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Simulation of Robot Arm Control System by Bluetooth Using Arduino

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ABSTRACT

Era 4.0 is often called the technological era, where technology has penetrated various fields. One application of technology in the industrial sector is the creation of 4-armed robots. However, in this case, 4-armed robots are rarely operated automatically. Therefore, a 4-arm robot simulation was designed using servo motors via Bluetooth. This research aims to design a 4-arm robot that is controlled using Bluetooth. The methodology used is the simulation method and literature study. Simulation results of a 4-arm robot controlled by Bluetooth that can rotate at angles of 45° and 90° and move automatically

Keywords: *4 Arm Robot, Arduino, Bluetooth, Simulation.*

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INTRODUCTION

The current 4.0 era makes all human activities and needs easier with the development of technology that functions to ease human tasks (Gaetani dkk., 2020; Joy dkk., 2021; Nunez-Tapia, 2020). One of them is helping people move goods from one place to another practically and efficiently. With the aim of improving production quality and efficiency of production costs and time, automatic robots were created which were controlled by wireless computer technology. Robots are one of the tools that under certain conditions are very necessary in industry (Park dkk., 2022; Prasetyawan dkk., 2018). Robots have many advantages that humans do not have, one of which is reliability in producing the same quality for repetitive work and can be

easily reprogrammed so that it can be used for several different tasks (Kunal dkk., 2020; Szot dkk., 2018). This can increase the quality and quantity of production in industry with efficiency in terms of time and costs.

Progress in the field of electronics has had a very good impact on the industrial world. Currently, many automatic controllers have been created, such as: microcontrollers, microprocessors, PLCs and others. With various developments in control systems, developers have added remote control systems to increase work efficiency. The microcontroller is the brain in controlling a robot by entering programming language into it according to the designer's wishes (Bao dkk., 2021; Khan & Khan, 2022).

The minimum system is a series of microcontrollers that can be used to run an application. The minimum system consists of the basic components needed by the microcontroller to function properly (Chandrasekhar dkk., 2020). To create a minimum system, at least a clock and reset system is needed, although some microcontrollers already provide an internal clock system, so that even without an external circuit the microcontroller can operate (Adi dkk., 2021; Wang dkk., 2022). One of the open source microcontroller minimum system boards is the Arduino Uno. ArduinoUno contains everything needed to support the microcontroller (Pilz Da Cunha dkk., 2020; Zhou dkk., 2019). In this research, Arduino Uno is used as a microcontroller to control a robot arm using Bluetooth as communication via cellphone.

Therefore, this research aims to design a Robot Arm Simulation Using 4 Servo Motors Controlled Via Bluetooth so that it can be run automatically (Pezzato dkk., 2020; Sun dkk., 2020; Xie dkk., 2020). This design is made by using servo motor components as joints that have different tasks. Where servo 1 is the base (moves the arm from left to right or vice versa). Meanwhile, servo 2 drives the robot arm up and down. And servo 3 as the up and down mover of the robot arm clamp. And servo 4 functions as an object clamp.

RESEARCH METHODOLOGY

This research time is 2 weeks for designing a robot arm simulation (using 4 servo motors) controlled by Bluetooth using Proteus and Arduino. The research location was carried out on the FKIP campus on December 1st, 2021-December 15th, 2021.

The stages of this research consist of:

A. Preliminary Study

   In this preliminary study, researchers looked for sources or information regarding robotic arm simulations (using 4 servo motors controlled by Bluetooth) by searching journals or looking for videos on YouTube as references.

B. Simulation Method

   The simulation method is carried out by designing a simulation design for a robot arm (using 4 servo motors) which is controlled by Bluetooth using Proteus and Arduino software which will be efficient in the data collection process.

