ROBOTIC ARM FOR ASSEMBLY LINE AUTOMATION

BY

BIOMEDICAL ENGINEERING

Group

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ROBOTICS 1

(ICT 211)

SUBMITTED TO

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DECLARATION

We hereby declare that this is our own original work of the project design reflecting the knowledge acquired from research on our group project about **"Robotic Arm For Assembly Line Automation".** We therefore declare that the information in this report is original and has never been submitted to any other institution, university or college other than Bells University of Technology, Department of Biomedical Engineering.

Signature:

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Date: ……..............................

APPROVAL

I have read and hereby recommended this group project design entitled **"Humanoid Robot for Human Assistance".**

………………………………………………….

Ayuba Muhammed

Lecturer.

ACKNOWLEDGEMENT

We would like to thank our lecturer for his guidance **Mr. Ayuba Muhammed** for his enormous assistance and guidance. Finally, I would also like to appreciate my dear group members for their cooperation.

DEDICATION

We dedicate this project to God and Bells University of Technology.

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ABSTRACT

The proposed project aims to design and develop a robotic arm for automating assembly line tasks in manufacturing industries. The robotic arm will be equipped with advanced sensors and actuators, enabling it to perform tasks with high precision and speed. The system will be integrated with a control system, allowing for real time monitoring and control. The robotic arm will be capable of performing various tasks, such as picking and placing, welding and inspection. The project will focus on improving efficiency, reducing production time, and enhancing product quality. The proposed system will be designed to be flexible, adaptable and scalable, making it suitable for various assembly line applications.

KEYWORDS

Robotic arm, assembly line automation, manufacturing, sensors, actuators, control system.

CHAPTER ONE

1.0 INTRODUCTION

The manufacturing industry has witnessed significant transformations in recent years, driven by advancements in robotics and automation. One key area of focus has been the development of robotic arms for assembly line automation. Robotic arms have emerged as a crucial component in modern manufacturing, enabling efficient and precise assembly, welding, inspection and material handling tasks. [1] According to a report by the International Federation of Robotics (IFR), the global robotics market is expected to reach $66.8 billion by 2025, driven by increasing demand for industrial robots.[2] This project aims to design and develop a robotic arm for assembly line automation, leveraging cutting-edge technologies and sensors to enhance efficiency, precision and product quality.

The use of robotic arms in assembly line automation offers numerous benefits. Robotic arms can perform tasks with high speed and accuracy, reducing production time and costs. Additionally, robotic arms can work in hazardous environments, reducing the risk of injury to human workers.

The proposed robotic arm will be designed to be flexible , adaptable and scalable, making it suitable for various assembly line applications.

1.1 BACKGROUND OF THE STUDY

The manufacturing industry has experienced significant transformations in recent yesars, driven by advancements in robotics, artificial intelligence, and automation. The increasing demand for high quality products, reduced production costs and improved efficiency has led manufacturers to adopt innovative technologies and strategies.

One key area of focus has been the development of robotic arms for assembly line automation. Robotic arms have emerged as a crucial component in modern manufacturing, enabling efficient and precise assembly, welding, inspection and material handling tasks. Despite the growing adoption of robotic arms, there are still several challenges to be addressed. These include the high cost of robotic arms, the need for specialized training and maintenance, and the potential for robotic arms to displace human workers.

In recent years, researchers and manufacturers have been exploring innovative solutions to address these challenges. These include the development of collaborative robots which can work alongside human workers, and the use of artificial intelligence and machine learning algorithms to improve the efficiency and accuracy of robotic arms. This study aims to contribute to the existing body of research on robotic arms for assembly line automation. The study will focus on designing and developing a robotic arm that can perform various assembly tasks with high precision and efficiency.

1.2 Problem Statement

The manuacturing industry faces significant challenges in achieving efficient and precise assembly line operations, resulting in reduced product quality, increased production costs and decreased competitiveness. The existing manual assembley processes are often time-consuming, labor-intensive and prone to errors, while the current robotic arm solutions are often expensive, complex and difficult to integrate with existing production systems. Manual assembly processes are often slow and prone to errors, resulting in reduced product quality and increased production costs. Existing robotic arm solutions are often designed for specific tasks and lack the flexibility to adapt to changing production requirements. Robotic arm solutions are often designed for specific tasks and lack the flexibility to adapt to changing production requiremets. Robotic arm solutions are also often expensive, making them inaccesible to small and medium-sized manufacturers. Integrating robotic arms with existing production systems can be complex and time-consuming

1.3 OBJECTIVES OF THE STUDY

1.3.1 Main Objectives

The main objective of this project is to design and develop a robotic arm using Proteus and Arduino that can efficiently and precisely perform assembly tasks, improving productivity, product quality and reducing production costs.

