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Digital Solution as Implementation of Ship Lubricant Monitoring Information System

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Abstract:- The development of Industry 4.0 in Indonesia which is increasingly fast and dynamic is able to change business patterns that were originally conventional into digital or online businesses. The application of digital technology and the speed of information is expected to make it easier for shipping entrepreneurs to quickly monitor the condition of lubricating oil on ships. This is because lubricating oil is one component of the basic needs of ship operations that must be met before the ship sails, so it is very important to carry out regular oil monitoring to ensure that there are no obstacles during the voyage. The purpose of this study was to determine the role of Digital Solution services as a new system integration in accelerating information on the condition of lubricating oil on ships. The Waterfall method is a sequential design where the process looks like a waterfall from the design process, initial project concept, analysis, design, coding, testing, implementation and maintenance. The results of the implementation of the Digital Solution are able to combine various services in monitoring the condition of the lubricating oil on board so as to be able to push information to customers.

Keywords: *Digital Solution, Monitoring, Waterfall.*

I. INTRODUCTION

Sutawidjaya et al. (2019) Industry 4.0 takes the emphasis on digital technologies of the last few decades to a new level with the help of interconnection through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems. According to a survey by the American Society for Quality (ASQ) conducted in 2014, 82% of organizations claimed to have implemented smart manufacturing and 49% stated that they had experienced increased efficiency, experienced fewer product defects, and customer satisfaction. Other benefits of the presence of Industry 4.0 technology in operations management include lower product manufacturing times, reduced manufacturing costs, integrated supply chains, increased process flexibility, better customer service, and higher product customization.

Currently, the development of Industry 4.0 in Indonesia, which is increasing fast and dynamic, is able to change business patterns that were originally conventional to digital or online businesses, this also does not change the way entrepreneurs think to immediately adapt to technological developments. The competition in the shipping lubricant business that increases competitiveness and the development of digital technology will certainly change the lubricant sales business strategy in retaining customers and attracting new customers.

The application of digital technology and the speed of information is expected to make it easier for shipping entrepreneurs to quickly monitor the condition of lubricating oil on ships. This is because lubricating oil is one component of the basic needs of ship operations that must be met before the ship sails, so it is very important to carry out regular oil monitoring to ensure that there are no obstacles during the voyage. Digital services as one of the new innovations in the process of monitoring the condition of lubricating oil onboard can also answer the customer's desire for digital services that can be accessed anytime anywhere.

Lubricating oil or better known as oil can be defined as a substance that is between two surfaces that move relatively in order to reduce interference between the surfaces. The basic principle of lubrication itself is to prevent solid friction (solid friction). Lubricants are derived from petroleum which is a mixture of several organics, especially the world. (Parmin, 2016).

Ladjamudin (2013) an information system is defined as an organizational procedure that, when implemented, will provide information for decision-makers and/or control of the organization.

A. State of the Art (SOTA)

The following are some of the previous studies that the author cites related to the waterfall method and was made within the framework of the State of The Art for uniqueness and difference from the research carried out by the author.

		Okta Veza, Nanda Jarti, KurniaMustafani (2019)	Ahmad Rofiq Hakim, SitiLailiyah, Rahmat Mujahidin (2019)	Hozairi, Buhari, Safiudin, HeruLumaksono, Marcus Tukan (2019)	DR Lucitasari, MSA Khannan (2019)	Atmogo, D.Y; Santoso, S (2021)
Type of Industry	Maritime	√	√	√		√
	Education				√	
Research variable	Monitoring	√	√	√	√	√
	Productivity					
Research methods	Waterfall	√	√	√	√	√

Tabel 1.1 State of The Art (SOTA)

Based on the data in the State of The Art (SOTA) table, the authors argue that this research has advantages in the development and integration of information systems from various after-sales services that have not currently been carried out related to monitoring the condition of lubricating oil in the shipping industry and can provide new innovations. Towards the digitalization era and can also increase customer satisfaction.

