Arm Robot Design using Web Control

Eka Dodi Suryanto[1*], Jafar Sidik[2], Fiya Monalisa[3], Riki Wahyudi Saputra[4]

{ekadodisuryanto@gmail.com[1], jaffarsiddiq524@gmail.com[2], fiyamonalisa00@gmail.com[3], rickywahyudisaputra@gmail.com[4]}

Faculty of Engineering, Universitas Negeri Medan, Medan, Indonesia

Abstract. An arm can be moved or controlled by a system using robotic arm technology. Currently, the robot arm is one of the tools used in the industrial world, so the development of robotic arm manufacturing is very rapid. Using this robotic arm, the system for picking up and placing an object can be accomplished easily. One example is the ability to move objects. This study aims to design and develop a robotic arm with 180 degrees of freedom so that it can be moved in multiple directions using a website. The utilized website is a static website that can be accessed via a pre-programmed IP address; we can then control it easily from our mobile device or laptop. As a result of the constructed system, the robot can move in multiple directions and transport goods to the desired location. The process of moving goods with this robotic arm is 100 percent effective. With the creation of this robotic arm, it is hoped that the programming process for industrial robots can be simplified, thereby facilitating all forms of activity or work in various companies and allowing for the creation of a circuit that is easily understood. The results of this study are anticipated to enhance the students' competence, skills, creativity, and innovation.

Keywords: Movement Control, Robot Arm, Website Program Control, Movement Rotation.

1 Introduction

Currently, technological developments are increasingly rapid and fast, coupled with the flow of globalization, which is developing dynamically and can create or present a variety of new products that are increasingly sophisticated and capable. Currently, robot technology has developed in various lines of human life with the aim of making human work easier. Robot technology has begun to develop in various fields such as industry, health, education, and even the world of entertainment. In the industrial world, for example, robots are widely used in various fields, such as to move goods. The robot arm moves by moving the prototype hand, which functions to move the process in the desired direction using a servo motor. While the use of robots in education has been widely used, one of them is to assist students who have physical limitations or disabilities.

This is done as a deliberate and effort to create a learning environment and process in which students can actively develop their potential for religious spiritual strength, personality, self-control, intelligence, noble character, and required skills required, society, nation, and state.

One of the most important aspects of the development of a robotic arm is to pay close attention to the suggestions and infrastructure required to make and develop the technology, because with good management of suggestions and infrastructure, especially in the field of education, usability can be maintained and the learning process can be supported [1].

ACEIVE 2022, October 20, Medan, Indonesia

DOI 10.4108/eai.20-10-2022.2328870

The purpose of a robot's program is to control all of its actuators so that it can perform according to its design. A robotic arm is a programmable, multifunctional machine designed to move materials, components, tools, or specialized devices through variable, programmed motions in order to complete a variety of tasks. Moving objects from one location to another is one of the tasks that may comprise a production line [2].

If a robot can be implemented, the production process will become more efficient. In addition, the movement is executed according to the reference obtained from the sensor or servo motor, which serves as its driving force. Programming the robot arm using a programming language is part of the control procedure for constructing the robot arm. In the future, controlling the movement of the robot arm will be as simple as moving one's hand by constructing a remote control-like control device. The primary characteristic of a robotic arm is its control system. The process of controlling the robot arm is accomplished by programming the robot arm with a programming language and a control system that has different advantages and functions for each component for each movement [3].

Using a servo and an HTML website, control the robot arm according to a predetermined function by moving it in various directions or with specific movements. Information and communication technology development has not been sufficiently optimized to meet current needs. It is difficult to comprehend the evolution of this robotic arm technology due to a lack of skill and understanding. This is because the acquired knowledge does not originate from their comprehension. In the future, more individuals will utilize this technology without requiring extensive computer resources. Currently, robotic arms equipped with various sensors for autonomous object detection and movement are being developed. Consequently, the need for management and comprehension will be optimized during the development of a robotic arm. Using collaborative learning, students in the Sensor and Transducer course can design and build robotic arms with the desired movement.

2 Research Method

This study employs the research method of research and development (R&D). This method is used to collect information about user requirements (needs assessment) while development activities are performed to create learning tools. The R&D stages consist of Potential and Problems, Collecting Information, Model Development, Model Validation, Model Revision, Model Testing, Wider Trial and Final Model Revision[4].

The development of the study of literature in this study sought a lot of sources of information and literature reviews to demonstrate an understanding of the topics and sciences studied in the development of this study. This study's development model incorporates the prototype model. The prototype model is a method for producing a structured system, and the manufacturing process for this model involves multiple stages that need to be completed successfully. If there is flaws during the process, the system will be reevaluated and will undergo the beginning process [5]. This research design is anticipated to produce and advance the manufacturing of system-controllable robotic arms. Figure [4] illustrates the procedure for conducting research using the Research and Development (R&D) method.

