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Research Paper

Design of the Process of Ascending and Descending of Davits on Lifeboats Automatically

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Abstract

The Davits on lifeboats is a tool for lowering a lifeboat where the lifeboat is a means of rescue when an accident occurs. A lifeboat is designed to save human lives in case of trouble at sea. A lifeboat generally refers to a vehicle carried by a larger ship for use by passengers and crew in an emergency. Researchers here use the RnD method, starting research at the time of marine practice on the MT ship. Fortune Pacific xlix, when researchers practice, researchers began to make observations of lifeboats and goddesses on board. Researchers began to make a frame of mind to design goddesses on lifeboats automatically. After that, researchers made skeleton designs of lifeboat goddesses and carried out mechanical and electronic designs. Researchers also tested mechanical and electronic devices after testing. Researchers began to find problems with goddess poles and ropes, then revised the product after revising the product. Researchers make product improvements. The process of making the design of the rise and fall of the goddesses on the lifeboat automatically through data collection methods in the form of observation, documentation, and data analysis methods begins with the design of the tool design in the form of the tool-making stage, trial stage, and evaluation stage and has been validated by Mr. Anang Budhi Nugroho M.Eng as a lecturer at the Semarang Shipping Science Polytechnic and in the process of making goddesses on the lifeboat automatically is also assisted by Nur Rokhim is a programmer who is currently carrying out education at UNNES. The suggestion for use in this design is not only to be applied to the system of rising and falling goddesses on lifeboats but can be applied to the shipping industry, which in its work intersects goddesses on lifeboats. Then the important process is to make an initial concept of the design model that will be made automatic by relying on electronics and mechanics on the tool.

Keywords *Procedure, Process, Lifeboat Davits*

INTRODUCTION

Ships are maritime vehicles that are highly essential as a driving force for economic progress in the world. Necessities and goods come from various regions, between islands, and even between countries separated by the sea. Special maritime transportation is needed to carry these essential goods. In the current era of globalization, maritime transport is widely used and chosen as the means of transportation. Ships are used because they are more efficient, capable of carrying many goods and passengers, and the costs are not as high as land or air routes. With various types of ships used, it becomes easier for users to choose according to their functions. The occurrence of accidents on ships that should not have happened or the failure to manage accidents on ships is often attributed to the malfunctioning safety equipment, and the delays in ship departures are also due to inadequate safety equipment on board. Based on these factors, attention should be given to the relevant parties, namely shipping companies and crew members, so that the maintenance of safety equipment becomes an important aspect that must be well-implemented to avoid losses for all parties, both the shipping company and its crew. One safety equipment that needs to be maintained is the davit on the lifeboat. The davit is an essential rescue tool in maritime accidents, but there have been accidents during lifeboat launch tests that resulted in injuries and fatalities. These accidents were mainly caused by component failures in the lifeboat launching apparatus.

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One effort to reduce failures in lifeboat launching equipment is to conduct hazard identification. Failure Modes and Effect Analysis (FMEA), combined with Fault Tree Analysis (FTA), the technique used to identify hazards or failures in the lifeboat launching apparatus. This research identifies critical components, namely wirefall and winch brake devices. The underlying causes of wirefall failure are exceeding the lifeboat's capacity, abrasion, poor lubrication, exposure to corrosive environments, incompetent operators, adverse weather, excessive weight-bearing duration, and improper wirefall winding. Failures during lifeboat descent can be attributed to several factors, such as the malfunction of supporting components. The remote control wire does not function when operated, the davit block is visibly corroded or unsuitable, which poses a danger during lifeboat descent, and rusted wirefalls that are no longer usable, causing the sheave on the davit not to rotate smoothly, obstructing the lifeboat descent process and consuming significant time. What should have taken around 5 minutes for lifeboat descent is hindered due to these issues. These problems arise due to a lack of attention to maintenance and timely replacement of items that are no longer suitable and the failure to promptly repair damaged parts. Considering the importance of maintaining the davits on lifeboats to prevent failures during lifeboat descent, motivates the researcher to conduct a study titled 'Design and Implementation of the Automatic Up and Down Process of Davits on Lifeboats'.

