



Automatic Water Ballast System Based on Arduino R3

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Abstract

In this modern era, technological development is very rapid, and many changes occur in technology, especially in human life, which also applies in the maritime field. Technology is very important to facilitate activities in human life so that everything that exists can be completed quickly, easily, and effectively. Of course, the development of this technology is very much the ability to carry out important infrastructure to improve the quality of work and time efficiency. Technology is also very useful in the business field because, with the development of technology, people will more easily get to know each other. This study aims to find out how the ballast filling system works and find out the components in the tool. The mode used is the Research & Development (R&D). Based on the findings and results of the study, it was concluded that the ballast system is a tool used to increase the ship's stability and increase the G force to be easily controlled at the equilibrium point of the fast or dismantled ship structure. The design of water ballast system operation aids is carried out sequentially in each manufacturing process and has been adjusted to the problem formulation. This teaching aid is very useful as a learning medium so that the material is easier to understand because it is demonstrated using real teaching aids.

Keywords *Water Ballast Auto, Prototype, Learning Media*

INTRODUCTION

The development of technology is very rapid in human life. This also applies in the maritime field, where technology is essential for human life to facilitate a heavy or light job so that everything can be completed quickly, effectively, and efficiently. Of course, the development of this technology can make a significant change for humankind and has an important role in improving the quality of work and the effectiveness of the time used. Technology is also very useful in the business field because of technological developments. People will get to know each other easily. We can also choose which has a positive and negative impact because every human being is free to choose his own right to choose. Intelligent humans will certainly be able to take advantage of technological developments and even make other technological advances. This becomes a field of search and income. This development has a very positive impact on industrial progress, making it more efficient and practical. Therefore, machinery in the maritime sector is growing rapidly, which is useful for facilitating ship operations and effectiveness in working. The development of science and knowledge in the maritime world will be increasingly applied to the world of work. Sooner or later, various kinds of knowledge and knowledge about technology are increasingly explored in order to create a work environment that makes it easier to use. The beginning of technology originated from the thoughts and development of evolved humankind. However, it will trigger everyone to always improve their skills and potential to avoid being left behind in technological developments.

A small example is the automatic control system. In the changing times, automatic control systems have begun to develop in human life, where the control system is the process of regulating or controlling one or several quantities (variables, parameters) so that it is at a certain price or range. Control systems or control techniques are regulatory techniques or control systems

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(Thomas, 1987). An example of a control system on board is using a water ballast system. According to Jhson (2002), the ballast system is one of the service load balancing systems on ships where the ballast will increase and dispose of the volume of water in the ballast tank. The ballast system positions the ship to be stable in an empty and loaded state; it is necessary to develop a valuable design as a learning medium for cadets/engineering students, especially in the maritime field, to learn about operating an automatic ballast water system. To make it easier to understand the operation on board. This system is used to balance the ship, filling water in each ballast tank ordered by a module that reads the movement or slope of the ship. Based on the knowledge that has been applied, this system is very necessary to support the operation of the automatic water ballast system. The design system is to use simple tools that are easy to apply in everyday life. As applied in ballast water management that the use of ballast to control the stability of the ship. In another sense, ballast water is used to control unloaded vessels' stability.

Rules covering the location of ballast water changes, such as the specified distance from land to sea, must exceed 12 nautical miles, sea depth exceeding 200 meters, and seawater sensitivity. These rules are regulated in the ballast water management convention and BWMS code. The IMO Convention (International Maritime Organization) official designation, "The International Convention for the Control and Management of Ships' Ballast Water and Sediments," was adopted by IMO in 2004 and entered into force on September 8, 2017. We need to understand that each country has its own rules and regulations to preserve ecosystems and habitats or other marine wealth in each country. This regulation has a very positive impact on all ecosystems because every human wants to create clean environmental conditions and not pollute the living environment on this earth. The marine environment is an aquatic environment that we must maintain so that in the future, our children and grandchildren will be. This research is expected to provide very positive knowledge and learning to make it easier to understand the working principle of the automatic ballast water system. In addition, this research is expected to develop again to support this technology to be more sophisticated, modern, and useful for learning.