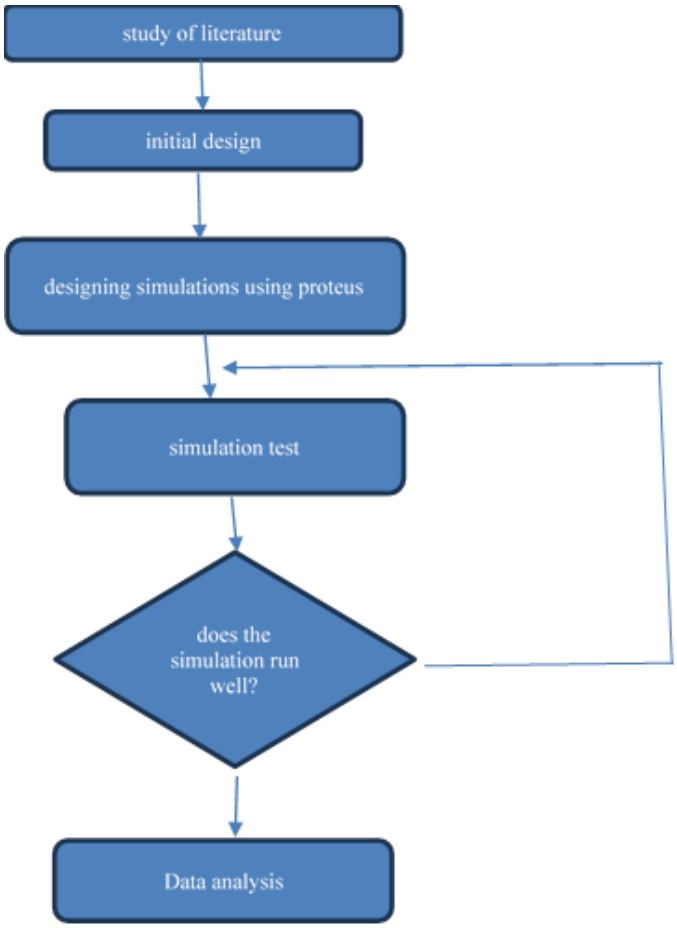

Figure 1. Research Flow Diagram

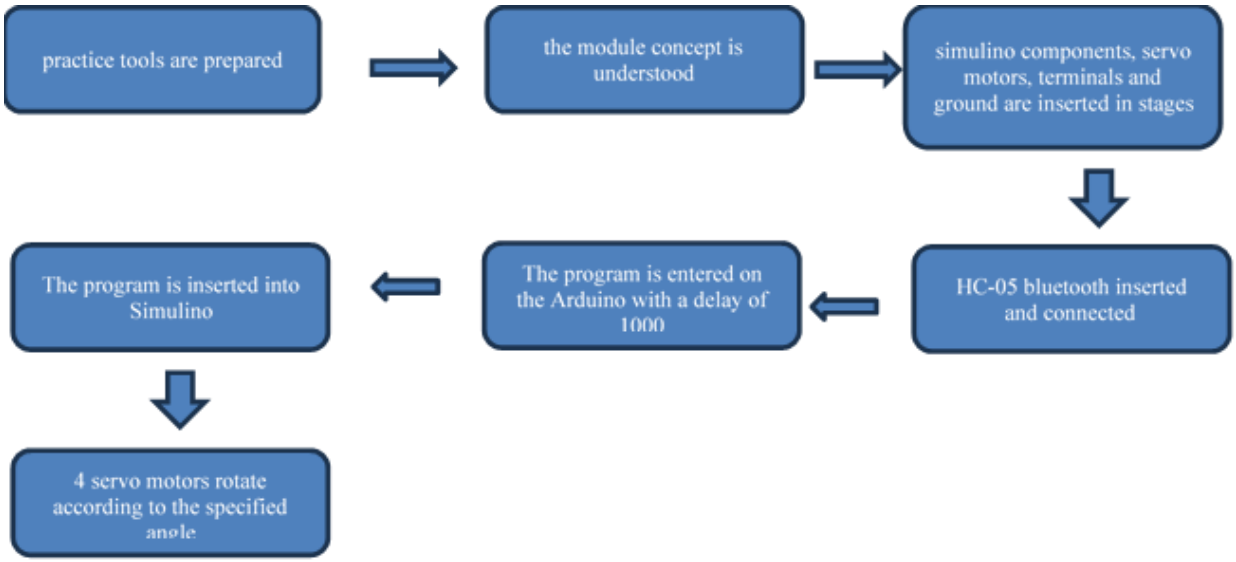

Figure 2. Design Flow

RESULT AND DISCUSSION

Result

In the results of the simulation experiment, a robot arm (using 4 servo motors) controlled by Bluetooth using Proteus and Arduino using several components, namely using 1 Simulino component, 1 virtual terminal, 4 servo motors, 1 Ground, 1 Power, and Bluetooth. HC-06 2 pieces are produced as follows:

