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Wireless Robotic Arm

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Abstract

This project "Wireless Robotic Arm" functions and demonstrates simplified electro-mechanical arm works and controlled by wireless technologies such as Ethernet(Internet), Bluetooth v2.0 UART module via Android application using Arduino microcontroller and standard Servo motors to mimic the human hand movements. This Wireless Robotic Arm gives rough idea of remotely controlled system with different wireless platform technologies.

Keywords- *Arduino microcontroller, Android application, Bluetooth UART, Ethernet Shield, Standard Servo motors*

I. INTRODUCTION

This document provides desired idea and working method of Wireless Robotic Arm. Due to incredible easiness and wide and variety input/ output interface range this project is using Arduino micro-controller as it's brain. The rapid growth in industrialization inspires this project but in different way. Normally the devices such like one are being controlled under worker/computer interface or via wireless but to a specific operation range. This system eliminates all the restriction as far as operation range is concerned. In order to achieve specific challenge through this it uses very handy and portable Android application along with Bluetooth UART and an Ethernet shield. As per requirements of user, they can select between operation by Android application or by Ethernet shield or work simultaneously.

II. BACKGROUND

In this topic different tools hardware as well as software regarding this Wireless Arm is discussed.

2.1. Arduino Microcontroller

Arduino Microcontroller is nowadays very rapid and small prototyping compact micro-controller system for hobbyists, artists and engineers to design small project based on microcontroller. This controller used its own developing environment called as Arduino IDE. Wireless Arm uses Arduino Uno microcontroller.

Arduino Uno is AVR based Atmel AT-Mega 328 microcontroller with clock speed of 16 MHz and 14 Digital Input/ Output pins with 6 analog inputs and 6 PWM (Pulse Width Modulation) output pins. Servo motors of this Arm are connected on these PWM pins of Arduino Uno.

2.2. Android App Inventor

Android App Inventor is online Android application developer, developed by Google and MIT. It uses unique programming language known as Block language and contains basic GUI. In this environment Bluetooth UART (Universal Asynchronous Receiver/ Transmitter) which will be connected to developed application in Android smartphone. Bluetooth UART will be connected with Arduino Uno and the corresponding controlling signals are sent from Android smartphone wirelessly.

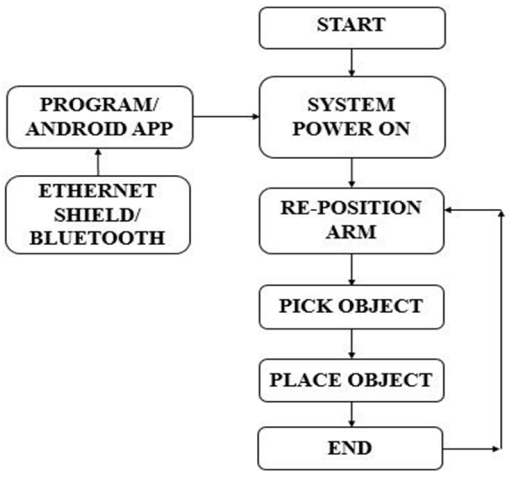
2.3. Arduino Ethernet Shield

As the name suggests itself this hardware is readymade PCB and can be directly mounted on any Arduino board. This will make any Arduino board connect on Ethernet by uniquely assigned IP address and range will be incredibly increased than Bluetooth UART module. Thus this project can be controlled simultaneously by 1. Android smartphone and customize developed Android Application in Android App Inventor 2. By simply developed HTML page in Arduino IDE and Ethernet Shield interfaced with Arduino Uno.

