HAND GESTURE CONTROLLED ROBOTIC ARMUSING ARDUINO NANO

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A. ABSTRACT

Technology is growing at the same time that human desires are rapidly expanding. Every day,the work done to meet these needs makes life easier, and the majority of this research is centred on robotic arms. Robot arms may communicate with humans or obey pre- programmed commands. In all sectors, industry and medicine are presently the most developed fields for robot arms. The robot arm, which was conceived and manufactured as part of the project, has five servo motors and can move in four directions. You may take the essential material from one location and carry it to another, as well as combine it with the material, it gets, thanks to the holder. The robot is controlled by hand gesture connected to an Arduino Nano microcontroller through a sensormodule.

1. INTRODUCTION

People nowadays have a constant need for extra assistance systems. Individuals are now being directed to look for other markets due to the rapid rise in the flow of information, and peoplehave entered the race to create excellent items ata low cost. This will need the use of automation technologies. Because standardised automation systems, as well as skilled and well-trained workers, are essential for high-quality goods. People had to employ auxiliary equipment in regions where their strength was
insufficient due to their physical traits. With the advancement of technology, many devices that formerly required human aid to work have been created to operatespontaneously without the need for human power. One of the most frequent components of automation systems is robots. Mechatronics Engineering, Mechanical Engineering, Electrical Engineering, and Computer Engineering have all contributed to the development of robotic systems. Researchers have been hired and included into the project in order to get a better understanding of mechanics and software during the operations of the robot arm, which is designed to carry out duties basedon predetermined commands. First, it was established what the robot arm's role would be and what actions it would be capable of. Robotic arm controlled by an Android phone or tablet that can transport the appropriate material, mix it up, and carry out the orders set by the user. If this is a defined duty, the robotic arm will take a piece of material and place it in the proper position, then record its motions and repeat the process until we stop it. Because the motor to bepicked must function accurately and at high torque, a servomotor is preferred to be able to conduct these activities efficiently. The robot arm is made up of five servo motors that can move in four different directions. The Arduino Nano microcontroller is coded in Java and servo motor control is supplied in this project. As a result, the needed actions may be performed using only the elements on the Arduino and no further circuit design than the circuit containing the servo motor inputs. The robot arm is designed with the SolidWorks programme for the mechanical portion, and its measurements are supplied. A 5V power supplyis also recommended for the robot to function properly.

The following is a list of the project's goals:
- To build a 6-axis robotic arm.

- To programme the robotic arm to respond to gestures.

- To have a better understanding of Leap motion sensor technology.

In this project, the gesture control approach will be used. The bomb disposal operation will be more efficient with this gesture controlled robotic arm since the robot can function in a faster and more intuitive manner, and no training is required.

2. THEORETICAL INFRASTRUCTURE

The project's theoretical underpinning is discussed in the sections below as main headings and sub-headings. The mechanism's last control element is servo motors. Servo motors are utilised in combination with electrical or programmable circuits because they are extremely sensitive. There are two types of engines: AC and DC. When brushless AC servo motors are used, the servo motors brush. Servo motors are usually made up of three cables. A red wire is for power black cable is for grounding, and a yellow cable is for control (data, data). Figure 1 depicts one of the servomotors utilized in the
project's production phase. In the project Tower, Pro SG90 Mini servo motor is used. Some features of this servo motor; versatile operation, 10 µs pulse widthcontrol, VP-P: 3-5 V Square wave and working voltage of 4.8-6V. At low operating voltage, the utilised servomotor has a working voltage of 0.12 s /60° and a torque of 1.2-1.6 kg/cm.

The following are the factors that have contributed to Arduino's quick spread:

- Because of the simplicity of the development environment and driver usage, it can be utilised on any platform. Even difficult procedures may be solved with the sophisticated library'sassistance.
- Because Arduino programmes are notexecuted on any other platform, they

runrapidly.

- Arduino programmes execute quickly since they are not run on any otherplatform.
- Because it is open source, communicating with the environment is

straightforward.

- A simple solution may be found if thereare any difficulties created by a large number of Arduino users.

The Arduino Nano is a breadboard-compatible, full-featured Arduino card that holds a microcontroller (Arduino Nano 3.x) or an

Atmega168 (Arduino Nano 2.x). It performs

The connection can be started by a master module, but it cannot be started by a slave module. We will give an external device to link to a slave PC or an android smartphone in our project. It is possible to send and receive bidirectional data in a healthy manner.

Fig 3: HC-06 Bluetooth Module

A virtual com port connected with the module is formed on our computer after adding the device to the Bluetooth devices. The module now allows you to interact over Bluetooth. A PC connected to the Bluetooth module may receive the codes transmitted through UART by the microcontroller (PIC18F46K22). Themicrocontroller receives data from the PC and COM ports.

2.1. CIRCUIT DIAGRAM

Inputs include servo inputs, Arduino pin inputs,and Bluetooth module inputs. The Bluetooth module Arduino Nano connectors and power supply connections are displayed, as well as how servo motors are actuated. The 5V from thepowersource may be distributed to the servo motors using the circuit we utilise.