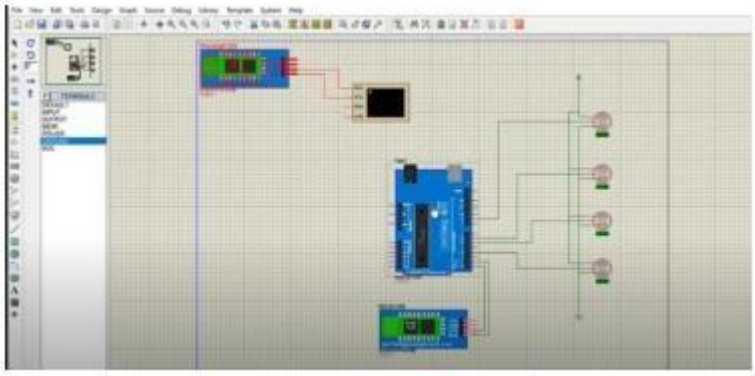

Figure 3. Simulation Design Results Of A Robot Arm (Using 4 Servo Motors) Controlled By Bluetooth

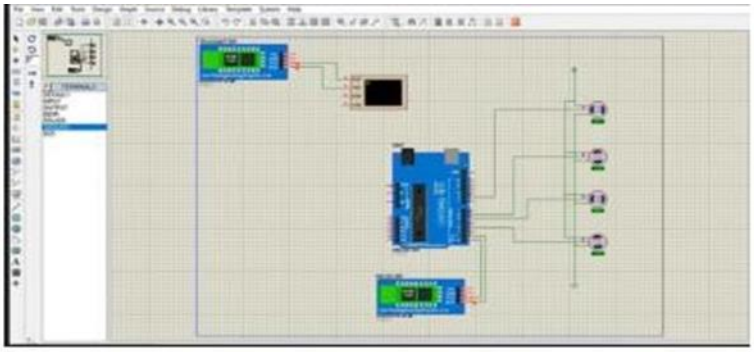

Figure 4. Simulation Of A Rotating Robot Arm (Using 4 Servo Motors) Controlled By Bluetooth

Servo motors 1 and 3 are set to rotate at an angle of 90, while servo motors 2 and 4 are set to rotate at an angle of 45 0. This is in accordance with the coding entered. The following is a program listing in the form of program code in the Arduino IDE:

Figure 5. Codding Arduino Uno Robot Arm (Using 4 Servo Motors) Controlled By Bluetooth

Discussion

The design of a robot arm simulation using 4 servo motors controlled via Bluetooth can be simulated by loading several components on Proteus, namely: 1 Simulino component, 1 virtual terminal, 4 servo motors, 1 Ground, 1 Power, and 1 Bluetooth HC062. fruit. This circuit has the working principle of 4 servo motors as a robot arm controlled by Bluetooth. According to Asep (Murdan & Ramkissoon, 2020; Qin dkk., 2022), the HC-06 Bluetooth Module functions as a data receiver from a smartphone and sends data to the Arduino Uno Module (Raj dkk., 2019; Zhang, 2021). The working principle of Bluetooth, which is connected to a virtual terminal, functions to find out the connection scheme with a serial GSM modem. Virtual terminal functions to simulate serial communication when creating projects related to GSM, GPS and other models (Dharmawan dkk., 2020; Humaidi dkk., 2020; Tong dkk., 2020). The serial communication in question is a type of communication that is common or frequently used in almost every type of microcontroller, for example on the Arduino Uno which provides this serial facility via pin 0 and pin 1.

