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Arduino controlled robotic arm

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Abstract. When we talk about robots, people tend to think that robots are only suitable for use in industry or only for the new world. At present, many names in the postal mail. To bridge the gap in the natural perception of "industrial spaces", use this robot to be used in everyday business. The robot is controlled by the Arduino Uno microcontroller which interacts with the internet using the Arduino Ethernet Shield. Two kinds of analysis were done for this project the accuracy test shows that the performance results for servo motor comparing Serial Fire to Arduino Uno online is between (90% to 95%). Show this form publicly for the previous operation.

Keywords: Hand robot, Arduino Uno, Arduino Ethernet Shield.

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1. Introduction

The field of robotics has its origins in science fictions. The word robot comes from the Czech word "robot" means forced labor in 1920. It took another 40 years before the modern technology of industrial robotics began. Today, robots are highly automated mechanical manipulators controlled by computers. A robot may appear like a human being or an animal or a simple electro-mechanical device. A robot may act under the direct control of a human (e.g., the robotic arm of the space shuttle) or autonomously under the control of a programmed computer.

Robots may be used to perform tasks that are too dangerous or difficult for humans to implement directly (e.g. nuclear waste cleanup) or may be used to automate repetitive tasks that can be performed more cheaply by a robot than by the employment of a human (e.g. automobile production) or may be used to automate mindless repetitive tasks that should be performed with more precision by a robot than by a human (material handling, material transfer applications, machine loading and unloading, processing operations, assembly and inspection)[16].

It has increased researches on robotics have thanks to up- and-coming new technologies and work on this field has gain speed. Especially, the pioneering researches based on robotics hand and arm designs have been realized in several research centers on the world since the 80's. The first prosthetic robot hand that consisted of 3 fingers and 1 thumb is developed by Utah University and MIT in 1986[2].

The technological advances in the fields of robotics and electronics have translated into the field of prosthetic hands. This has resulted in new commercial devices like dexterous hands, motorized wrists and elbows that can potentially restore enhanced manipulation abilities. However, this new hardware requires suitable control systems and interfaces in order to maximize its effectiveness. The control interface should allow for easy activation of prosthesis functions and grasps that in turn are reshaped automatically Manuscript received June 6, 2014; revised October 6, 2014, March 8, 2015, July 26, 2015 and December 13, 2015; accepted January 2, 2016. Date of current version January 11, 2016. This work was supported in part by Brevican Innovation A/S, The Danish Agency for Science, Technology and Innovation and Sahva A/S [20].

The main aim of making human hand tracking system is to create interaction between human hand and robotic arm. Man – machine interaction gives the relation between human and computer. The idea shows the creation of a robotic arm which is as similar to the human arm as possible and not to limit the arm to one set of tasks. internet nowadays is becoming the center for everything. People tend to get online rather than doing household chores[18]. Internet is now everywhere, compare to the last decades where internet is only wired, and people needs to be in front of the computer to access the internet but nowadays, internet is just at the tip of your finger. This is an advantage to introduce robot to household [1][19]. The robot is wireless controlled to ensure it can journey a long way from the user. For example, previous project robot Autonomous Robot Navigation using radio frequency that similar to this project. The robot was prepared mechanically to be suitable for this RF to work [4]. Introduced the technology used to track the arm and interface it to control the robotic arm for different activities. The motions can be controlled by the user by moving our hand in any direction. This paper is very important since it gives an intuitive way to develop human centered forms of human machine interaction. At the same time it is difficult to control, since it needs different identification schemes of hands such as pattern recognition, tracking, color identification and giving X and Y axis to the points.

This new hardware requires suitable control systems and interfaces in order to maximize its effectiveness. The control interface should allow for easy activation of prosthesis functions and grasps that in turn are reshaped automatically by the prosthesis. Traditional control schemes in the field of upper limb prosthetics include both single sensor modalities and multimodal approaches. The most frequently used single sensor modality is the electromyogram (EMG) signal; several studies have been carried out using surface EMG and intramuscular recordings [20].