II. WATERFALL METHOD

The waterfall model is a classical model that is systematic, and sequential in building software. The name of this model is actually "Linear Sequential Model". This model is often referred to as the "classic life cycle" or the waterfall method. It is called a waterfall because the stages that are passed must wait for the completion of the previous and sequential stages (Presman, 2015).

The phases in the Waterfall Model according to Pressman's reference:

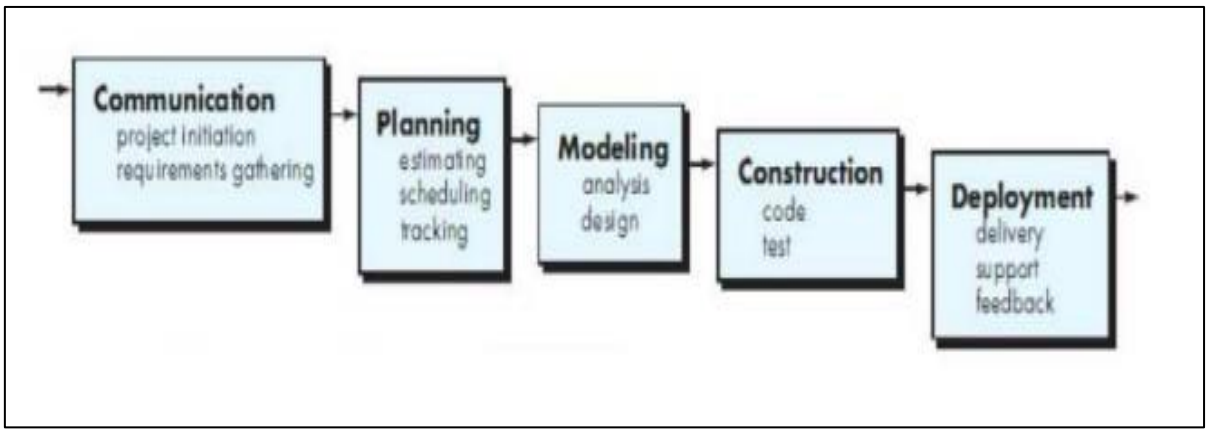

Fig. 1: Waterfall Model

Source: Software Engineering, Pressman, R.S. (2015)

Here are some explanations of the stages in making an information system using the waterfall method;

- Communication (Project Initiation & Requirements Gathering)
  Before starting technical work, it is very necessary to communicate with customers in order to understand and achieve the goals to be achieved. The result of this communication is the initialization of the project, such as analyzing the problems encountered and collecting the necessary data, as well as helping to define the features and functions of the software. Additional data collection can also be taken from journals, articles, and the internet.
- Planning (Estimating, Scheduling, Tracking)
  The next stage is the planning stage which explains the estimation of the technical tasks to be carried out, the risks that can occur, the resources needed to create the system, the work products to be produced, the work scheduled to be carried out, and the tracking of the system work process.
- Modeling (Analysis & Design)
  This stage is the system architecture design and modeling stage which focuses on the design of data structures, software architectures, interface displays, and program algorithms. The goal is to better understand the big picture of what will be done.
- Construction (Code & Test)
  This construction stage is the process of translating the design firm into a machine-readable code or form/language. After coding is complete, testing is carried out on the system and also the code that has been created. The goal is to find errors that may occur to be corrected later.

- Deployment (Delivery, Support, Feedback)
  The Deployment stage is the stage of implementing software to customers, periodic software maintenance, software repair, software evaluation, and software development based on the feedback provided so that the system can continue to run and develop according to its function.

The advantage of the software development model approach using the waterfall method is that it reflects the practicality of engineering, which makes software quality maintained because its development is structured and supervised. On the other hand, this model is a type of model that is a complete document, so that the maintenance process can be carried out easily.

