Full Paper

Work Instruction Monitoring at Company of Flextronics Technology Indonesia

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ABSTRACT

Work Instruction (WI) was a reference for the work process according to the instructions listed. WI contains the work process, the tools employed, the materials used, and anything that requires attention related to K3. WI was created by product data management with engineer and quality engineer. WI can be changed because of the actual process, the process was changed or improved alert quality. PT Flextronics Technology Indonesia at present uses e-WI, but its digital system is limited to only displaying pdf files. WI is unintegrated if changes occur. For this reason, a work instruction monitoring application was created to make WI more efficient.

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1. INTRODUCTION

1.1 Background of Study

PT Flextronics Technology Indonesia is a manufacturing company that provides electrnoics assembly services to other electronic companies. PT Flextronics Technology Indonesia also offers design, distribution, and after-sales services to original equipment manufacturers (OEMs). To carry out these business activities, the company has an area that is used as a place of production, machines to carry out production, tools, materials, and human resources.

In a production area, there are several lines of machines which a line are used for a project. That line of machines consists of several workflows. In a workflow, there are several stations. A station is a place where an operator performs production activities. According to Mahesti Ayu Lestari, Work Instruction (WI) is used as a reference for completing tasks in more detail on the procedures to be carried out by the operator at each station[1]. The Work Instruction contains the work process and what needs to be considered related to K3.

In accordance with applicable operational standards, prior to production activities, an Admin will be responsible for making Work Instructions for the Operator to use. Work Instructions will be adjusted to actual data in the field with the approval of the Engineer and Quality division.

An admin has to create Work Instructions manually in Microsoft Excel. After discussing with the Engineer and Quality, the Admin records the feedback given by each division. The feedback provided is used to revise the Work Instructions. After the Work Instruction has been completed, the Admin inputs the Work Instruction file on each station's computer manually by pasting the file using a flash disk so that it can be displayed to the Operator. It is wasting time and very inefficient. Moreover, each station's computer CPU is placed in a place that is difficult to reach even if it is only to connect a flash disk.

This application is built and designed to facilitate the process of making Work Instructions and displaying them directly to Operators via the Website. The feedback needed by the admin can also be

updated directly in the application in real-time. This Work Instruction Monitoring application uses the ASP.NET framework using the C# programming language. With the Work Instruction Monitoring Application, Operators no longer open files manually to view Work Instructions, but directly access them via the Website.

1.2 Literature Review

1.2.1. C# 5.0

C# is an OOP (Object Oriented Programming) based programming language develop by Microsoft. C# is a programming language based on C++ and contains features similar to the Java programming language [2]. This system used C# as a programming language.

1.2.2. NET Framework 4.7.2

Active Server Pages .NET (ASP.NET) is part of the NET Framework which is designed to create dynamic web pages. ASP.NET is a web application framework developed and marketed by Microsoft [3]. The .NET framework with version 4.7.2 is used to facilitate the creation of this website.

1.2.3. SQL Server 2019

SQL Server is a DBMS (Database Management System) created by Microsoft to participate in the competitive world of data processing following its predecessors such as Oracle [4]. To support the creation of this system, SQL Server 2019 is used as the DBMS.

2. RESEARCH METHOD

2. 1. System General Description

Before production activities, an Admin will be responsible for making Work Instructions for operators to use. Work Instructions will be adjusted to actual data in the field with the approval of the Engineer and Quality division.

Admin, Quality, and Engineer must be logged in to be able to access the application. The admin will input data on the production process instructions and what needs to be considered regarding safety. Engineers will enter data streams used to define production flows as well as station information. The data set will be stored in the database.

The application will collect this data and generate Work Instructions. Engineers and Quality can view Work Instructions so that they can provide feedback as improvements so that the production process goes well. However, the Work Instructions cannot be seen by the operator if the Engineer and Quality do not agree to the Work Instructions. An overview of the design can be seen in Figure 1.