The Arduino microcontroller is an easy to use yet powerful single board computer which has on board microcontroller ATmega-328 operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing Parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. It has total 28 pins including analog and digital pins. There are 3 PWM (Pulse Width Modulation) output pins on this

board. Also, it has 6 analog inputs, a USB connection, a power jack, a 16 MHz ceramic capacitor, an ICSP header and a reset button. The Arduino programming language is a simplified version of C/C++. The Arduino programming language is a simplified version of C/C++. The Arduino has ability to interact with the outside world through its input-output (I/O) pins. The Arduino has 14 digital I/O pins labeled 0 to 13 that can be used to turn motors and lights on and off and read the state of switches as shown in figure 2. To check the workability and serial port of board with PC, a simple LED flashing code and serial communication code is burned and results are as under: Operation: 1) condition 'on' – LED blinks 2) condition 'off'- LED doesn't blinks [2]. Arduino is used as the brain of the robotic arm, force sensors are placed at the gripper for finding the force applied on the object, and potentiometers are used at the joints for detecting the position of the motor shaft [17].

2. Objectives and problem statement

The main problem that discuss in this paper is difficulty capturing objects that are far from the user in confined spaces and the lack of efficiency and flexibility of the human hand [4]. The objectives of this paper are:

- To design the robot arm to suit a specific task for household or Industrial usage.
- To control robotic arm using Arduino.

3. Related work

Presented the development of an internet controlled robotic arm. The movement of the robot arm can be controlled by a computer via the internet. This robot can be used to demonstrate that a robot can be used inside a home for daily human chores [1].

Suggested in this study, a robot hand is intended to repeat finger movements depending upon flexible sensors mounted on any wearable glove. In the literature, various sensors that detect the finger movement are used [2].

Developed of 5-Degree of Freedom (DOF) robotic arm which is used for feeding the elderly or specially challenged people, where the position of the joints is controlled by the user. Using principles of robotic Kinematics and MATLAB, the robotic arm is controlled[15-17]. The algorithms are verified using stick diagram. A Graphical user Interface is developed for controlling the actuators which in turn controls each joint of the robotic arm[14]. Arduino MEGA2560 I/O board is the main heart of this project which interface with the Graphical User Interface, motors and sensors. A mimic of the developed robotic arm is designed in MATLAB and it is simulated using forward and inverse transformation to check the accuracy of the algorithm [3].

Presented the development of a wireless mobile robot arm. A mobile robot that functional to do pick and place operation and be controlled by using wireless PS2 controller. It can move forward, reverse, turn right and left for a specific distance according to the controller specification. The development of this robot is based on Arduino Mega platform that will be interfaced with the wireless controller to the mobile robotic arm [4].

Proposed control is based on the Flexible sensor and the Arduino controller. It is used glove to transferring the gestures to simulate the motion of the five fingers of human hand by using five fingers of the robotic hand [5].

Showcased various practical applications of an animatronic model of hand by the use of MATLAB. Gesture-based communication is utilized in this design. A gesture will be recognized through a webcam and image grabbed using Image Acquisition toolbox of MATLAB [6].

Focused on understanding the different techniques that are used for human robot interaction in robotic hand arm systems. Diversification is stated in areas of human and robotic hand interaction, the degrees of freedom, the grasping ability, number of fingers and materials used for the hand. The flexibility of grasp is compared in terms of Degrees Of Freedom (DOF) and the number of finger end effectors [7].

Explained of a robotic arm, prepared by him, which is operated & controlled wirelessly with the help of hand gestures. It's a CLASS – 5 Robot (Numerical Control Robot). The complete robotic assembly is made into 2 parts viz a transmitter assembly put on the gloves comprising of APC-220 Module, Arduino Board, Gyroscope, Accelerometer and a receiver (Robotic Arm) comprising of

APC-220 Module, Arduino Board, Servo Motors and arms mounted on circular revolving base made of acrylic sheets [8].

Proposed applications in different fields, ranging from simple household chores to space explorations. There are different ways to control these robots, but imagine the case of controlling a robot miles and miles away through the internet. This paper describes the use of internet to control the robotic arm from a remote end by means of a visual feedback so the user can see the movement of the robotic arm from anywhere [9].