A. Programming Language

The programming language used in making web-based applications in this research consists of hypertext preprocessor (PHP), and hypertext markup language (HTML). The explanation of the programming language used is described as follows:

a) Hypertext Preprocessor (PHP)
Supono&Putratama (2018) stated that "PHP (PHP: hypertext preprocessor) is a language used to translate the program code base into machine code that can be understood by a server-side computer that is added to HTML".

b) Hypertext Markup Language (HTML)
Hypertext markup language (HTML) is the basic language of web creation. HTML uses a mark (mark), to be parts of the text. HTML is referred to as the basic language because in making the web if you only use HTML, the web appearance feels bland (Rerung, 2018).

A. Databases

Risnandar (2013) defines "a database as a collection of data stored in tables. The tables are arranged by row and column. Regarding databases, there is several software or open-source software provided to create a database, namely MySQL which uses the Structured Query Language (SQL) language.

a) Structured Query Language (SQL)
Subagia (2018) suggests that "Structured Query Language (SQL) is a language that is widely used in various database products".

b) MySQL
MySQL is open-source database software that is often used to process basic data using the SQL language (Subagia, 2018).

III. DISCUSSION

Enterprise Resource Planning (ERP) is an enterprise/institutional information system designed to enable all the resources, information, and activities required for complete business processes. The most important requirement of an ERP system is integration. The integration is meant to combine various requirements on one software in one logical database, making it easier for all departments to share information and communicate. There are several main modules that have been developed and will be integrated into this research, namely:

A. Module Ship Check

This module is a module that shows the results of ship visits to find out the conditions used on the ship and problems regarding lubricating oil on board.

B. Module Lubricant Chart

This module is a module that helps view the list of machinery and lubricant recommendations according to Original Equipment Manufacturing (OEM) used on ships.

C. Oil Condition Monitoring Module

This module is a module that provides information about testing lubricating oil samples on a regular basis.

Service	Output	Input	Productivity (Hours)
Oil Condition Monitoring	1	120	0,008
Lube Chart	1	96	0,010
Ship Check	1	60	0,016

Table 3.1 Calculation of Work Productivity before Digital Solutions

Source: Company Data Processing in 2022

Service	Output	Input	Productivity (Hours)
Oil Condition Monitoring	1	72	0,014
Lube Chart	1	48	0,021
Ship Check	1	24	0,042

Table 3.2 Calculation of Work Productivity after Digital Solution

Source: Company Data Processing in 2022

Based on the above calculation, it is obtained that the average productivity of the working time needed to complete 1 report before there is a Digital Solution is 0.011 hours while after there is a Digital Solution it is 0.025 hours. This shows an increase in work productivity so that it can be a solution in supporting information to customers.In addition, with the Digital Solution service, there is a work

efficiency of around 44 hours so that it becomes more efficient in doing work.