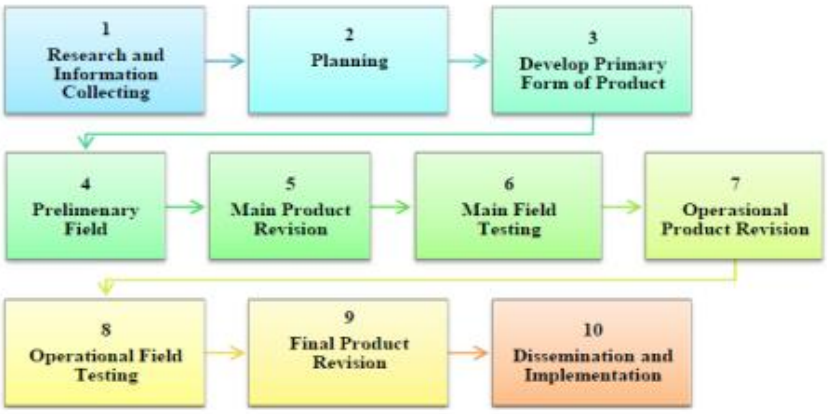

Figure 1. Research and Development (R&D) procedure[4]

This robotic arm's research procedure employs a prototype model. This research and development model for prototypes consists of several stages, including gathering requirements, constructing prototypes, evaluating prototypes, coding the system, testing the system, evaluating the system, and employing the system [5]. This development model is selected for this research procedure since it explains the process of creating a system that will be constructed in a structured manner and has several stages that must be passed in its manufacture.

This model is well-organized and has the appropriate stages for carrying out the activities.

For this reason, the author uses this model as a development model to create a robotic arm that conforms to the prototype model's stages in order to conduct quality research. The prototype model is depicted in the figure 2

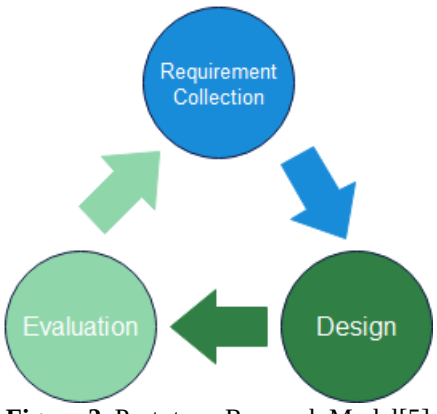

Figure 2. Prototype Research Model[5]

This prototype research model's initial analysis begins with the processes for identifying the fundamental problems in the implementation of manufacturing robotic arms. The preliminary analysis performed is:

1. The gathering and analysis of requirements will begin with a meeting between clients or users and developers, who will then determine the overall purpose, any known requirements, and an overview of the components that will be required next.
2. Design, This design represents all known aspects of the software, and it serves as the foundation for prototyping.
3. Prototype Evaluation, In this process the client or user will evaluate the prototype made to clarify software requirements.

The results of the previous analysis activities are used as a reference and a basis for determining how the series of robotic arms is made. In this study, the design of a robotic arm using this prototype model went through several stages, namely [5]:

1) Necessity Gathering, In the requirements gathering stage, the customer and the developer together define the format and the overall software requirements, identify all requirements, and outline the system to be built.
2) During the prototyping phase of system development, the customer and system designer jointly determine the input and output formats that will be produced by the system.
3) Evaluation of prototype following the prototyping development phase, the Customer and developer define the overall format and requirements of the software, identify all requirements, and outline the to-be-built system.
4) Coding System, in this stage the agreed prototyping is translated into the appropriate programming language.
5) Testing System, during the system testing phase, the previously-created code will be examined to determine if it functions properly, if there are any parts that require repair, or if there are any parts that do not comply with the customer's specifications.
6) Evaluation System, System evaluation is not an evaluation of a prototype; rather, it is the evaluation of a completed system or software to determine whether or not it meets customer requirements. If not, the system will be revised and stages 4 and 5 will be revisited. If the system is deemed acceptable, it is ready to move on to the next phase.
7) Using System, This stage is the final stage of making the system using the Prototyping Model method. At this stage the finished software and have passed the test, are ready to be used by the customer/user.

Data collection in this study was carried out by looking for literature studies that were in accordance with the manufacture and design of robotic arms, to find information related to design, manufacture, literature study and theoretical basis. In this research, the research instrument used in data collection is to collect as much data as possible to collect data and information needed in research, such as data on the initial condition of respondents or research objects, needs analysis, and other necessary data.