The mechanical component design and the mechanical part installation are separated into two sections in the design section.

3.1.PROJECTED METHOD

First, historical study on robot arms wasconducted to collect the essential information required to set up the system. Because of the holder, the robot used in the project has an arm joint and can move in four directions (left and right, up and down, and hold and swing motions). The Arduino Nano microcontroller isutilised to provide the robot arm the best possible control. Because the open-source code is easier to use than other microcontrollers and the number of users is bigger, this microcontroller is preferred because it is more accessible to find a solution to a probable mistake.

Following these investigations, precise information on the servo motors to be utilised was gathered. The servomotor was chosen because it can be employed smoothly in a robot project, has a high torque output, and can be regulated precisely. Five servo motors make upthe robot arm. Because of the overabundance, servo motors are numbered from top to bottomto illustrate their functions.

4. CONCLUSION

The 5V electricity from the supply source is sentto the servo motors through the connecting boxThis procedure makes use of servo motor inputs, Arduino pin inputs, and communication circuit elements.The mechanical element of the robot arm is created by correctly mixing pre- selected pieces. To appropriately operate therobot arm, software using the chosen Arduino microcontroller was created, followed by an experiment with the Bluetooth module and servomotors to learn about the system's functioning. The software has been programmed to workwith the proper Arduino microcontroller, allowing the robot arm to move as needed for the task at hand. The android application's axes maybe moved in the '-' and '+' directions to control the robot arm. Many aspects of robotic arms can be developed.Many duties have been made easier as a consequence of the robotic arms, and the ensuing error level has been reduced to a minimum. Some pharmacy-based drug-giving robots and a proposed robot arm, for example, have been created. Furthermore, the robot arm'scapacity to
move is enhanced, and when the camera is positioned in the finger region and thesensitivity is raised, it may be employed in a variety of applications ranging from medical to automation systems. The danger of infection in the medical industry is reduced, and human mistakes during surgical interventions are reduced, thanks to robotic arms produced in thismanner. Despite the fact that this project's robotic arm is a prototype, it has a quality that can be

enhanced for future robotic systems. Aside from these, the robotic arm industry, which is still developing, will continue to be important in the future.

The goal of the project is to operate a four-axis moving robot arm using an appropriate microcontroller and Bluetooth module, as well as an Android application. For this goal, the essential theoretical and practical knowledge has been acquired, and the project's infrastructure has been constructed. A lot of theoretical information was translated to practise during the process of creating and developing the project, and it was assured that it was suitable for the project's objective.

5. REFERENCE

1. WMHW Kadir, RE Samin, BSKIbrahim. Internet controlled a robotic arm.
2. Procedia Engineering. 2012.
3. MAK Yusoff, RE Samin, mobile roboticarm. Procedia Engineering. 2012.
4. AM Al-Busaidi, Development of an educational environment for online control of a biped robot using MATLAB and Arduino, (MECHATRONICS), 9th France- Japan.2012.
5. HS Juang, KY Lurrr. Design and controlof a two-wheel self-balancing robot using the
6. Arduino microcontroller board. Control and Automation (ICCA),2013.
7. R Krishna, GS Bala, SS ASC, BBP Sarma. Design and implementation of a robotic arm based on haptic technology.Int. J. of Eng. Research. 2012.
8. 7. Electric Electronic Technology-Step and Servo Motors, SVET, 2007. [11]Barisal, A. K., & Mishra, S. (2018). Improved PSO based automatic generation control of multi-source nonlinear power systems interconnected by AC/DC links. Cogent Engineering, 5(1), 1422228.
9. Mishra, S., Barisal, A. K., & Babu, B. C. (2019). Invasive weed optimization-based automatic generation control for multi-area power systems. International Journal of Modelling and Simulation, 39(3), 190-202.
10. Sahoo, S. S., Chatterjee, K., & Tripathi, P. M. (2019). A coordinated control strategy using supercapacitor energy storage and series dynamic resistor for enhancement of fault ride-through of doubly fed induction generator. International Journal of Green Energy, 16(8), 615-626.
11. Barisal, A. K., Panigrahi, T. K., & Mishra, S. (2017). A hybrid PSO-LEVY flight algorithm based fuzzy PID controller for automatic generation control of multi area power systems: Fuzzy based hybrid PSO for automatic generation control. International Journal of Energy Optimization and Engineering (IJEOE), 6(2),42-63.
12. Sahoo, S. S., Roy, A., & Chatterjee, K. (2016, December). Fault ride-through enhancement of wind energy conversion system adopting a mechanical controller. In 2016 National Power Systems Conference (NPSC) (pp. 1-5). IEEE.
13. Sahoo, S. S., Tripathi, P. M., & Chatterjee, K. (2020). Effectiveness evaluation of passive resistive element placement on a fault ride-through enhancement in a DFIG-based wind energy conversion system. Wind Energy, 23(3), 825-848.