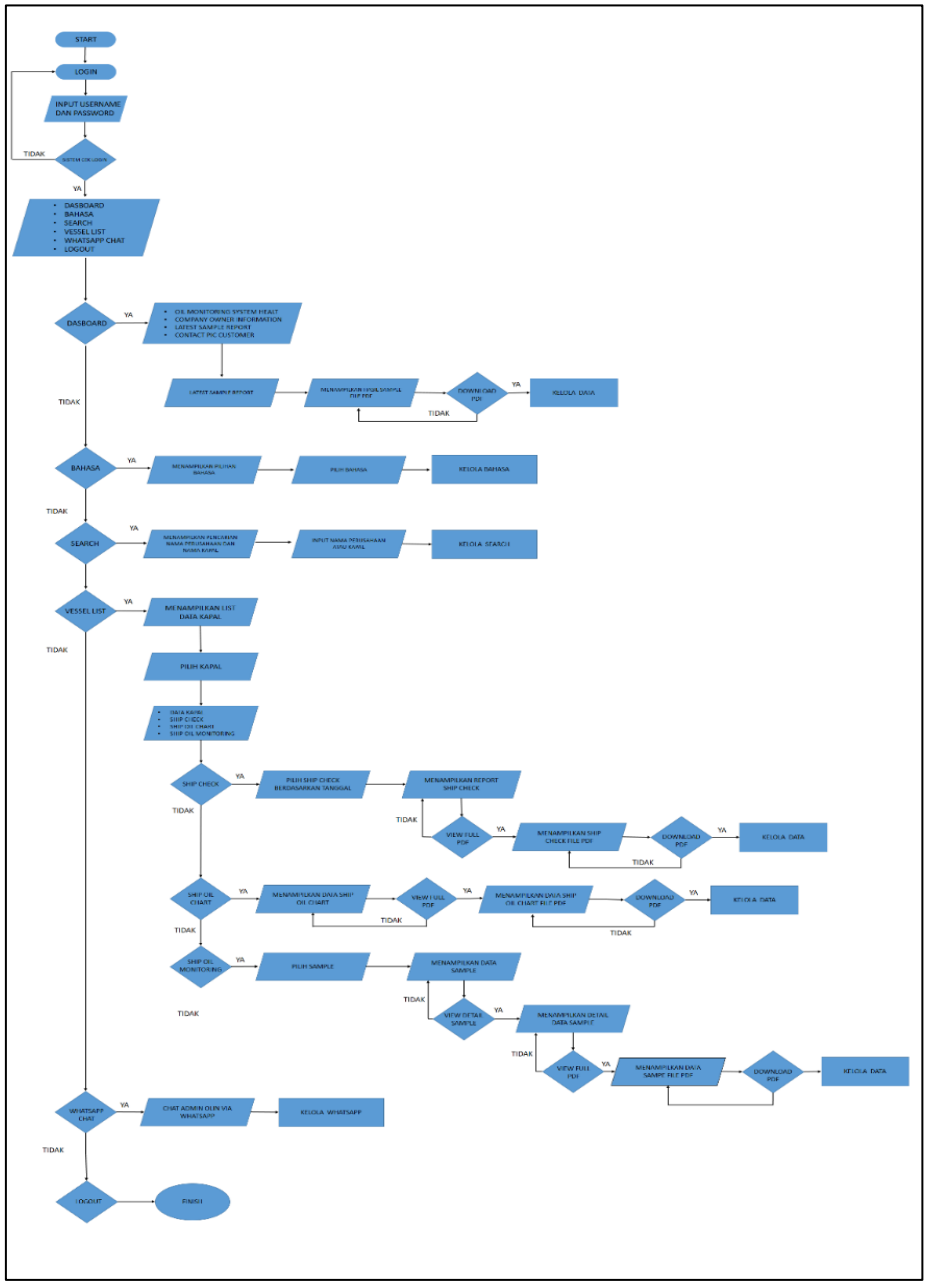

Fig. 2: ERP Digital Solution Flowchart

Figure 2. Shows that every customer has access as a user to be able to do the monitoring. Each customer who is granted access as a user must first login in order to view and download the available files according to the module type. However, if you log in as a super admin user, the user can make changes to data such as filling out reports, entering ship data, uploading data, and can also reply to questions given by customers via the WhatsApp feature.

D. Implementation System

System implementation is a system procedure or steps taken to complete an approved system design such as testing, installing, and starting to use a new system or an improved system.

