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Implementation of Production Monitoring Systems in A Small Textile Company

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Abstract

We perform monitoring processes to obtain information continuously from a particular activity so to make positive results that are following the objectives set. Previous studies have indicated that there was much research on computer-based monitoring systems, with most of them are trying to obtain optimal results in the monitoring processes. Unfortunately, those studies were done using large enterprises as their case studies. What about small businesses? Can a computer-based monitoring system be implemented there? In this study, we are trying to implement a production monitoring system in a small textile company. CV Indotas experienced a significant increase in its customers, including companies and big brands such as state-owned enterprises, E-Commerce, travel service providers, and many more. Generally, as the product demand increased, errors are inevitable; this has created the opportunity to solve the issue using production monitoring systems. We also carried out the system acceptance test using four different actors that granted access to the system. The percentage of test results obtained was 88.38%, concluded from 28 test cases. We suggest expanding this study to become a system that can communicate with other modules or separate systems such as payment transaction systems and production scheduling systems.

Keywords:
textile production, computer-based, monitoring systems, small company,

1. Introduction

The ever increasing development of production demands puts more pressure on the company to fulfill the order (Birtel et al. 2018). Specifically, in manufacturing textile products, it shows a vast amount of growth since clothing is one of the basic human needs; thus, the market will always exist (McGrath et al. 2016). It is a business which needs to keep up with the times, hence require planning of production and making decisions such as to increase business capital, increase the number of workers, total production capacity, increase sales distribution or improve marketing strategies (Guo et al. 2015) (Sales et al. 2019). Increased production demands can create problems such as miscommunication and information between internal entities of the organization (Arrohman, Az-zahra, and Wijoyo 2019). Hence, they require a lot of monitoring, which is an activity that can be explained as an awareness of what you want to know. High-level monitoring carries measurements through time that indicate movement towards the goal is moving away from it (Novas et al. 2017). These measurements use the assistance of computer software. A monitoring information system is useful to integrate data, production scheduling, and data collection of each product produced. Previous studies have indicated that computer-based monitoring systems are used to obtain optimal results in the monitoring processes. The technology includes RFID-based monitoring systems (Guo et al. 2015), IoT (Zhong, Wang, and Xu 2017), artificial intelligence (Abellan-Nebot and Romero Subirón 2010), and visual-based surveillance monitoring systems (Mörth et al. 2020). The monitoring system also applied in various industries such as manufacturing (Chen 2020), oil and gas (Fang et al. 2017), agriculture (Lambin et al. 1993), and livestock (Ikhsan et al. 2019).

All of those mentioned are broad and labor-intensive industries. What about small businesses? Can a computer-based monitoring system be implemented there? Unfortunately, not many studies address the implementation of a production monitoring system in a small business. This study seeks to answer these challenges by discussing how a small industry applies a computer-based monitoring system. We took a small company called CV Indotas as our case study of implementing a computer-based monitoring system in a small company. This company produces various kinds of bags, including a tote bag, backpack, and a pouch. Currently, CV Indotas experienced a significant increase in its customer base, including companies and big brands such as

state-owned enterprises, eCommerce, travel service providers, and many more. As the product demand increased, errors are inevitable; a study provided the issue of the production process time (Huang and Yan 2019) (Uhlmann et al. 2018). Also, in monitoring the production progress, many of them require a long process because each division does not have a well-integrated data (Abellan-Nebot and Romero Subirón 2010).

This research carries a significant impact on determining to what extent the support of computer-based software in production monitoring systems can strengthen the activities in small companies. It also implies the competitive positioning of a small company so that it can help to improve the quality of the company. We would claim that this study will contribute to assisting companies in solving problems that occur in the production process of goods. Such issues include data disintegration, lack of monitoring in raw material inventories, lack of control in operations and production progress, and less detailed production reports.