LITERATURE REVIEW

Many factors caused the cadets to have difficulties with previous learning methods. Considering the typical evidence of the problem, the authors outline the extent to which the plan needs to be addressed. Planners simply limit problems to the impact of new instructional techniques by guiding practice using teaching aids. In the learning process, authors need to understand the impact of new teaching methods on cadets to ascertain how to utilize the working techniques of a design. Many factors caused the cadets to have difficulties with previous learning methods. Considering the typical evidence of the problem, the authors outline the extent to which the plan needs to be addressed. Planners simply limit problems to the impact of new instructional techniques by guiding practice using teaching aids. In the learning process, authors need to understand the impact of new teaching methods on cadets to ascertain how to utilize the working techniques of a design.

RESEARCH METHOD

Research steps

This research method is Research and Development (R&D). Research uses steps and product development from analysis, design, programming, and testing. According to the Big Indonesian Dictionary (KBBI), R&D is a product's research and development process. It will produce a product, which will produce a new product or refine an existing one. Hardware (electronic modules and module planes) can be developed, but also software (applications for computers, operating systems, and other electronic devices). Model research determines the automatic water ballast

system trainer, namely by applying an electronic circuit device as the main module to signal the system in accordance with the observation manual run on board the ship so that it can be applied to the research and development of this trainer, and several electronic devices needed as supporting tools.

Research Method Phase I (Research)

A. Quality method

According to Handoyo (2007: 22), qualitative research is used to find, investigate, describe, and explain the idiosyncrasies or qualities of social influences that are not explained, measured, or described through a qualitative approach.

According to Salman (2018: 11), the qualitative method is a research method that is a philosophy of post-positivism, used to examine the natural condition of objects before starting a research experiment as a key instrument, data source collection techniques are carried out a snowball and purposive, data analysis is inductive, and the results of this study emphasize meaning rather than generalization.

1. Place of research

The place of research in this research is in the workshop of tools and machines and can also be done in the place of practice to support the knowledge that will be learned when returned to the campus environment.

2. Research sources

The data source in the study is where the data is obtained, and researchers get data when carrying out practice on board by observing the parts of the work system of the object and asking the machinist who works on the ship. Researchers also study how the system works and the components used as research data sources that can be developed.

3. Data collection techniques

Research conducted trials to get the results to make miniatures with work tools to formwork system innovations on board so that researchers can observe the old system with innovations and how the system can work. Test this trial so researchers can make the teaching aids innovation work well.

4. Data analysis

The data analysis process includes several stages, such as data collection, data processing, data exploration, data visualization, statistical analysis, and interpretation of the analysis results. Data analysis can be applied in various fields, namely social sciences, business, health, technology, and others.

5. Product design design

The mechanical design of this research makes the water ballast system automatic and considers its shape, design, and size. The electronic design design makes the placement of the position of the components and the electrical system to support the stability of the ballast construction when tested later.

6. Design validation

Design validation can also help ensure that the product or system is made in accordance with applicable standards. Design validation can be done through various methods, such as computer simulation, physical testing, or user testing. By performing effective design validation.

Product test design

In this diagram, researchers also use the stages that will be used to produce a tool that will be used

as a learning medium for cadets—a diagram used for automatic water ballast system trainers. Through good product test design, developers can improve the design before launching the product, product test design is very important for product developers and testing new concepts. In addition, product test design can also help developers estimate product performance and identify problems before the product is produced on a mass scale.

1. Research subject

The subject of study can be people, animals, organizations, or even natural phenomena. The data source used was a machinist who worked on the ship, and researchers also asked the crew in the engine section. The sciences in the manual book on board, as well as their experience while working on the ship, the purpose of this research subject is to increase knowledge and insight for cadets.

2. Data collection techniques

This research data collection technique was obtained from literature studies and observations. Literature studies are obtained from books, journals, articles, research reports, and other sources of information. While observation is carried out in two ways, namely open observation and hidden observation.

3. Data analysis techniques

The instrument in this study is the researcher himself. Non-human instruments include interview guidelines, observation guidelines, and so on.

4. Data analysis techniques

Data analysis techniques used in the preparation of this study are data reduction, data presentation, and conclusion.