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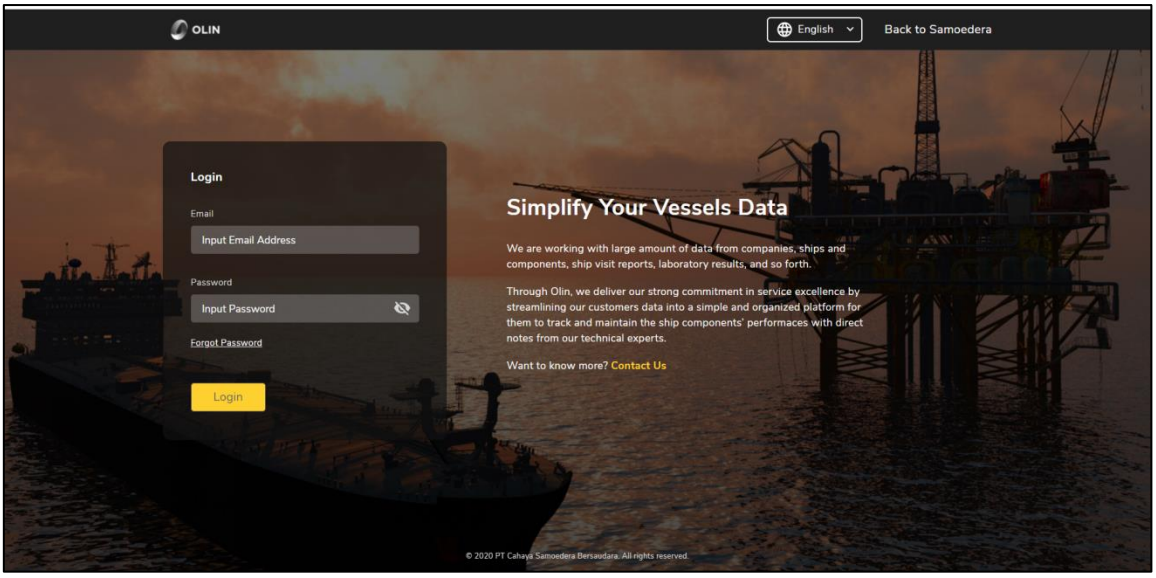