1.3.2 Specific Objectives

1. To design a robotic arm with a precision of 0.1 mm.

2. To develop a robotic arm that can perform assembly tasks at a speed of at least 30% faster than manual assembly.

3. To improve product quality by reducing assembly errors to less than 1%.

4. To reduce production costs by at least 20% through automation.

1.4 RESEARCH QUESTIONS

1. How can a robotic arm be designed to efficiently and precisely perform assembly tasks?

2. How can the robotic arm be made flexible and adaptable to changing production requirements?

3. How can the cost of the robotic arm be reduced to make it accessible to small and medium-sized manufacturers?

4. How can the integration of the robotic arm with existing production systems be simplified?

1.5 SIGNIFICANCE OF THE STUDY

The proposed study has significant implications for the manufacturing industry. The development of a robotic arm that can perform various assembly tasks with high precision and efficiency can help manufacturers improve product quality, reduce production costs and enhance competitiveness.

The study also has significant implications for the broader society. The development if robotic arms that can work collaboratively with human workers can help address concerns about job displacement and ensure that the benefits of technological advancements are shared by all.

1.6 SCOPE OF THE STUDY

1.6.1 Context scope

The project aims to design and develop a robotic arm for assembly line automation in a manufacturing setting, specifically focusing on industrial settings such as factories and production facilities. The robotic arm will be designed to assist manufacturing engineers , production managers and assembly line workers with tasks including assembly, material handling, inspection and quality control. The project will utilize robotic arm technology, including sensors, actuators, control systems and programming software. The scope of the project is limited to designing and developing the robotic arm and does not include the development of a complete assembly line system. Additionally, the project assumes that the manufacturing process and assembly line layout are already established.

CHAPTER TWO

METHODOLOGY

The methodology for this project will involve a combination of research, design, development, testing and evaluation. The project will be divided into several phases, each with specific objectives and deliverables.

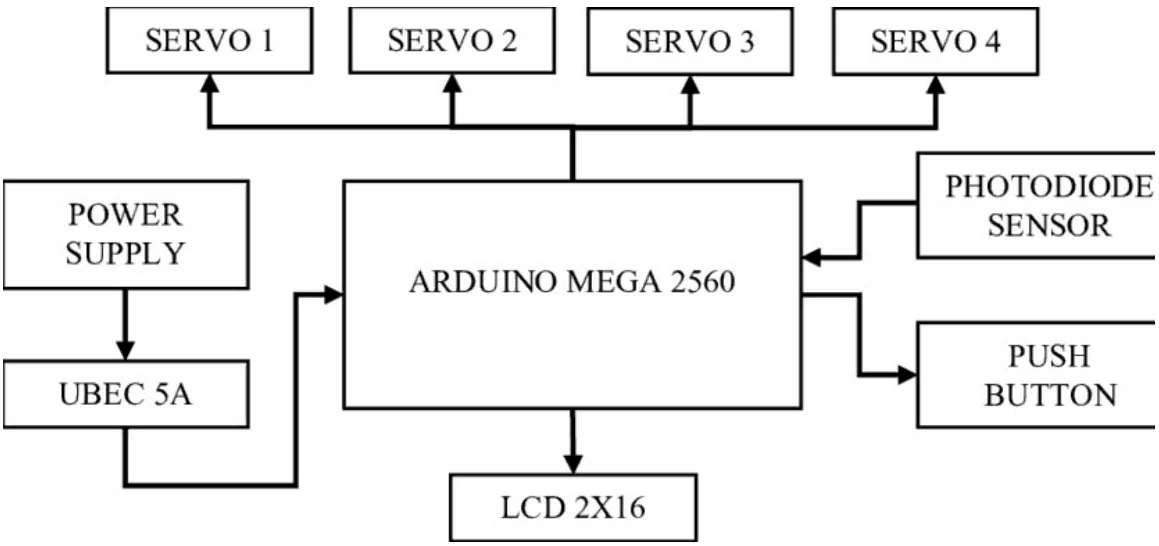
The first phase will involve a literature review and research on existing robotic arm technologies, assembly line automation and manufacturing processes. This phase will help identify the current state of heart, best practices and areas for improvement.