As previously explained, the virtual terminal TXD is connected to the RXD pin on the HC-06 bluetooth. Meanwhile, the RXD virtual terminal is connected to the TXD pin on the HC-06 Bluetooth as a transmitter. So that the virtual terminal can connect to Bluetooth as a connection interface with the modem. Meanwhile, the HC-06 Bluetooth connected to the Simulano functions as a receiver (Agustini dkk., 2020; Pascale dkk., 2021; Rakshit dkk., 2020). The difference is, the Bluetooth receiver functions as the receiver, while the Bluetooth transmitter is the sender. This is because the TX pin is a pin that functions to send data from the module to another device (microcontroller). The signal voltage on this pin is 3.3V so it can be directly connected to the RX pin on the Arduino because a signal voltage of 3.3V is considered a HIGH value signal on the Arduino.

Meanwhile, the RX pin is the pin that functions to receive data sent to the HC-06 module. The signal voltage on the pin is the same as the signal voltage on the TX pin, namely 3.3V. As a safety measure, a voltage divider is used to connect this pin to the Arduino. The voltage divider uses 2 resistors (Buhl dkk., 2019; Liu dkk., 2021; Sengupta dkk., 2019). The resistors used as voltage dividers are resistors with resistance values of 1K ohm and 2K ohm. In servo motors, the degree of rotation can be controlled by regulating the pulses that enter the motor. The servo motor will work when the control pin is given a PWM signal with a frequency of 50 Hz.

In the circuit, an angle of 900 is used for servo motor 1 and servo motor 3, while an angle of 450 is used for servo motor 2 and servo motor 4. When issuing the myservo.write command (45); after the command myservo.write (90); the servo motor will automatically move clockwise. When coding is given, the servo motor rotates because it is the output for the driving device which moves according to the microcontroller's commands which are filled in by the program automatically (Duan

dkk., 2021). This servo motor rotates at an angle of 450 as per the code entered. After the circuit is created, before entering coding, you need to know the function and coding formulation as follows:

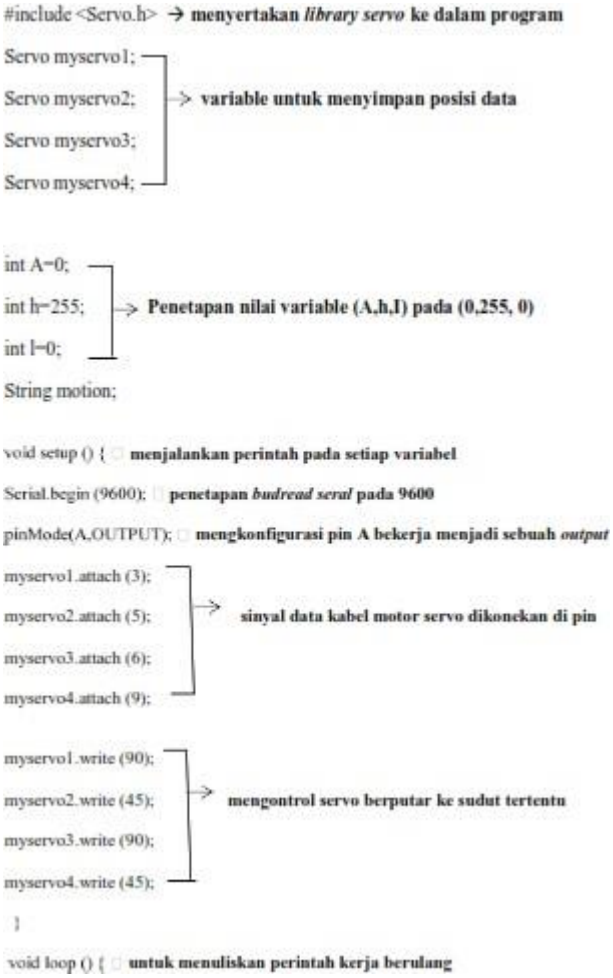

Figure 6. Program Explanation

CONCLUSION

From the robot arm simulation experiment using 4 servo motors controlled via Bluetooth, it can be concluded that the design of a robot arm simulation using 4 servo motors controlled via Bluetooth can be simulated by loading several components on Proteus, namely: using Simulino components, virtual terminals, servo motors, Ground, Power, and bluetooth HC-06. This circuit has the working principle of 4 servo motors as a robot arm controlled by Bluetooth. The working principle of Bluetooth is the same as COMPIM, which is connected to a virtual terminal to find out the connection scheme with a serial GSM modem. When given input, the servo motor rotates automatically at angles of 45° and 90° according to the input entered.

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