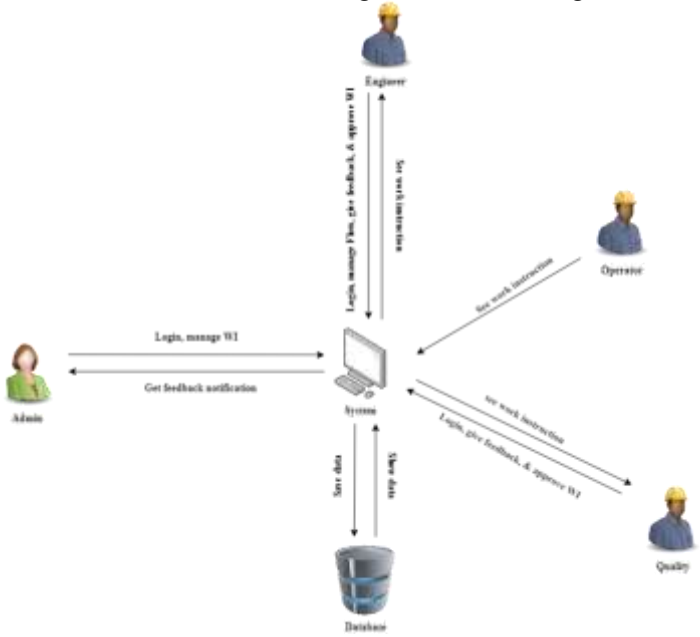

Figure 1. System general description

2. 2. Methods

The waterfall method is a sequential software life flow starting from the analysis, design, coding, testing, and maintenance stages [5], [6]. This method is used in making the system because the process is carried out more regularly so that the processes that take place do not collide with each other.

Here is the waterfall method used to build the application monitoring work instruction in order to achieve success in building the system presented in Figure 2.

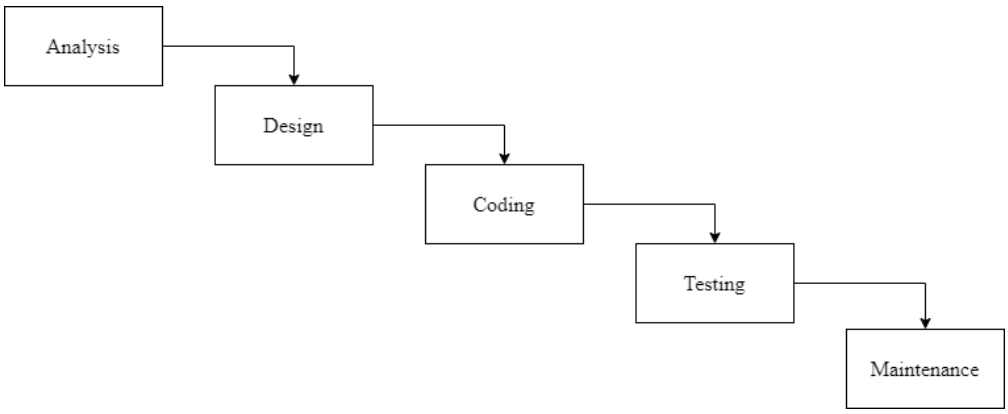

Figure 2. Metode *Waterfall*

2.2.1. Analysis

The author analyzes what will be needed to build this application, from software requirements to software limitations.

2.2.2. Design

The author designs in detail, starting from flowcharts, design files, table designs, table relations, so as to form a complete application according to the desired function.

2.2.3. Coding

The author builds a system with program code to realize the system design that has been made.

2.2.4. Testing

Tests are carried out to find out whether the programming implemented is correct so that it produces the desired function. This test is also carried out as a limitation of feedback and weaknesses of the application program that is made, then improvements are made as much as possible.

2.2.5. Maintenance

The completed system can be changed. The completed system can be changed. These changes may occur due to errors that were not detected during testing or adapting the system to a new environment.

2. 3. Functional requirements

Functional requirements are system requirements that are needed so that applications can run optimally in terms of the processes carried out by the system. The functional requirements of the application are as follows.

Table 1. Functional requirements

Functional	Information
F001	Users can log into the app with access that is processed from another system
F002	User can manage the Flow Work Instruction
F003	User can manage the Work Instruction
F004	User can see the Work Instruction
F005	User can approve the Work Instruction
F006	User can give feedback about Work Instruction
F007	User can log out from the application

2. 4. Non-Functional requirements

Non-functional requirements are requirements that the system has in terms of properties. The following are non-functional requirements of the application.