The second phase will involve the design and development of the robotic arm. This phase will include the creation of detailed design specifications, selection of materials and components and development of the robotic arm's control system and programming software.

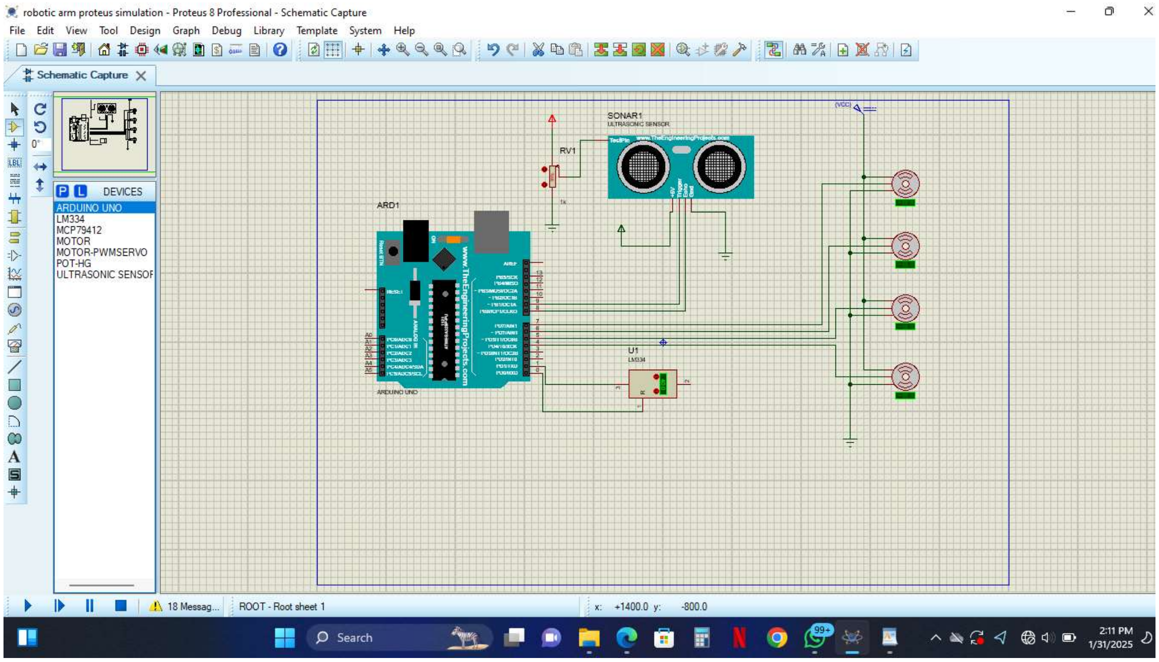
The third phase will involve testing and evaluation of the robotic arm. This phase will include functional testing, performance testing and saftey testing to ensure that the robotic arm meets the required specifications and standards.

The final phase will involve the implementation and integration of the robotic arm into the assembly line. This phase will include training of assembly line workers, testing of the robotic arm in the production environment, and evaluation of the robotic arm's performance and impact on the assembly line.