FINDINGS AND DISCUSSION

Product Initial Design

This stage is very important to understand the problem to be solved and know the limitations that exist. The development and idea stage is the stage where the initial ideas are generated and evaluated. This idea is expressed in the form of hand sketches or mock-ups. The design and prototyping phase involves making a model or prototype of a developed design; this can be done using various techniques and equipment, such as 3D printing, software use, computer design, or functional models built by hand. As explained earlier, the main purpose of a design is to make humans design an object to be useful and produce benefits for humans, so the designs used are many and varied depending on the type of needs made for ease of life. Some of the design objectives are as follows: To create objects, systems, components, and structures that are beneficial to humans and to make innovations that are created from ideas that will be channeled into the technology field.

- a. To create something that can increase efficiency, productivity, and quality of human life.
- b. Design combined with elements of art and technology aims to create safety, comfort, and beauty

Explanation

- a. Arduino module is a source of settings of a system that will work on a sensor that accepts a weak current source, but before that, Arduino cannot read the sensor by itself. There is a coding or salt language in the module made using C ++ language. The module sends a weak current signal to the 6050 gyro device with pre-calibrated specifications, and the gyro sends a signal back to the module with movement as a sensor is processed. The module signals the OLED / LCD panel as a digital medium to find information that continues in the digital instrument.
- b. Then the module informs the movement of the gyro that reads and calibrates the

information to be processed because the current given is AC current and converts it to DC by using a diode as a current director, then the current provides a source for 3 DC motors with each working on a sensor to be received. The DC motor is driven by the Arduino module sensor, which will send a signal to the water level sensor as a race or information source that will give a signal to the module, and then the module gives a signal to the LED indicator light that will light up as a race that a system is working and running properly. The sensor in the module will work and reprogram information that will be processed to create maximum results in calculating the pass point to find a result that will be used to calculate the balance of the ship, water ballast, and the volume of water in the ballast tank.

Operation of instructional tools

- a. Turning on the Device
 1. Connect both power supply cables to the power supply unit.
 2. Connect both power supply adapters to a 220V power source.
 3. Or use power from the battery
- b. Using Instructional Tools
 1. Make sure the Arduino power adapter and motor driver power adapter are connected to a 220V power source.
 2. Make sure the DC motor adapter cable is connected to the 220V voltage source
 3. Select Manual or Auto Mode Selector
- c. Turning Off the Tool
 1. Move the selector from on to off

Based on the data analyzed, the results showed that cadets of the Engineering Study Program considered the operation and maintenance of davits on lifeboats beneficial. They stated that this design serves as an automatic water ballast system and is beneficial for Semester I, II, III, and IV cadets who will undergo marine practice as a practical guide for their ship training. After product testing and electronic revision, the product is tested by Dr. Andy Wahyu, S.T., M.T and Capt. Suroto, M.Mar and the following suggestions were given:

- a. Improvement of the physical body of the ship.
- b. Add captions of functions and buttons.
- c. Need to add ship particular

In addition, it is necessary to add a bepan ballast and rear.

CONCLUSIONS

Conclusion

Based on the results of the research that has been carried out and the material that has been discussed and described in this research, it can be concluded as follows:

- a. The function of automatic water ballast is to help regulate and maintain the stability of the ship during sailing, especially when the ship has a different load or load with the automatic water ballast system; the crew can carry out other tasks that are not dependent on ballast operation.
- b. This research encourages it because of the innovation created in a researcher's mind. In addition to materials that are easy to obtain, these teaching aids also do not require complicated components and are easy to operate this teaching aid. This trainer has several sensors, namely: a water level sensor that is useful for providing signals from the capacity of the ballast tank that will be used later, connected to Arduino on a sensor that will be used, and also equipped with gyro sensors to determine the slope that exists

on a ship later and also equipped with a nominal instrument panel that is on the information running on the sensor, and equipped with LED lights as indicators that will support information that runs on the system to be worked on.

Advice

Based on the conclusions above that have been described, researchers can convey suggestions for making automatic water ballast system operating props as follows:

- a. For development that can be done for this improvement is the addition of a water pump that is used to charge and dispose of the denpan and rear ballast as a medium for increasing weight and maximum stability.
- b. Lecturers/teachers can use this automatic ballast water system trainer for learning media so that cadets more easily understand how ballast works.
- c. This teaching aid is a miniature model innovated by researchers that will be applied on board, so it is hoped that in the future, this teaching aid can be developed again with better technology and materials.

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