Table 2. Non-Functional requirement

Non-Functional	Information
NF 001	Display colour
NF 002	The system can be accessed using google chrome and microsoft edge
NF 003	System available in English

2. 5. Use Case Diagram

Use case diagram is a diagram that explains the context of the interaction between actors and the system [7]. There are 5 use cases and 4 actors in this system which are presented in Figure 3 below.

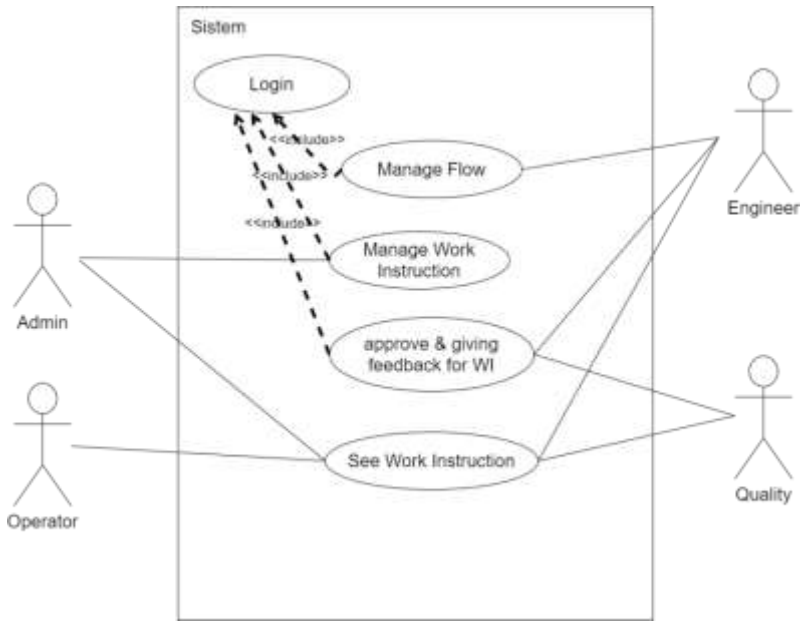

Figure 3. Use Case Diagram

The following are the functions of each actor, namely Admin, Engineer, Quality, and Operator.

Table 3. Use Case

Actor	Use Case	Desc
Admin	Manage work instruction	Create, Read, Update, and Delete work instruction
Engineer	Manage flow	Create, Read, Update, and Delete flow
Engineer, Quality	Approve & giving feedback for WI	Engineer and Quality can approve and provide feedback on WI
Admin, Engineer, Quality	Login	All users except Operators, must login to be able to access the system based on the roles that have been set
Admin, Operator, Engineer, Quality	See work instruction	All users can see work instruction

3. RESULTS AND ANALYSIS

This work instruction monitoring system is built with the C# programming language, ASP .NET as the framework, and SQL Server as the DBMS.

3.1. Interface Implementation

3.1.1. Main Page

On the main page, users can see the flow of a selected Work Order through the available drop downs.