Fig. 3: Login page

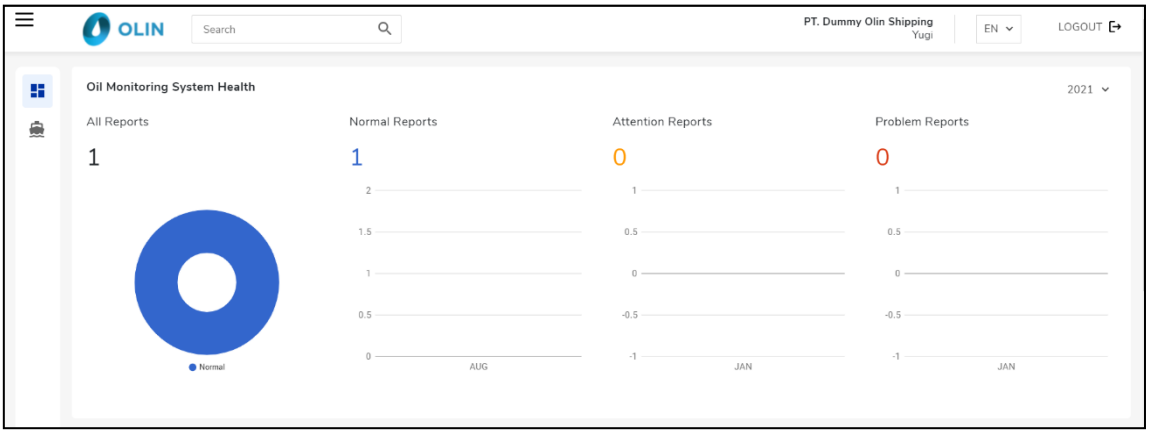

Fig. 4: Login Dashboard Page - Oil Monitoring System Health

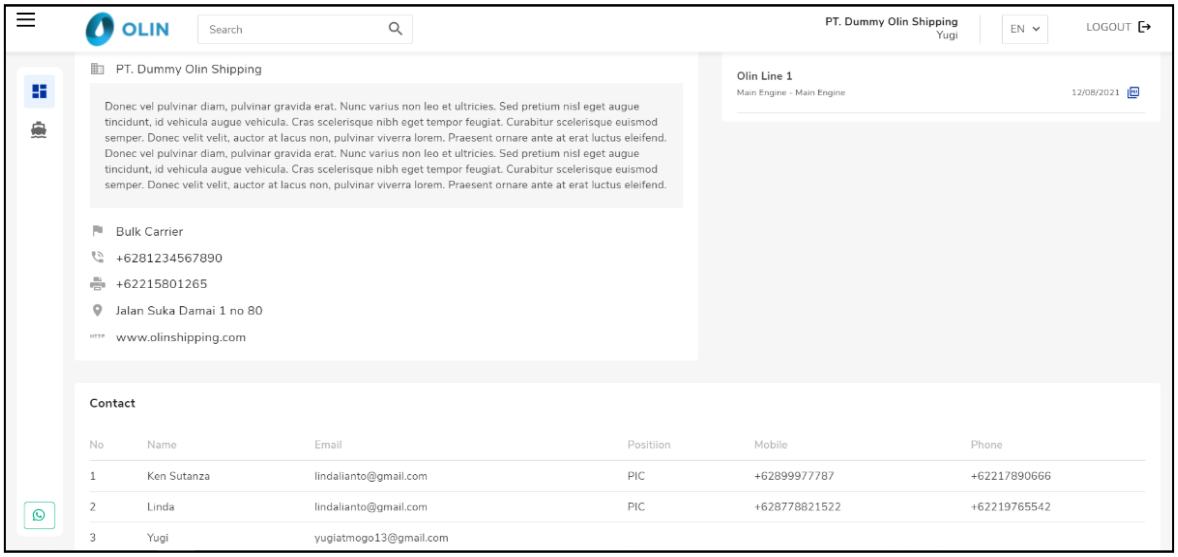

Fig. 5: Dashboard Login Page – Customer Information

The views in Figure 3, Figure 4, and 5 are the login and homepage views. Where this display displays Summary Oil Monitoring System Health from all ships as well as information related to customers.

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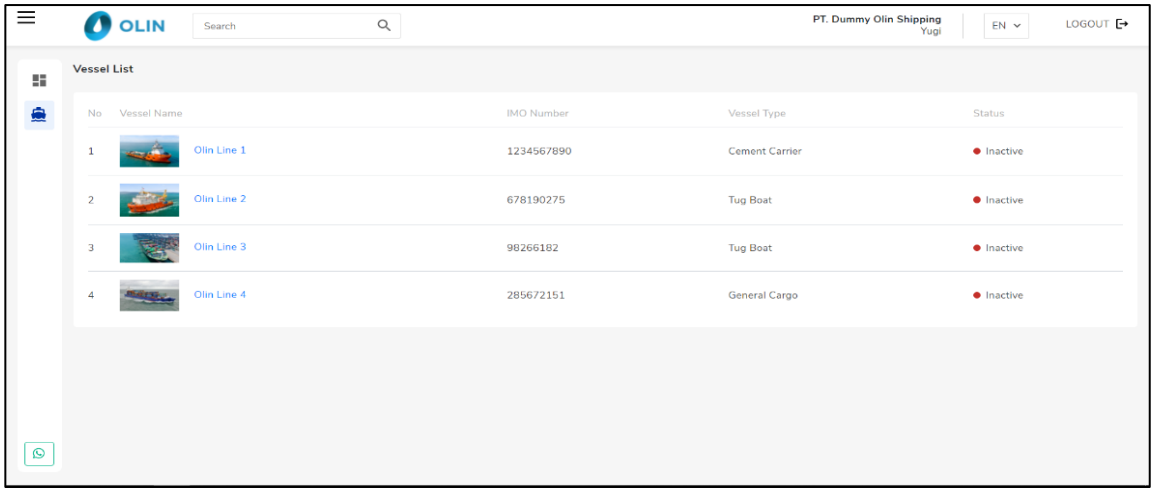

Fig. 6: Ship List Page

Figure 6 shows a list of vessels owned by customers including the IMO number and vessel type and there is a status to distinguish vessels that have used Shell products, making it easier for admins and also a reminder for customers to switch to Shell products. This is important considering that the monitoring process will only be carried out for ships with an active status.

