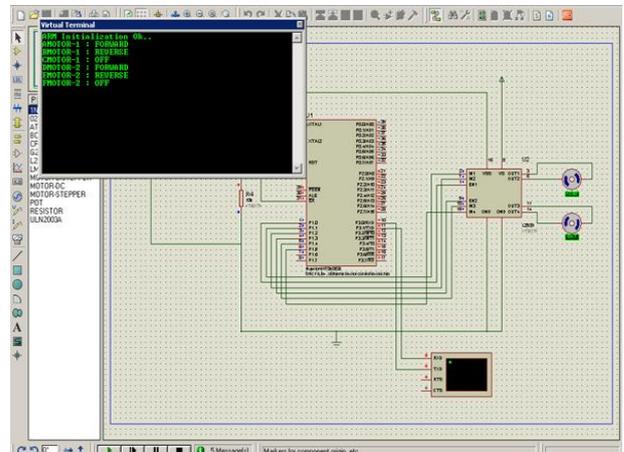


Figure 5: Input Commands & Output Response

IV. CONCLUSION

Robotic Control system is designed and simulation conducted through the Proteus software with our designed schematic robot moving through a sequence of motions and performs an autonomous task or motion. Therefore we conclude the following deductions. The numeric position for each of the Arm motors can be defined by user so that constitute a physical position of Robotic Arm and observe it move actually 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 position values within ranges and can see the system prompt him for valid inputs. The virtual terminal software allows the user to control and verify the motors and thus the position of arm in the terminal window.

V. FUTURE WORK

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

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