2.4. Servo Motor

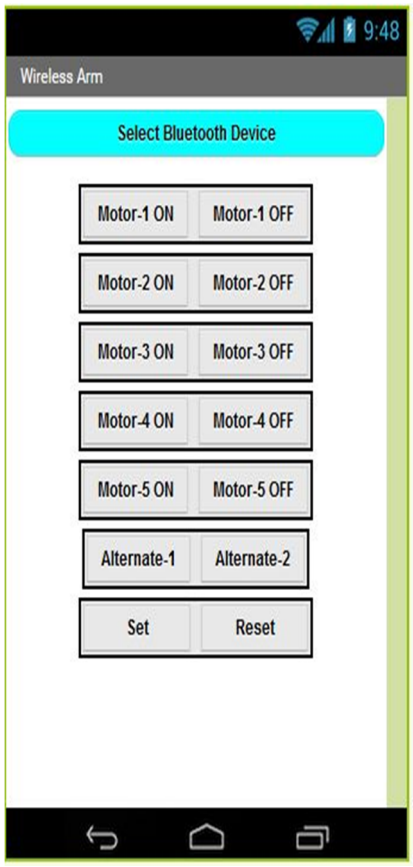
A motor is used to convert electric current to motion. Current may be alternating or direct, depending upon application. As far as motion concern electric motor used to rotate 360, but some specific application such like one is requires only few degrees of rotation. To achieve this accurately Servo motor is used. Servo motor rotates 0-180 instead. In Arduino IDE there is library available for Servo motors for easiness and fast interfacing. For this Arm four servo motors used to get desired motion of Arm and a separate 5VDC power supply.

III. WORKING ALGORITHM



IV. SOFTWARE APPLICATIONS

This section represents the GUI software developed in HTML and Android App Inventor for computers and Android smartphones respectively. The HTML page source code runs in Arduino microcontroller along with Bluetooth UART controlling software. The development of HTML page is being done is Arduino IDE as well. But the difference was Android App runs on Android smartphones and is standalone system instead. Below two pictures are snapshots of HTML page taken from PC and Android application taken from direct App Inventor developer's page respectively.



V. WORKING METHODOLGY

In this section working flow of this system is discussed. Starting from Ethernet shield

5.1 Workflow from Ethernet shield

After connecting or mounting Ethernet shield directly on Arduino Uno micro-controller and connecting with PC, user(s) have to start their internet browser application in order to operate this Arm via Internet/ Ethernet over wireless such as Wi- Fi. After opening the web browser user must have to unique IP address of the Arduino Ethernet shield pre-programmed in Arduino IDE. Providing same IP address following page will open in web- browser and the entire Arm which will interfaced with Arduino microcontroller will controlled by this panel via Ethernet shield.

5.2 Workflow from Android Application

As discussed from above section this Arm can connected and controlled via Android Application by connecting Arduino microcontroller. In order to achieve that user must have an Android smartphone and they have to enable or switch On the Bluetooth in it. Advancing, for multi- media transfer user must have to pair one another devices to enable data transfer, same way here to enable communication between microcontroller and Android application they must pair Arduino interfaced with Bluetooth UART and Android smartphone. After the pairing is successful a message will pop-out on Android smartphone "Connected" (not shown here). After as per Ethernet shield HTML page opened and user can direct control the Arm, exactly same way here after popping-up of "Connected" message users can directly operate Arm by corresponding Motor On- Off buttons on application GUI layout.

VI. IMPLEMENTATION

Advancing in design implementation, as from above this system is under its prototyping stage. For prototyping, light weight is must for such application. The initial preference were light weight wood, plastic sheet but last choice was transparent 3mm acrylic sheet instead. The sheet was LASER cut by customized size to reduce chances of failure by considering center of gravity, replacement and interfacing of servo motors if needed for maintenance. The overall dimension for this system was at prototype level is 93 square inches. This system works under 5VDC @ 2A power supply and weights around 450 grams.

Above whole design can be further modified to industrial grade/ level by changing only power supply for corresponding Servo motors going to use. Entire power supply unit will also have to match the corresponding microcontroller compatible to Arduino microcontroller boards such as Uno, Mega 2560, Due, Duemilanove. Above leads to end and conclusion of this sytem.

VII. CONCLUSION

Concluding this article, this project tested and executed its functionality completely under necessary requirements. This leads us, we can achieve and implement such projects to its necessary application and wireless operation seeking places, firms, plants and industries where human activity restricted or harmful.

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