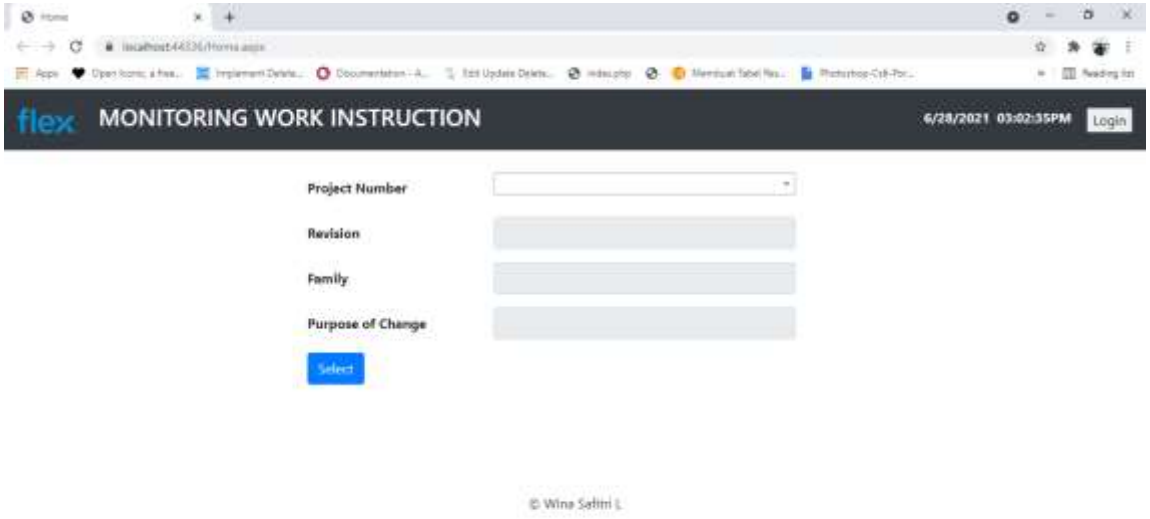

Figure 4. Main Page

3.1.2. Data Flow Menu

On the following data flow menu page, engineers can view, add, modify, and delete flows from a Work Order.

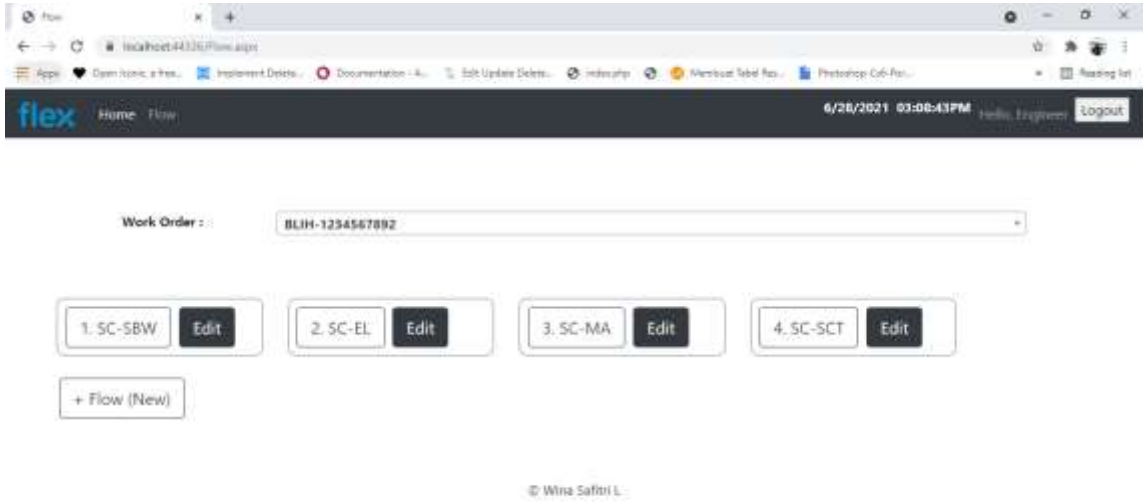

Figure 5. Data Flow Menu

3.1.3. Add Flow

The following is an interface to add flow from a Work Order.

