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Internet Telerobotic System

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Abstract—Teleoperation and robotics together combine and form a major field known as the Telerobotics.. As the autonomous robots are not completely developed, a human operator is required for the operation of the robot. Hence the principle of Teleoperation is considered for solving the problem. When the robot is able to perform the tasks independently it is called as Telerobotics whereas Teleoperation just concerns about remote access and operation. Telerobotics plays a major role when man has difficulty working directly as in the field of nuclear power plants or when the tasks are sufficiently complex. In our project we have used an application that has its platform in Android as well as i-OS to perform for teleoperation. This application connects to the system (here we have used a robotic arm with five degrees of freedom) which is also connected to a network through a common server. To connect the robotic arm to a network, we have used the Arduino Ethernet shield. Signals from the application identify the robotic arm by recognizing the network configuration properties of the robotic arm. These signals are processed by the robot controller and corresponding actuation is produced.

Keywords—Telerobot; ESP8266; Arduino Mega 2560; Blynk Application;

I. Introduction

When we hear the word Robot, the first thought that appears in our brain is either that in industries or that with the scientists for experimentation. But the main purpose of introducing robots is to help humans as in the case of industries or in doing household chores. To bridge this gap of thought internet will be in use [5] [2].

Robots are mainly introduced in to the industry not mainly to remove human labors but to perform repetitive tasks as humans are not efficient all time. The robotics can be divided into two major areas as service and industrial robotics. A service robot is the one that operates either semi- or fully autonomously for the well-being of humans.

In the recent years, internet is becoming the center for everything [5]. People tend to get online right from shopping to business rather than doing household chores compared to the last decades, internet is everywhere; just at the tip of your finger as in the form of smartphones and tablets.

This provides a great advantage to introduce Telerobots to household [5]. The robot is controlled using Arduino MEGA 2560 as the brain of the robot, connected to the internet via Arduino Ethernet Shield.

The robot's movement is controlled by inputting the desired degree of movement and then the robotic arm will move to the exact location that has been inputted.. There is also a per-processed movement of the robotic arm with a click of a button.

This project presents the internet controlled robotic arm. The movement of the robot arm can be controlled by any Android / i-OS smartphones/tabs via the internet that we are using in our everyday eliminating the need for a complex remote controlling.

The entire robotic system is connected to an internet server using Arduino Ethernet shield which is interfaced with the Arduino MEGA 2560 microcontroller and this in turn increase the flexibility of operation with the help of smart devices. This telerobot eliminates the need for the technical operator to be present at the time of operation.

In this project, an Android application called BLYNK is used in order to achieve the teleoperation of the robotic arm via the internet and control it.

II. CONCEPT OF TELEOPERATION

Teleoperation means operation of a machine from a distance which is similar in meaning to "remote control" and it is usually related in the field of research, academic and technical environments. It is most commonly associated with mobile robots and robotics in which a device or machine is operated by a person from a distance [6]. Devices designed to allow the operator to control the robot from a distance is sometimes called telecheric robotics.

Teleoperation is the term used in both research and technical communities and is by far the most standard term for referring to operation from a distance [2]. This is opposed to "telepresence" that is a less standard term and might refer to a whole range of interaction existence that include a remote connotation.

In simple cases the operator's command actions correspond directly to actions in the device to be controlled, as for example in a radio controlled aircraft or a tethered deep submerge vehicle; where communications delays make direct control impractical or it is desired to reduce operator workload; as in a remotely controlled spy or attack aircraft, the device cannot be controlled directly, instead a specified path is sent as a command.

At increasing levels of advancement, the device may operate somewhat independently in matters such as obstacle avoidance, also commonly employed in planetary rovers.

A telemanipulator or teleoperator is a device controlled remotely by a human operator. If such a device performs the work autonomously, it is called a telerobot. If the device is completely autonomous, it is called a robot.

III. Components and Their Description

ARDUINO MEGA 260

This is a microcontroller board and it is based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM or Pulse Width Modulation outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. As a microcontroller; it contains everything. Connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to begin the process. The Mega 2560 board is compatible with most shields designed for Arduino/Genuino Uno and the former boards Duemilanove or Diecimila.ARDUINO ETHERNET SHIELD

High efficiency DC/DC converter: The Arduino Ethernet Shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip. The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It has provisions for four simultaneous socket connections. Using the Ethernet library to write sketches, connect the microcontroller to the internet using the shield. The ethernet shield is interfaced to an Arduino board using the extending long wire-wrap headers from the shield. This keeps the pin layout intact and allows another shield to be stacked on top.