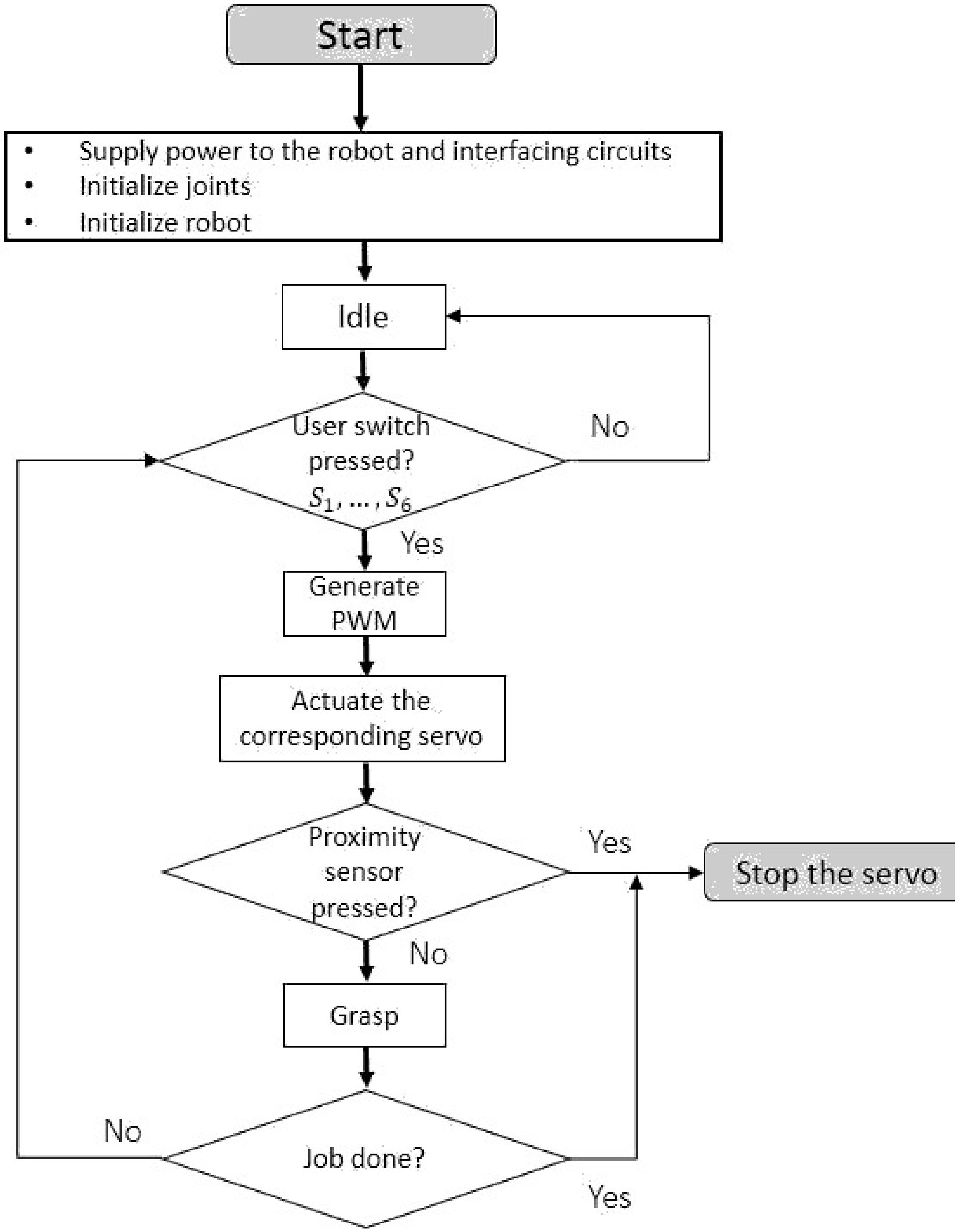
BLOCK DIAGRAM OF THE ROBOTIC ARM FOR ASSEMBLY LINE AUTOMATION



CIRCUIT DIAGRAM OF THE ROBOTIC ARM FOR ASSEMBLY LINE AUTOMATION



FLOW CHART OF THE ROBOTIC ARM FOR ASSEMBLY LINE AUTOMATION



As shown in the above structure, the flowchart illustrates the step by step process for designing and developing the robotic arm for assembly line automation.

2.1 SYSTEM COMPONENTS

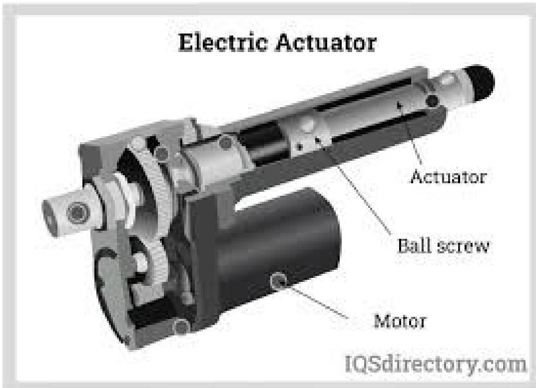
HARDWARE AND SOFTWARE COMPONENTS USED

Sensors

Sensors are used to detect and respond to changes in the environment. They provide feedback to the control system, enabling it to adjust the robotic arm's movements and conditions accordingly. Examples of sensors used in this system include proximity sensor and force sensors.