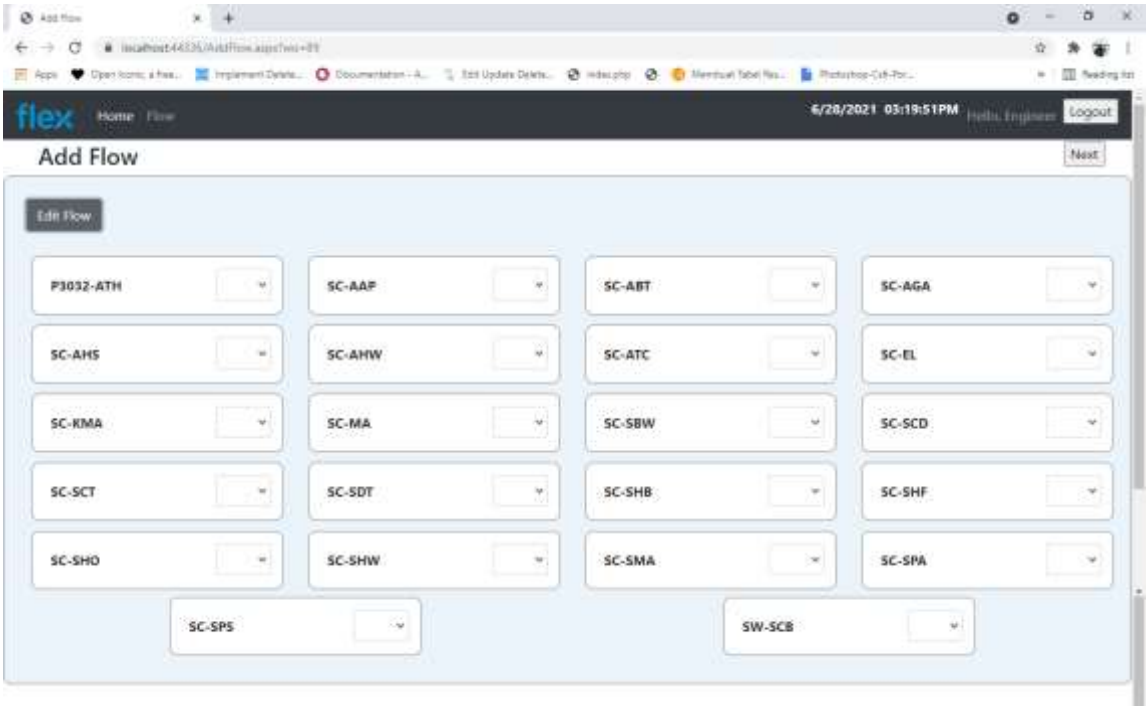

Figure 6. Add Flow

3.1.4. Work Instruction Data Menu (Admin)

On the following work instruction data menu page, admins can view, add, change, and delete WI from a Work Order.

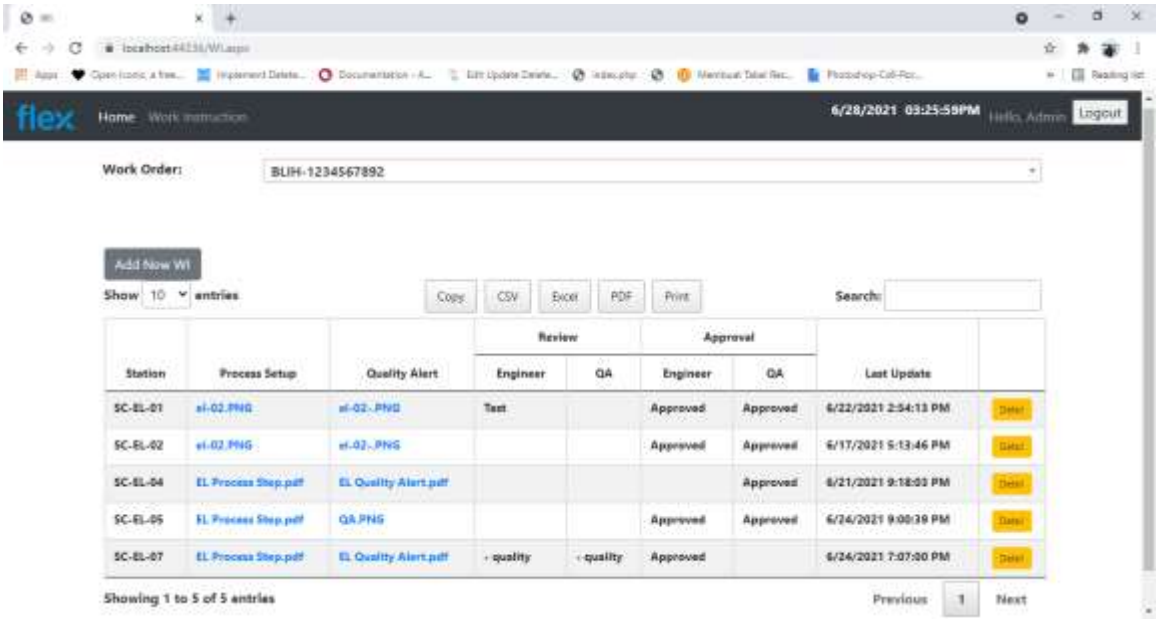

Figure 7. Work Instruction Data Menu

3.1.5. Add Work Instruction (Admin)

The following is a view to add Work instruction data from a Work Order.