The most recent board exposes the 1.0 pinout on rev 3 of the Arduino UNO board. The Ethernet Shield has a standard RJ-45 connection, with an integrated line transformer and Power over Ethernet enabled.

The onboard micro-SD card slot on the shield can be used to store files for serving over the network. It is compatible with the Arduino Uno and Mega (using the Ethernet library) boards. The microSD card reader is accessible through the SD Library.

There is also a reset controller on the shield, to ensure that the W5100 Ethernet module is properly reset on power-up. Previously the shield were not compatible with the Mega since there was a need for manually reset, after power-up.

The current shield has a Power over Ethernet (PoE) module designed to extract power from a conventional twisted pair Category 5 Ethernet cable:

- IEEE802.3af compliant
- Low output ripple and noise (100mVpp)
- Input voltage range 36V to 57V
- Overload and short-circuit protection
- 9V Output
- typ 75% @ 50% load
- 1500V isolation (input to output)

MICRO SERVO MOTOR

The unit consists of a 30cm wire which is a 3 pin 'S' type female header connector that fits most receivers, including Futaba, JR, GWS, Cirrus, Blue Bird, Blue Arrow, Corona, Berg, Spektrum and Hitec.

This is particularly used since it can rotate 180 degrees (90 in each direction) (approx.). Any servo code, hardware or library can be used in order to actuate these servos. So it's great for beginners who want to move their stuff without building a motor controller with feedback & gear box. This is because; it contains everything that will fit in small places. The MG995 Metal Gear Servo also comes with a hardware and selected arms to get you set up nice and fast!

STEPPER MOTOR

The conversion of electrical pulses into discrete mechanical movements for the achievement of electromechanical movement is achieved by a stepper motor. Applying electrical command pulses in proper sequence, makes the shaft or spindle of the stepper motor rotate in discrete step increments. This is particularly used here in order to rotate the end effector for its roll motion.

IV. REASON FOR CHOOSING ARDUINO

- It is an open-source project, with extremely accessible software/hardware and very flexible to be customized.
- It is flexible, consist of variety of digital and analog inputs, SPI and serial interface and digital and PWM outputs
- It is easy to use, a USB is used to connect to the computer and communication occurs using standard serial protocol.
- The board is inexpensive and comes with free authoring software.
- Arduino is backed up by a growing online community, lots of source code is already shared and we can share and post our examples for others to use, too!
- Arduino MEGA 2560 is having about 54 I/O ports which is compatible for our project for connecting multiple servos and devices.

V. BLYNK APPLICATION

Blynk is an application that has its Platform in iOS and Android to control Arduino, Raspberry Pi and the likes over the Internet

By simply dragging and dropping widgets on the digital dashboard, you can build a graphic interface for your project.

Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Blynk will get you connected to the internet and ready for the IOT (Internet Of Things), once your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip.

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For connecting Blynk with the Arduino MEGA 2560 we need to install Blynk library in Arduino Software for programming. This Blynk app is connected to an internet server from where we receive signals from the User.

VI. OPERATION

Here in this an Android application called Blynk is used to send input to the arm via internet. The Blynk application works with both the leading operating systems used in smart devices. These smart devices are connected to the internet for running the application. When the device is connected to the internet the application gives us a security token for accessing the input signals from a specific device.

On the other hand the robotic arm with Arduino microcontroller is interfaced with an Arduino ethernet shield for connecting it to the internet via an Ethernet cable. The Arduino ethernet shield is pre-configured for connecting it with the internet using specific IP and network configurations within the program.

For receiving the signals via internet from the application.The user need to include the security token within the Arduino program. The Blynk application and the Arduino controller is inter linked by including the blynk library in the Arduino software. Now the codes in the Arduino can able to communicate with the application in the smartphone using internet. The input signals from the smartphone can now be processed by Arduino and the arm can be moved with the help of servo system for a specific program.

VII. CONCLUSION

The entire project can be divided into two major sections as the hardware development and software development. The hardware development includes the automation process of controlling servo motors and also develops the robotic arm link and joint. Software development consists of programming the Arduino MEGA 2560 using BLYNK app.

From the analyses that have been made, it's clearly shows that controlling a servo motor is quiet easy and the output is exactly accurate and precise. Thus, the servo motor is the right choice for the actuation of the robot arm.

As the internet connectivity is widespread nowadays, robots can be controlled via internet instead of an assigned controller or computers just for the control of robots. The main feature of this robot is quite the same as [7]. This project was successful and proved that robots can be controlled via internet and can be very flexible for controlling over smart devices.