Suggested control methods for robotic systems that involve the use of central pattern generators (CPGs) have been attracting considerable attention owing to the fact that most humans or animals move and walk easily without explicitly controlling their movements. Furthermore, they exhibit natural adaptive motions against unexpected disturbances or environmental changes without considering their kinematic configurations [10-13].

4. Design steps

Step 1: Connect the DC board to the Arduino so that it becomes as in the figure 1:

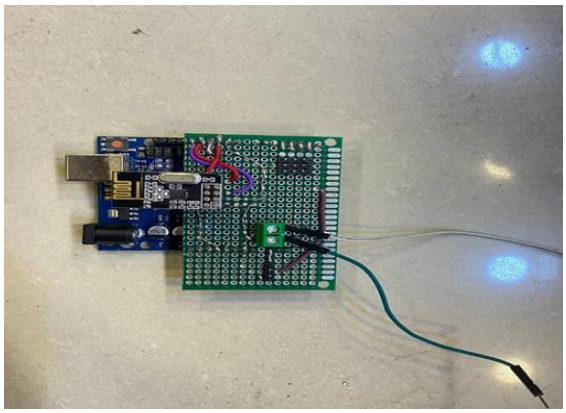

Fig.1. Step 1 Project Design

Step 2: connect the DC Board blocks to the servo motors wires. The wire consists of (VCC, Ground, and Signal). It is connected internally to preserve the wire from movement and signal loss Connect the NRF with the DC Board through the following data (9, 10, 11, 12, 13) that transmits data via Wi-Fi. As shown in the figure 2.

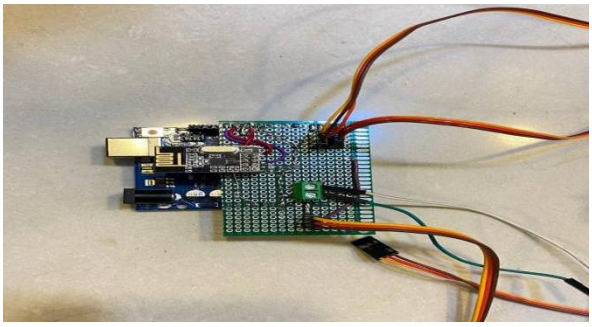

Fig. 2. Step 2 Project Design

Step 3: In this box we put a piece of DC Board with Arduino (RX), which will be the robotic hand, as shown in the figure 3.

Fig.3. Step 3 Project Design

Step 4: Shield joystick consists of four push-button joysticks and a movable joystick, and we connect the NRF with the pins () and the rest of the pins to the push-bottom, and we used the joystick for easy movement of the hand and this part is called (TX), as shown in the figure 4.

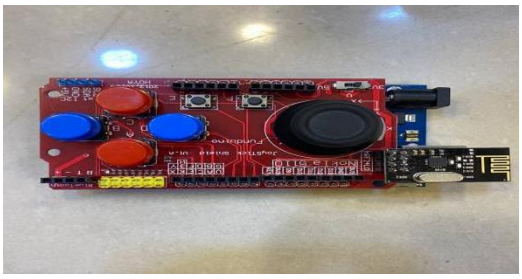

Fig.4. Step 4 Project Design

5. Result and Discussion

The robotic arm that operates in the Internet, as shown in Figure 5 and 6 has been developed for real-world applications. Can simulate human movement such as pick, place and manoeuvre.

Fig. 5 and 6.

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المخلص .عندما نتحدث عن الروبوتات، يميل الناس الى الاعتقاد بأن الروبوتات مناسبة فقط للاستخدام في الصناعة او للعالم الجديد فقط. في الوقت الحاضر هناك العديد من الاعمال المتداولة للروبوتات. وذلك لسد الفجوات في الاستخدام "للمساحات الصناعية" . ولكن االستخدم هذا الروبوت في الاعمال اليومية والصناعية . يتم التحكم في الروبوت بواسطة Arduino Uno الذي يتصل بالانترنت بأستخدام .Arduino Ethernet Shield تم أجراء نوعين من التحليل والتجربة لهذا الروبوت أضهرت االنتائج بأن دقة ال servo motor مقارنتا مع ال Serial Fire تتراوح بين 90% الى 95%.