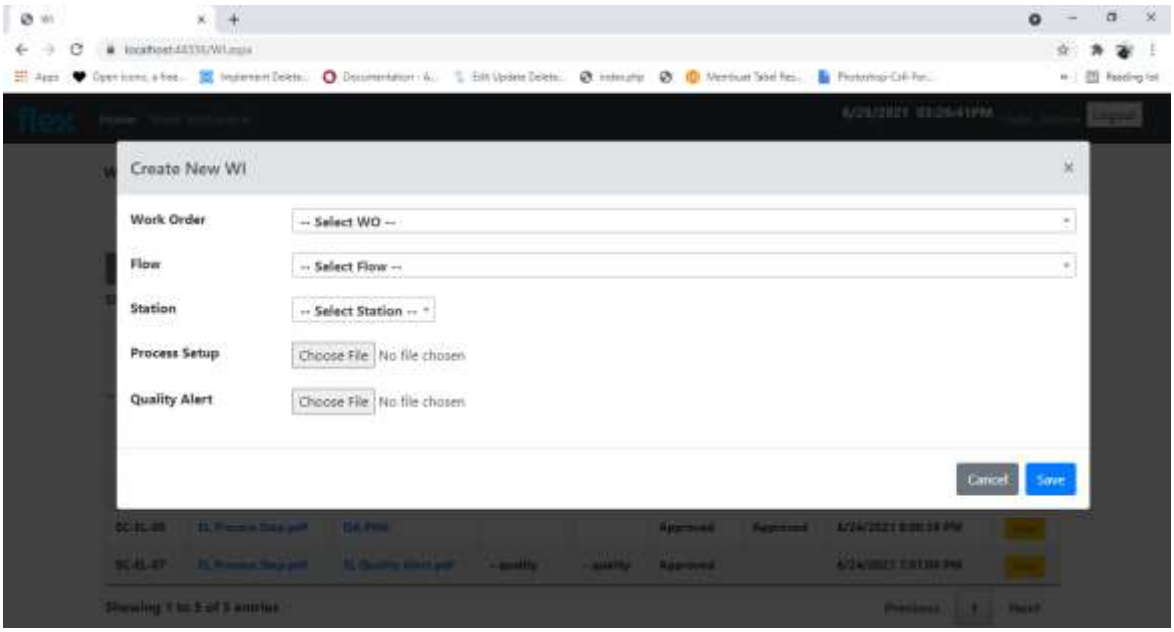

Figure 8. Add work instruction

3.1.6. Review Work Instruction

Before the work instructions can be seen by other users, the work instruction must get approval from the engineer and quality. Figure 9 below is a view of the work instruction review that will be approved or given feedback by the engineer and quality.