2. Research Method

This study uses several techniques for data collection consisting of interviews with relevant parties and observations in the company. We conduct the interview processes at the CV Indotas warehouse located in South Cimahi, Indonesia. The first visit was made on the 23rd of January 2020 to meet with the production manager and ask permission to conduct interviews with staff involved in the production process. More meetings were held on the 3rd of February 2020 until the 5th of February 2020 and began speaking about the business process, the actors involved, and to thoroughly explain the activities carried out at the company. In addition to the interview, the observation process also took place from 12 to the 15th of February 2020. The activities carried out during the observation were to look at the events in the company, see who the actors were there, and record the results of observations, which would then be reported to the person in charge at the next meeting—namely, the production manager.

2.1 Business Process Identification and System Objective

The first stage in software development is to identify the business flow to create the objective of the system (Yazdani Seqerloo et al. 2019). The business process that runs on CV Indotas starts with an order from the customer (coming to the warehouse or via telephone). After the customer orders the goods and makes a payment, then the order data is input into the system after the order data comes in, then the admin creates a production schedule. Next, the order is forwarded to the raw material section for checking the raw material stock. If the raw material is available, the provider will verify them and proceed to the process of measuring the material, printing (screen printing/embroidery), cutting the fabrics, and entering the sewing stage.

Table 1. Problems Found during Business Process Identification

No	Problems Found	Description
1.	Production information is not accurately recorded	Information regarding production progress is challenging to monitor by the company or the customer.
2.	Data on production needs are not mutually integrated	Data that is not integrated makes it less efficient the time needed to check
3.	Time estimates cannot be monitored.	The estimated time to work on each part is not well monitored, so that in the production process, which creates a chaotic situation in many jobs.
4.	Production reports are not good enough for analysis	Production reports that are not recorded under the process result in inadequate information received by the manager, making it difficult for the evaluation process.
5.	Data of Order Request are not presented in detail.	Disorganized order data makes there are often errors when producing, for example, the number, design, and size of goods that are not following the order.

Problems found during the identification process determine the system's objectives which can be seen in Table 2.

Table 2. Objectives of the Integrated monitoring system

No	Objective Description	Solving Problem No-
1	Thoroughly monitoring the production process and provide statuses on each process.	1, 2,5
2	Provide information about needs during the production process.	2,5
3	To estimate the time of production.	1, 4
4	Making reports according to the production carried out.	4,5
5	Order data recorded in detail.	5

2.2 System Design

This stage finds out what the user needs to solve problems (Del Amo et al. 2018) that exist in the company. System design aims to translate user needs, analyze them in a form that is easily understood by the user. Database design planning needed, including the ordering database and the production database. The database design of this system is presented in Tables 3 and 4.

Table 3 design database Order

No	Attribute	Type	Length	Index	Information
1	Id_pesanan	BigInt	20	PK	*Not Null,*
2	faktur	Varchar	10		*Not Null,*
3	name	Text	15		*Not Null,*
4	no_telf	Varchar	255		*Not Null,*
5	alamat	Longtext			*Not Null,*
6	kode_track	Varchar	255	FK	*Null,,*
7	catatan	Longtext			*Null,*
8	file	Varchar	255		*Not Null,*
9	user_id	BigInt	20	FK	*Null,*
10	created_ at	timestamp			*Null,*
11	update_at	timestamp			*Null,*

Table 3 explains the data requirements that will be used by the admin to store data on orders for the production of goods. The actors using the data include the admin, the production department, and the manager. In order database analysis, it produces two foreign keys, namely user_id and kode_track, because later, the data is related to other tables.

Table 4 design database Production

No	Attribute	Type	Length	Index	Information
1	id_produksi	BigInt	20	PK	*Not Null,*
2	kode_produksi	Varchar	255		*Not Null,*
3	bahan_id	BigInt	20	FK	*Null,*
4	pesanan_id	BigInt	20	FK	*Not Null,*
5	deskripsi	Text			*Null,*
6	catatan	Text			*Null,,*
7	jadwal_produksi	Date			*Null,*
8	estimasi	Date			*Null,*
9	status	Enum			*Not Null,*
10	created_at	Timestamp			*Null,,*
11	update_at	Timestamp			*Null,*

Table 4 explains the data requirements to be used by the production department. Apart from this data production division, this table also links with other user groups of admin, manager, and raw material provider. The results of the analysis of database design for production found two foreign keys in the bahan_id table and pesanan_id because the table has relations with other tables.