LITERATURE REVIEW

Many factors have led the cadets to experience difficulties with the previous learning methods. Considering the distinctive evidence of the problems, the author outlines the extent to which the plan needs to be addressed. The planner only confines the issue to the impact of new instructional techniques by guiding the practice using teaching aids. In the learning process, the author needs to understand the impact of the new teaching method on the cadets in order to ascertain how to utilize the working techniques of a design. Many factors have led the cadets to experience difficulties with the previous learning methods. Considering the distinctive evidence of the problems, the author outlines the extent to which the plan needs to be addressed. The planner only confines the issue to the impact of new instructional techniques by guiding the practice using teaching aids. In the learning process, the author needs to understand the impact of the new teaching method on the cadets in order to ascertain how to utilize the working techniques of a design.

RESEARCH METHOD

Research is a series of scientific activities that begin with the existence of a problem to be answered. In research, the working steps are essential to ensure the results or reports can be accounted for. The steps in conducting research are as follows:

a. Analysis Phase

It is a strategy to find answers to the existing framework problem by collecting the existing parts and simplifying them into simpler parts to make the arrangement suitable for the framework needs. (Bentley and Whitten (2009: 160)) In this analysis phase, the researcher needs to understand and study the system of the apparatus that will be designed, namely the automatic design of the davit's lifting and lowering process on the lifeboat. From there, the researcher will create a sequence of lifting and lowering the davits on the lifeboat on the ship. This process uses a microcontroller based on ESP32-32D.

b. Tool Design Phase

According to Timotius (2017: 102), in creating tool design, the plan will certainly consider many factors, including the development of specific item devices. So, most of this phase is a basic stage used by analysts.

In creating this instructional tool, the researcher will consider many factors to achieve optimal results. One of these factors is the condition of the tool or item to be made, so the designer must go through a planning stage that can produce optimal results. In this phase, the researcher creates two plans: a mechanical design plan and an electronic design plan. In the mechanical design phase, the researcher creates the ship and parts to place the apparatus, considering their size and shape. As for the electronic design, it is for creating the control system. The designer makes a programming block diagram using the microcontroller.

c. Tool Production Phase

In this research, the designer creates the tool themselves, and they create the parts of the instructional tool based on the dimensions designed in the previous phase to avoid wasting materials.

a. Lifeboat Framework

In creating the lifeboat frame, the researcher uses basic materials such as mahogany and pulai wood, each with a thickness of 2 cm per piece. This is used to create the lifeboat framework and davits. The choice of wood aims to make it easy to shape. The researcher created the lifeboat with dimensions: length of 20 cm, width of 15 cm, and davits' height of 16 cm, width of 30 cm.

b. Tool Design Phase

After the parts of the design have been created with careful consideration, the next step is the design phase. This phase is divided into two parts:

Parts like the lifeboat prototype have been made according to the existing design. Later, a motor system will be installed in the instructional tool.

Electronic design is the most crucial part of this research since the researcher integrates the microcontroller control system. The researcher designs an up-and-down system with control. In this phase, the researcher installs the electronic system in the prototype ship according to the design. An important component of this instructional tool is the microcontroller.

c. Testing Phase

After the tool is designed according to the procedure, it must be tested to ensure that it functions well as intended by the designer. This testing phase is done according to the functions of each component, both mechanically and electronically, with the hope that any tools that do not function properly can be improved.

a. Up and Down Test

Testers test the lifting and lowering of the lifeboat davits. The designer will test whether the lifting and lowering process occurs in this test.

b. System Control Performance Test

This test is carried out by operating the components that support the electronic system, module, and application by operating them through the microcontroller. The tester tries to determine whether it works by testing the provided buttons. If there is a system error, the designer will improve by analyzing the programming and assembly process. This is done according to the procedure with a better sequence and reference.

c. Evaluation Phase

Evaluation is the stage where the researcher summarizes the results of testing the created instructional tool. The aim is that if the tool does not meet expectations, the designer can make repeated or periodic improvements, both in mechanical and electronic parts, including manual control systems. Evaluation can be seen as the final stage, where the designer assesses the instructional tool that has been created, whether it is suitable or not to be demonstrated, and if

it is suitable to be considered as an initial product design.