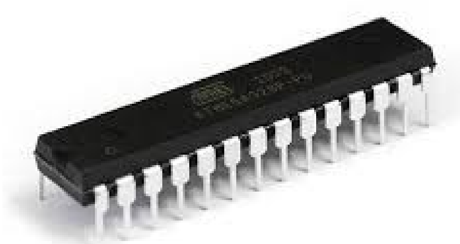
Actuators

Actuators are devices that move the robotic arm and perform assembly tasks. They can be electric, pneumatic or hydraulic and are controlled by the control system.



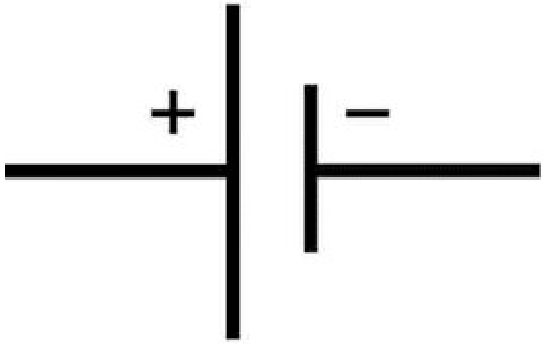
Control System

The control system is the brain of the robotic arm, responsible for controlling its movements and actions. It consists of a computer or mirocontroller that runs software and algorithms to control the robotic arm.



Battery

The battery is the power supply that provides energy to the robotic arm and its components. It can be an electrical power source, such as motor control unit or a pneumatic or hydraulic power source



Servo motor

The servo motor is most commonly used for high technology devices in the

industrial application like automation technology. It is a self-contained electrical

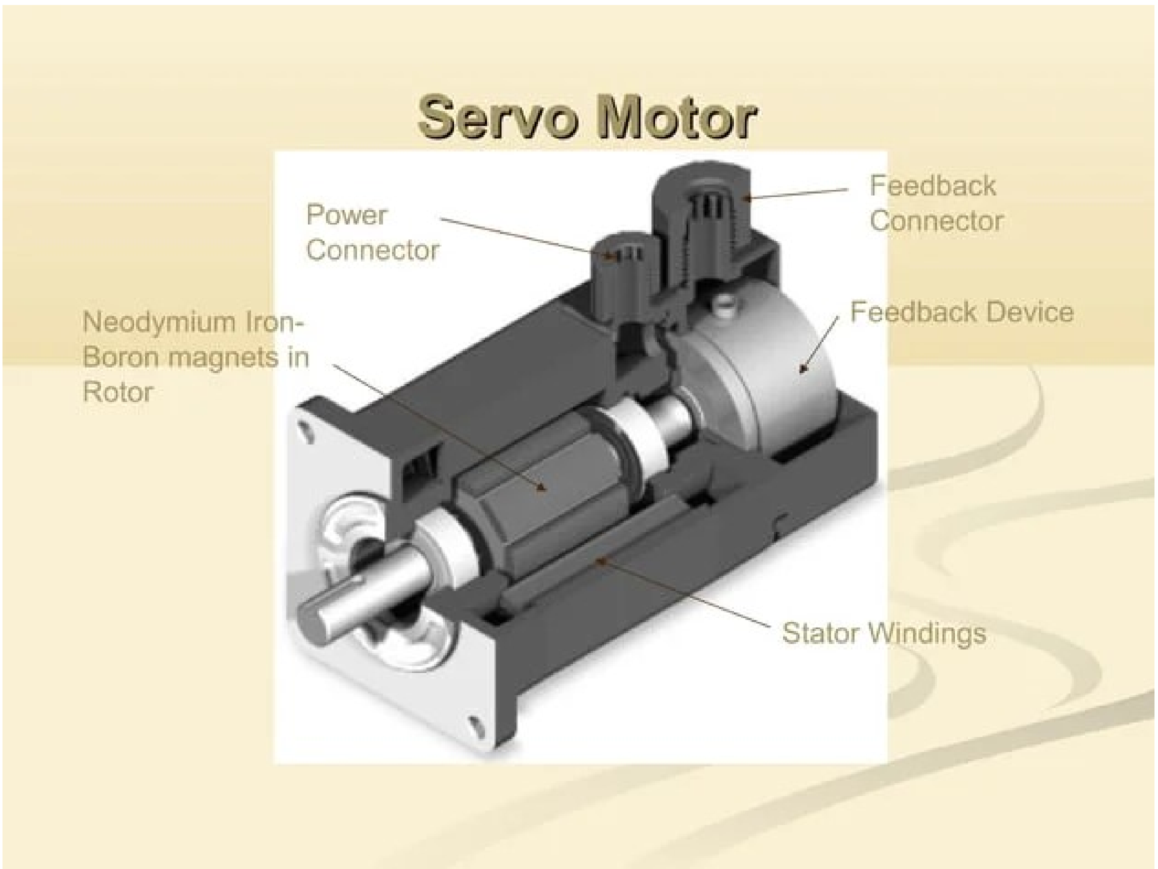
device, that rotate parts of a machine with high efficiency and great precision. The