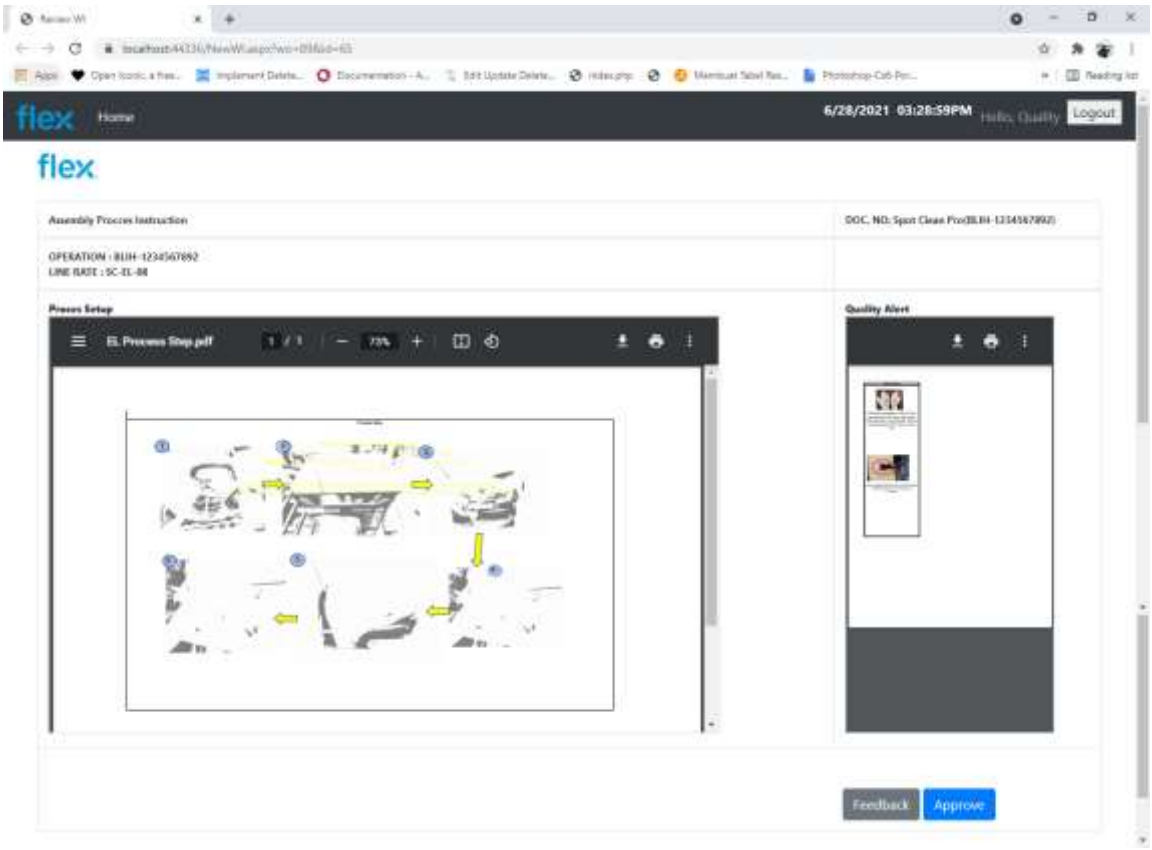

Figure 9. Review work instruction

3.2. Application Testing

The Work Instruction Monitoring application was tested using the alpha testing method. Alpha testing is a test that is carried out in a controlled developer environment. The purpose of this test is to ensure that the application being tested can run smoothly without any errors or bugs [8], [9].

System testing was carried out on 4 users, namely testing on operators, engineers, quality, and admins. Tests on the admin can be seen in table 4, tests on engineers can be seen in table 5, tests on quality can be seen in table 6, and tests on operators can be seen in table 7.

Table 4. Testing on Admin privileges

No	Nama Skenario	Scenario	Result
1	Login	Login successful	√
		Login failed	√
2	Manage Work Instruction	Create WI	√
		Update WI	√
		Delete WI	√
3	See Work Instruction	Successfully see the work instruction display	√

Table 5. Testing on Engineer privileges

No	Scenario Name	Scenario	Result
1	Login	Login successful	√
		Login failed	√
2	Manage Flow WI	Create Flow WI	√
		Update Flow WI	√
		Delete Flow WI	√
3	Approve WI	Give the feedback	√
		Approve WI	√
4	See Work Instruction	Successfully see the work instruction display	√

Table 6. Testing on Quality privilages

No	Scenario Name	Scenario	Result
1	Login	Login successful	√
		Login failed	√
2	Approve WI	Give the feedback	√
		Approve WI	√
3	See Work Instruction	Successfully see the work instruction display	√

Table 7. Testing on Operators privilage

No	Scenario Name	Scenario	Result
1	See Work Instruction	Successfully see the work instruction display	√

4. CONCLUSION

The conclusions that can be seen from the results of the implementation of the Work Instruction monitoring application are:

1. The Work Instruction monitoring application has been successfully built using the C# programming language and ASP .NET as the framework, with SQL Server as the DBMS.
2. All features that have been designed for the Work Instruction monitoring application have been successfully implemented.

The following are suggestions that can be used for further development:

1. To make it easier for Engineer, Quality, and Admin in carrying out their duties, it would be nice to add a notification feature directly through the web, because at this time the notification is via email.

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