2.2.1 Actors Identification

Identification of actors is carried out to find out who are the actors involved and the function of their roles. Based on the analysis conducted, there are several actors involved in this case, namely: Admin, raw material, cutting, sewing, measurement, printing, manager, and customer.

Table 5 Actors Identification

No	Actor	Description	Mentioned in
1.	Superadmin	Super Admin is an actor whose job is to provide User access rights.	Second observation
2.	Admin	Admin is an actor whose job is to add orders.	The second interview
3.	Parts raw material provider	It is the actor who updates the availability of raw material stock for production.	The second interview with the manager
4.	Material cutting section	The actor who did the earliest production process was cutting patterns.	Interview questions to the production department resource

5.	Measurement section	The user group who measure goods on materials for production.	Interview questions to the production department resource
6.	Tailoring section	The actor who did the sewing process on the pattern made.	Interview questions to the production department resource
7.	Printing department	Actors who print designs such as screen printing, embroidery, etc.	Third observation
8.	Manager	Actors who can view production reports and evaluate.	Interview questions to the production department resource

2.2.2 Functional Analysis

Functional analysis is done so that the system is built following needs (Fishbein & Ajzen 1993). System requirements analysis is based on existing processes in the system during the production process carried out at CV Indotas. Based on the results of the study of the running system, we can conclude that the functions contained in the current system on CV Indotas as in Table 6:

Table 6 Functional Analysis

No	Function	Description	Solving Objective No-
1.	Manage Users	To set access rights into the system	1,2,3,4,5
2.	Manage Orders	To add data to orders that will be produced	2,4,5
3.	Manage raw materials	To view and monitor the stock data of raw materials available for production	2,4
4.	Manage production	To record data on the production carried out	2,3,5
5.	Manage Qc	To record the quality and quantity of production so that it can be evaluated	1,4,5
6.	Manage Tracking	To monitor the production process	3,4
7.	Manage reports	To see the production report that has been done	4
8.	Manage history	To view order and production history	1,4

2.3 System Development

The software that has been built is then implemented and tested (Mörth et al. 2020). Before running the software, there are several software requirements needed to support and facilitate the testing of the software that was built (Mantzana et al. 2007). This software is produced based on the web using the PHP programming language with Visual Studio Code tools and uses a MySQL database and Apache Web Server in the Laragon application, google chrome as a media web browser, Laravel Framework for PHP and CSS Foundation Framework.

3. Result and Discussion

The design and manufacture of software available in this study were completed in four months. In the testing phase, there are two tactics, namely system testing, and user testing. The test will determine the quality, success, testing stages, and conclusions of the study.

3.1 Production Monitoring System

The interface design created is the result of the identification of the system design that was carried out in the previous stage (Dunn et al. 2011). The monitoring system created will be used as a monitoring system of the production process carried out by several actors, including the cutting section, the sewing section, the printing department, and the manager. Every part of the production process is completed (Vidgen, Avison, and Wood 2002), so each piece is required to conduct Qc and make an evaluation of the finished production activities. There are 84 order data (January - March 2020), which have been entered into the system for testing purposes. The final results of the production verification and evaluation will be made a production report to the manager. Users are required to fill in user names and passwords for access to the system as shown in Figure