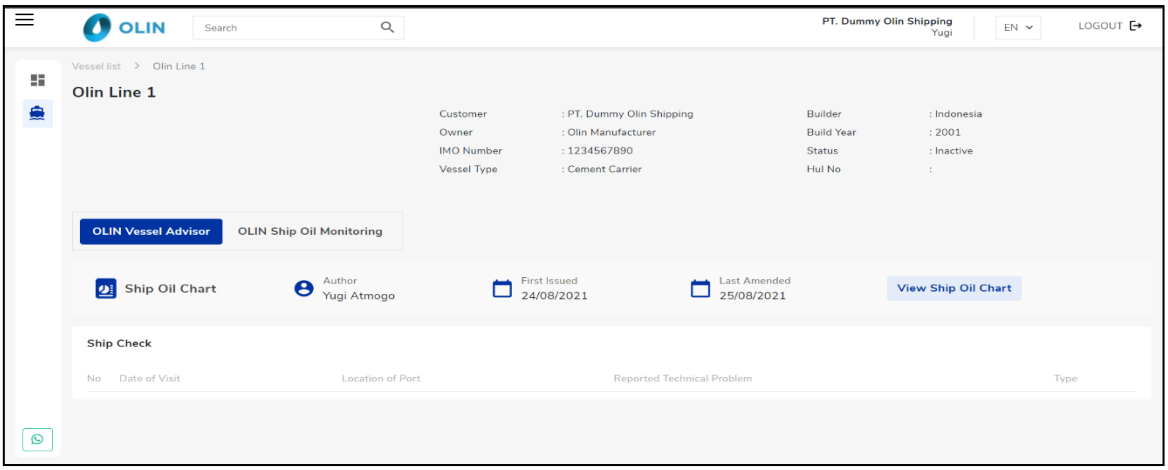

Fig. 7: Ship Check & Ship Oil Chart Module

Figure 7 shows the form of the Ship Check report including the location of the visit and a summary of the technical report. In addition, there is a Ship Oil Chart module to show a list of recommended lubricants used on ships, and the second data can be viewed and downloaded if needed.

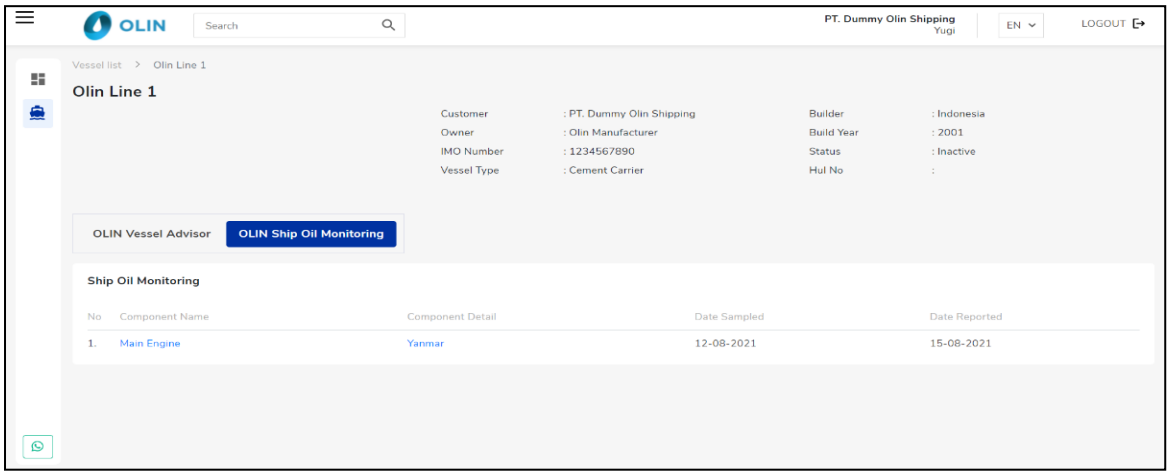

Fig. 8: Ship Oil Monitoring Module

Figure 8 shows a detailed list of machines that performed the test along with specifications of the machine model, sampling date, and date reported. Each Analysis result will be at the top as the latest information.