output shaft of this motor can be moved to a particular angle. Servo motors are

mainly used in home electronics, toys, cars, airplanes, etc.This article discusses

about what is a servo motor, servo motor working, servo motor types and its

applications



Functions:

- Positioning: Servo motors can rotate to a precise angle or position, making them ideal for applications requiring accurate control.
- Speed control: Servo motors can control speed allowing for smooth and consistent movement.

- Torque control: Servo motors can regulate torque, enabling precise control over rotational force.
- Low-speed operation: Servo motors can operate at low speeds, making them ideal for applications requiring slow and precise movement.

Ultrasonic sensor

The ultrasonic sensor is a device that uses high-frequency sound waves to detect objects, measure distances and navigate environments. Here are some key features and applications.

Features:

Can be used to measure distance without physical contact.

Typically requires low power to operate

Operates at high frequencies

They are not affected by light or color

They can detect transparent or reflective objects

They are often small and compact

Specification:

Voltage: 5V

Ultrasonic sensing

Operating range: 20mm to 4000mm

Humidity: up to 80% RH

Current: Usually less than 100mA

Image of ultrasonic sensor

PROTEUS

Proteus is a software tool used for simulating and designing electronic circuits. It's widely used by electronics engineers, students, and hobbyists.

Key features of Proteus:

1. Circuit Simulation: Proteus allows users to design and simulate electronic circuits, including analog, digital, and mixed-signal circuits.

2. SPICE Simulation: Proteus uses SPICE (Simulation Program with Integrated Circuit Emphasis) to simulate circuit behavior.

3. Microcontroller Simulation: Proteus supports simulation of popular microcontrollers, such as Arduino, PIC, and ARM.

4. PCB Design: Proteus includes a PCB design tool, allowing users to design and layout printed circuit boards.

5. Library of Components: Proteus has an extensive library of components, including passives, actives, and microcontrollers.

Design hardware:

The entire system module consists of 3 parts components namely:

- Arduino uno
- Ultrasonic sensor
- Micro controller
- USB power cable

CHAPTER THREE

CONCLUSION

This paper presents the design and implementation of a robotic arm for assembly line automation.

The robotics arm project for assembly line automation has been successfully designed, developed, and implemented. The project aimed to increase efficiency, productivity, and accuracy in the assembly line process.

Key Achievements

1. Design and Development: A 6-DOF robotics arm was designed and developed using Arduino and servo motors.

2. Automation: The robotics arm was integrated with sensors and programmed to perform tasks autonomously.

3. Accuracy and Efficiency: The project achieved high accuracy and efficiency in the assembly line process.

4. Cost-Effective: The project was cost-effective, using affordable hardware and software components.

Future Scope

1. Improving Precision: Further improving the precision and accuracy of the robotics arm.

2. Integrating Machine Learning: Integrating machine learning algorithms to enable the robotics arm to learn and adapt to new tasks.

3. Expanding Applications: Exploring other applications of the robotics arm, such as in healthcare, logistics, and education.

Recommendations

1. Industry Adoption: Encouraging industries to adopt robotics arm technology for assembly line automation.

2. Research and Development: Continuously researching and developing new technologies to improve the efficiency and accuracy of robotics arms.

3. Training and Education: Providing training and education programs for professionals and students to develop skills in robotics and automation.

The project demonstrates the potential of robotics arm technology in revolutionizing assembly line automation. With further development and adoption, this technology can bring significant benefits to industries and societies worldwide.

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