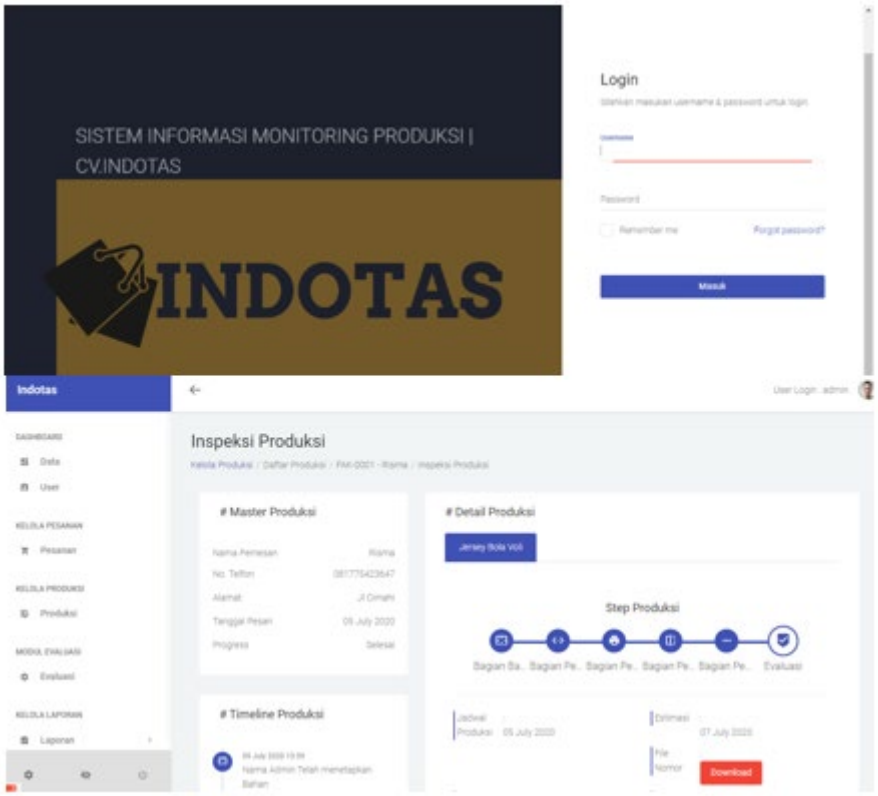
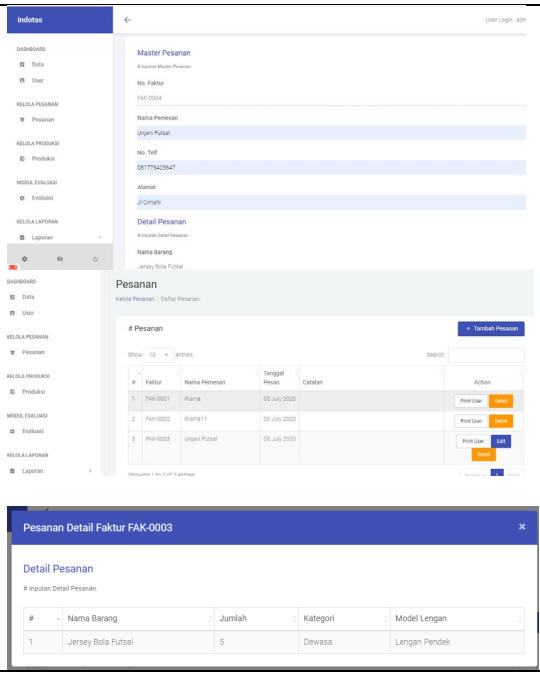


Figure 1 Production Monitoring System

In the system, there is an order management function to input orders that have entered and have already made payments. After payment is made, then the request is inputted by the admin, and a production schedule will be made after the raw material section confirms the availability of raw material stock.

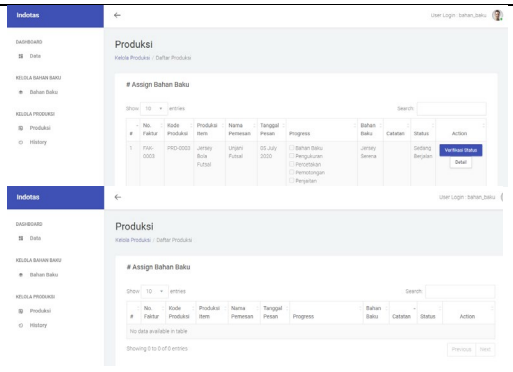
Table 7 Scenarios for the test case for the added balance function