FINDINGS AND DISCUSSION

Based on observations conducted by the researcher during sea practices on the MT. FORTUNE PACIFIC XLIX, it was found that lifeboats function as safety equipment on ships, used to leave the ship in case of emergencies and the inability to survive on the ship. The operation of the davits on the lifeboat involves lowering and raising them through a control panel.

In the system's design process for raising and lowering the davits on the lifeboat, a microcontroller in the form of an ESP32 is used, along with an L298N and a dynamo motor as supporting tools for the davits' movement. The control is done via a smartphone application called BLYNK IOT, which is connected to the ESP32 through IoT (Internet of Things) technology. The main voltage source is a 12V 5A power supply connected to the microcontroller. This voltage source serves as an input voltage for the ESP32, L298N, and is also used to power the dynamo motor for the davits' movement. Additionally, a custom-made electronic circuit is used for the power supply of the DC motor, derived from a 12V 5A adapter.

Operation of the Instructional Tool

a. Powering On the Tool
    1. Connect both power supply cables to the power supply unit.
    2. Connect both power supply adapters to the 220V power source.
b. Using the Instructional Tool
    1. Ensure the Arduino and motor driver power adapter are connected to the 220V power source.
    2. Ensure that the DC motor adapter cable is connected to the 220V voltage source
    3. Connect your smartphone or device to the ESP32.
    4. Open the BLYNK IOT application.
    5. Connect your smartphone or device to the tool.
    6. Make sure the system is running smoothly and properly.
c. Powering Off the Tool
    1. Disconnect the smartphone or device connected to the ESP32.
    2. Disconnect the connected device from the BLYNK IOT application.
    3. After disconnecting, turn off the electronics.
    4. Disconnect the adapter cables from the power supply.

Data Analysis Results

This data analysis technique involves several respondents, including the crew of the MT. FORTUNE PACIFIC XLIX as oiler I, Agus, as well as the programming team consisting of final year students from UNIVERSITAS NEGERI SEMARANG, Nur Rokhim, and cadets from the Teknika Study Program of Politeknik Ilmu Pelayaran Semarang in the seventh and eighth semesters. Based on the analyzed data, the results indicate that the Teknika Study Program cadets found the operation and maintenance of the davits on the lifeboat useful. They expressed that this design is a practical application method for the davits' operation and is beneficial for Semester I, II, III, and IV cadets who will undergo sea practices as a practical guide for their shipboard training. After the product testing and electronic revisions, Mr. Anang Budhi Nugroho, M.Eng, retested and validated the product. The following suggestions were provided:

a. Wifi Connection: It is suggested to use a single smartphone for user convenience.
b. Good performance, running smoothly.

Additionally, it was recommended to regularly apply grease for maintenance to ensure that the ropes and davits' poles operate smoothly.

CONCLUSIONS

1. The design and construction of the davits' frame on the lifeboat are carried out through assembly using mahogany wood, pulai wood, and ropes. A dynamo, L298N, power supply, and servo are utilized for the electronic components. Afterward, product testing and electronic revisions are performed, followed by further testing and validation by Mr. Anang Budhi Nugroho, M.Eng.
2. Creating the automatic davits on the lifeboat utilizes the Research and Development (R&D) method, involving data collection methods such as observation, documentation, and data analysis. It begins with the design phase, followed by the construction, testing, and evaluation phases. This process has been validated by Mr. Anang Budhi Nugroho M.Eng., a lecturer at Politeknik Ilmu Pelayaran Semarang. Additionally, Nur Rokhim, who is undergoing education at UNNES, assisted in creating the automatic davits on the lifeboat.

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