The research uses a qualitative data analysis technique to investigate social phenomena and human problems, research procedures that produce descriptive data in the form of written or spoken words from people and observable behavior[6].

The essence of qualitative research is observing people in their natural environments and interacting with them, attempting to understand their language and interpretation of the world around them, and approaching or interacting with people related to the research focus with the intention of attempting to understand, exploring their perspectives and experiences in order to obtain information or data that is necessary for the study.

Qualitative research where the role of the researcher is as a key instrument in the process of data collection as well as data interpretation. Direct observation, interviews, and document studies are the three primary methods typically utilized by data collection tools. When the problem at hand is unclear, when hidden meanings need to be uncovered, when social

interactions need to be comprehended, or when theories need to be developed, qualitative research is the method of choice.

3 Results and Discussion

This research focuses on the development of a robot arm design with a website-based movement control system. This robotic arm was developed through experiments based on requirements and learning outcomes. Based on the author's analysis, including assembling the robot arm according to the concept and design scheme, installing a servo motor as a driver for each part of the robot arm, and connecting the servo motor cable to the breadboard as a connection that will be driven by a controller on the website, the following are the stages of a series of robot arm designs with web-based movement control systems.

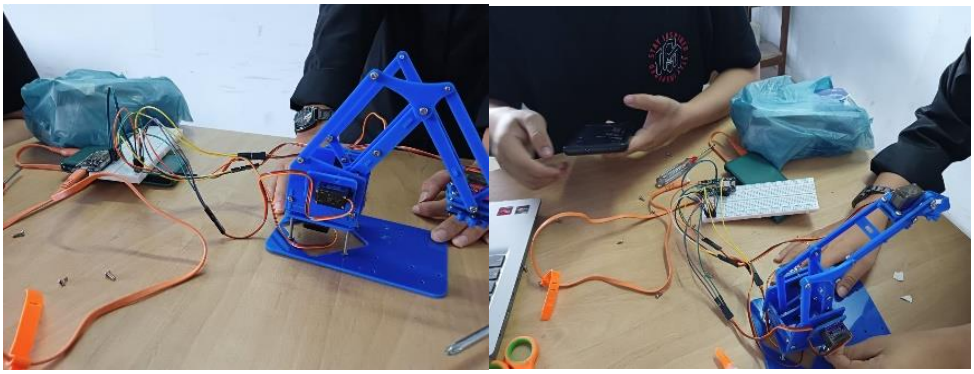

Figure 3. Arm robot assembly and installation

Figure 4. Arm robot test

The results of the author's research indicate that the robot arm developed for this study has successfully moved using the website's controls. The movements performed on the robot arm range from the initial foundation to arm movements, back-and-forth movements, and claw movements.

4 Conclussions

According to the results of the research and discussion that have been submitted, this study succeeded in developing a robot arm design with a website-based movement control system using a prototype model and research and development research methods. The procedures and stages in designing the robot arm are adjusted to the stages in the research method that has been used so that the author can design a robot arm with this website-based control system. For that, we need the supporting materials needed in the design of this robot arm, such as a literature study to compare and get consideration from the results of previous research and the main materials used in the manufacture of the robot arm, as well as the software used for the robot arm control system.

Acknowledgements

The authors would like to express their gratitude to Universitas Negeri Medan for providing funding for the implementation of this research. The researcher would also like to thank the research team, lecturers, students and all parties who have assisted in the implementation of this research.

References

[1] R. Wahrini, L. Labusab, and N. Nuridayanti. (2020). Rancang Bangun Smart Assistant Lengan Robot Penghapus Papan Tulis," *J. Edukasi Elektro*, vol. 4, no. 2, pp. 165–170, doi: 10.21831/jee.v4i2.35188.

[2] E. Sitompul. (2020). Prototipe Manipulator Lengan Robot Berbasis Arduino dengan Metoda Kendali Lead-Through. *Jurnal ELEMENTER*, vol. 6, no. 1, pp. 1–14.

[3] B. Utomo. (2020). Kendali Robot Lengan 4 DOF berbasis Arduino Uno dan Sensor NPU-6050. *Jurnal SIMETRIS*, Vol. 11 No1, 89–96.

[4] Ninla Elmawati Falabiba *et al.*(2014). Model Pengembangan dan Penelitian Research and Development (R&D). *Pap. Knowl. . Towar. a Media Hist. Doc.*, vol. 5, no. 2, pp. 40–51.

[5] R. Setia. (2015). Rancangan Bangun Multimedia Pembelajaran Dengan Berbantu Metode Explicit Instruction,. *Univ. Pendidik. Indones.*, vol. 53, no. 9, pp. 1689–1699.

[6] Notoatmodjo and M. (2018). Metodologi Penelitian, *Rake Sar.*, pp. 54–68.