Use Case ID	ORD_001
Use Case Name	Add Order
Test Scenario	Test case for adding order management to the order management function
Test Case	Enter data in full format
Pre-Condition	Blank order form
Test Steps	1. Click Add order
	Fill in the data completely
	1. Click “save”
Te“t Da”a	2. Input the order name <"Unjani Futs “l">
	3. Enter the telephone number <"081775423647">
	4. Enter the address <"Jl Cimahi">
	5. Enter the item name <"Futsal Soccer Jersey">
	6. Input the raw material <"Jersey Serena">
	7. Input the <"Short"> arm model
	8. Input the <"Adult"> category
	9. Input size <"Uk s = 2, uk M = 2, uk L = 1, uk XL = 3">
	Input design file <"file.jpg">
	Enter the back number <"nama.xlsx">
Expected Result	Notification: order added “
Post Condition	“Order added“successfully”
Status ”Pass/Fail)	PASS

Actual Result	

There is also a page for managing raw materials to see the stock of available production materials or not to meet production needs. After that, production planning will be carried out by inputting the production schedule on the system by the admin. With the production schedule on the network, production activities can be started according to the stages and can be monitored by the admin, production manager, and customer.

Table 8 Scenarios for the test case for the added balance function

Use Case ID	ORD_002
Use Case Name	Confirm the availability of raw materials
Test Scenario	Test case for raw material management
Test Case	Enter data in full format
Pre-Condition	Blank order form
Test Steps	1. Click the production icon
	Select the order to be produced
	Click “Verify Status”
	Upload” proof of raw material stock
Expected Result	Notification “Raw material“ has been successfully verified.”
Post Condition	Status verification successful
Status (Pass/Fail)	PASS
Actual Result	

On the production page, there is a verification process and upload proof that the product has been completed where the process must be carried out by every actor involved in the production division. If the actor has not yet verified in the system, it cannot proceed to the next stage of production. After the production process is completed, a quality control process will be ca be carried out to obtain an evaluation of the output and produce a detailed report on the production activities.

3.2 The Acceptance Test

User testing is the stage of testing by users of the system created. The test proves that the software has been made to meet user needs. This test has gone through 28 test codes for four actors, namely, admin, raw material, production, and manager.

No	User/Tester	Acceptance Rate	Notable comments	User description
1.	Admin	(23 out of 28) 82,13%	"I'm still having trouble uploading files to add orders."	-Two user -Gender: Female -High school graduate
2.	Raw material section	(25 out of 28) 89,28%	"It's quite good and understandable, but in verification, there are still difficulties in checking the status of orders which have been verified by us."	-Two user -Gender: Man - High school graduate
3.	Production department	(25 out of 28) 89,28%	"It's good enough, easy to understand."	-Eight user -Gender: Man 6 Ladies 2 - High school graduate
4.	Manager	(26 out of 28) 92,85%	"the report is good, but I want to add a pdf format."	-One user -Gender: Man - Vocational School graduates
	Avg Acceptance	**88,38%**		

Based on table 9, we analyzed what issues failed to be accepted by the users of the system. In interviews about user testing, it is known that for admin actors do not approve 5 of 28 test cases. Some users said:

"....the display tends to be too brightly colored", and
"the buttons on the ordering data are piling-up,";

While other actors also commented on the presentation of production reports is poorly understood. Actors supplying raw materials do not approve 3 test cases, with most of them agreed on the raw material data display is less colorful. The third user group is the production department, and they also did not approve 3 of the 28 tests with reasons that several parts had to be verified by including a photo. Also, they found an error that occurred during the photo selection. Lastly, the manager does not approve the test cases with two reasons for appearance when opening a report and when to print different documents.

4. Conclusion

We conclude users can accept this study of implementing production monitoring systems in a small company with a percentage of almost close to 90%, which means the user has given confidence to researchers to be able to develop this research better. Implementation of a production process monitoring system can help problems that occur in the company as evidenced in 9 tables created to produce some percentage of system acceptance when testing is done, each actor is of suitable value, and it can be concluded that the system is useful and helps the actors. We suggest expanding this study to become a system that can be integrated with other modules or separate systems such as payment transaction systems, production scheduling systems, and so on.

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