ISSN No:-2456-2165

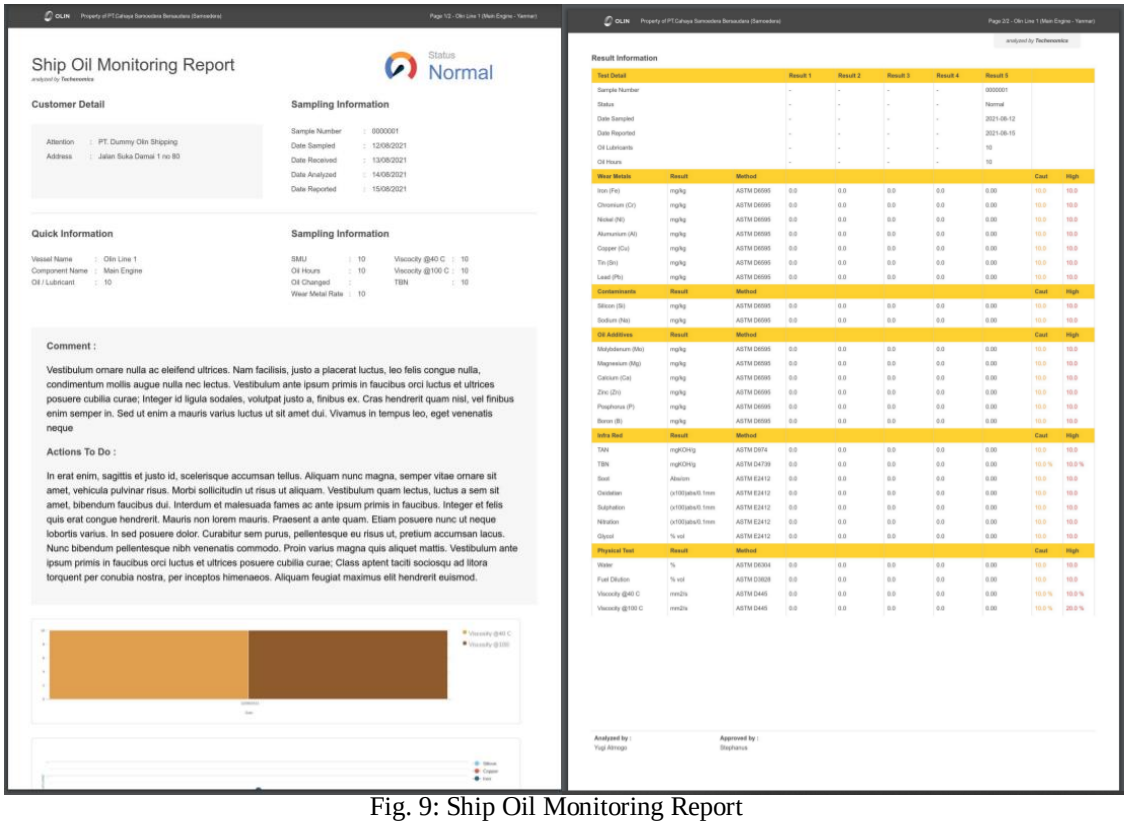

Fig. 9: Ship Oil Monitoring Report

Figure 9 shows the Ship Oil Monitoring report which contains customer details, sampling information, and quick information. In addition, there are comments and actions that need to be taken from the interpretation of the laboratory analysis results. On the analysis report page, there are also viscosity trends and wear trends as well as detailed laboratory analysis results for each test parameter.

Finally, an ERP-based Digital Solution provides convenience in monitoring the condition of the lubricant. In addition, all information and communication can be done in an integrated manner through this service.

IV. CONCLUSION

From the research that has been done, several conclusions can be drawn as follows:

1) The Digital Solution application has been successfully built, technically it has resolved several problem system data and reporting related to the lubricant monitoring process that was not previously integrated.
2) Digital Solution is able to increase time efficiency and work productivity so that it can be a differentiator in services with other competitors.
3) This research will assist companies in implementing industry 4.0 in the shipping lubricant sector and can be of added value that can be offered to customers.

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