VIII. TABLE

SERVO MOTORS

1. SPECIFICATIONS

Weight	55 g
Dimension	40.7 x 19.7 x 42.9 mm
Stall torque	8.5 kgf•cm (4.8 V), 10 kgf•cm (6 V)
Operating speed	0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
Operating voltage	4.8 V a 7.2 V
Dead band width	5 µs
Temperature range	0 ºC – 55 ºC
	Stable and shock proof double ball bearing design

STEPPER MOTORS

1. *SPECIFICATIONS:*

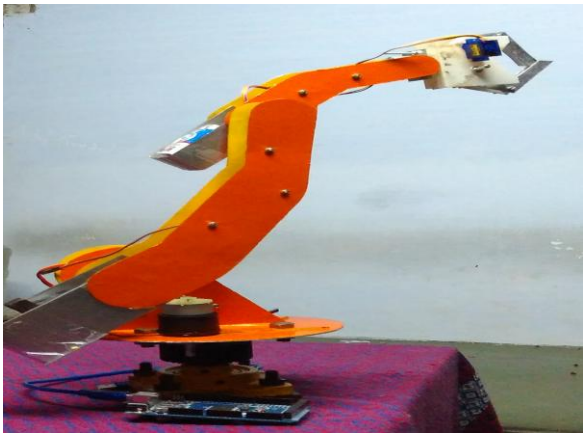
Rated voltage	5VDC
Number of Phase	4
Speed Variation Ratio	1/64
Stride Angle	5.625° /64
Frequency	100Hz
DC resistance	50Ω±7% (25℃)
In-traction Torque	>34.3mN.m (120Hz)
Self-positioning Torque	>34.3mN.m
Friction torque	600-1200 gf.cm
Pull in torque	300 gf.cm
Insulated resistance	>10MΩ (500V)
Insulation grade	A
Rise in Temperature	<40K (120Hz) <35dB(120Hz,No-load, 10cm)
Model	28BYJ-48 – 5V

STEPPER MOTORS

2. SPECIFICATIONS

Weight	9g
Dimension	22.2 x 11.8 x 31 mm
Stall torque	1.8 kgf•cm
Operating speed	0.1 s/60 degree
Operating voltage	4.8 V (~5V)
Dead band width	10 µs
Temperature range	0 ºC – 55 ºC

FIGURES OF TELE ROBOT SYSTEM



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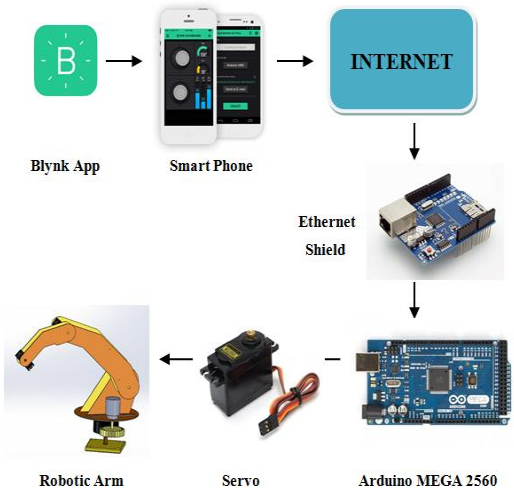
FIGURES OF BLYNK APPLICATION WHICH REMOTE THE TELE ROBOT



References

i. *R. C. Luo, K. L. Su,.A multi agent multi sensor based real-time sensory control system for intelligent security robot. IEEE International Conference on Robotics and Automation, vol. 2, 2003, pp.2394 .2399.*

ii. *Riyanto T.Bambang "Development of Architectures for Internet Telerobotics Systems"*

iii. *Larry Leifer, George Toye, Machiel Van der Loos "Tele-service-robot: Integrating the socio-technical framework of human service through the InterNet-world-wide-web"*

iv. *Alberto Sanfeliu, Norihiro Hagita, Alessandro Saffiotti "Robotics and Autonomous Systems"*

v. *Alberto Jose Alvares, Joao Carlo Espindola Ferreira "Web Turning: Teleoperation of a CNC turning center through the Internet".*

vi. *Keitaro Naruse and Makoto Oya, "Muscle-like Control of Entertainment Robot over Internet", International Conference on Advanced Intelligent Mechatronics, Monterey, California, USA, 24-28 July, 2005.*

vii. *Tse Min Chen and Ren C. Luo," Multisensor Based Autonomous Mobile Robot Through Internet Control", Department of Electrical Engineering, National Chung Cheng University.*

viii. *Cecilia E. Garcia, Ricardo Carelli, Jose F. Postigo,Carlos Soria "Supervisory control for a telerobotics system: a hybrid control approach".*

ix. *Hao Zhong, Juan P. Wachs, Shimon Y. Nof "Telerobot- enabled HUB-CI model for collobrative lifecycle management of design and prototyping".*