e-ISSN 2477-6025
DOI:10.21776/ub.jemis.2021.009.01.5

PRODUCTION MACHINE INFORMATION SYSTEM BASED ON TECHNOLOGY GROUP IN RELATIONAL DATABASE ENVIRONMENT

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Abstract *The world is entering industry 4.0. The digital enlarges to machine maintenance known as troubleshooting. Troubleshooting is a series of actions needed to deal with machine damage treatment. Problems that often occur in troubleshooting are that technicians are not in the location, the information is still in the form of printed books, the risk of books being lost, books slipping, and the location of books far from the location of machine failure. This research was to solve this problem by developing an application called Production Machine Troubleshooting Information System (SITMEP) in relational database environment. This system was developed by integrating several methods such as knowledge of machine damage obtained from tacit, namely data sourced from mechanical technicians, experts in their fields and explicit knowledge sourced from machine manual books. GT is to combine knowledge with machine hierarchies and it supports systems for database and SQL. The tool used was MS Access with VBA.*

***Keywords**: System Information, Maintenance, Group Technology, Knowledge Management, Database, Microsoft Access*

1. Introduction

The industrial revolution 4.0 is a popular topic in professional field and academic [1]. Industry 4.0 is the main keyword used by researchers, policymakers and entrepreneurs while describing how the world's industrial systems will develop in the near future by utilizing Internet-connected technology to generate added value for organizations and society [2]. The industry is currently experiencing what experts call the “Fourth Industrial Revolution”, it is also called Industry 4.0. This fact is closely related to the integration between physical systems and digital production environments. The integration of the environment allows the collection of large amounts of data collected by different equipment, located in different sectors of the plant [3]. Besides, the new technologies of Industry 4.0 integrate people, machines, and products, enable a faster and more targeted exchange of information [4]. This concept has smart manufacturing as its main element [5] followed by factory integration with the entire product life cycle and supply chain activities [6] [7]. This system changes the way people work [8].

Production scheduling and maintenance planning are most common and significant problems faced by the manufacturing industry [9]. Maintenance activities such as repairs and inspections have a significant impact on production operations as they can shorten time and costs [10]. A sustainable production process and an increasingly competitive market, effective maintenance activities are becoming increasingly important [11], therefore information system support is needed, for example, machine maintenance science that is packaged in a maintenance management information system.

KUD (Village Unit Cooperatives) of fresh milk production in the business activity can process some milk productions. Yet, the capacity is still smaller than the amount of milk

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Published online at http://jemis.ub.ac.id

Cite this Article As Farhan, A., et.al (2021). PRODUCTION MACHINE INFORMATION SYSTEM BASED ON TECHNOLOGY GROUP IN RELATIONAL DATABASE ENVIRONMENT. Journal of Engineering and Management in Industrial System, 9 (1), p. 45-58.
Paper Accepted : April 30th, 2021

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distributed to the Milk Processing Industry (IPS). KUD BATU receives 16-17 tons every day. The problems occur while dealing with machine breakdowns because information about machine repair is only from experienced technicians and a good information system has not been organized. Thus, it results in a long repair process. This research was conducted in a plate heat exchanger (PHE) machine. Machine maintenance based on the factory manual will have many problems, for example the hard copy module is easily scattered or tucked away and it does not contain the practical work experience of technicians. Cases such as manual books on machines produced by technicians are not found in the field during emergencies although the machine is a core part of the pasteurized milk production process. In addition, experts who handle repairs related to troubleshooting (TS) may not always be on site at all times. Knowledge Management (KM) paradigm is a smart paradigm in managing knowledge that has not been empowered to increase competitive advantage, the quality of human resources through the cultivation of a culture of knowledge sharing, and company profits [12]. KM strive to develop practical technical knowledge from technicians. An example of practical experience is that when a boiler engine makes a unique hum, the technician immediately understands that the boiler chimney is clogged. Furthermore, the chimney must be cleaned with a scouring iron. Knowledge is generally classified into two types, there are Tacit knowledge and explicit knowledge. Tacit knowledge is subjective and inherent in individual knowledge and difficult to form and transfer to others. Explicit knowledge is formal and systematic that is easy to communicate and share, for example in book form [13]. Since the task has to be converted into a form that can be understood by computer, task analysis is becoming increasingly important because of the difficulty of externalizing operator's tacit knowledge [14]. Tacit knowledge contains all cognitive skills and technical skills which are difficult to articulate [15]. Without acquiring tacit knowledge, the chances of missing out on important information and best practices are very high [16].

This research aims to conceptualize to assist repair action on machine failure in terms of troubleshooting with the assistance of digitization technology. Data collection through direct survey to the factory. Problems that often arise with TS are: technicians are not necessarily in the location all the time, the TS manual of a machine is still a risky printed book: books are lost, books slip, and the book is located far from the location of the machine failure.

As in digital era, this research attempts to solve this problem by developing an application called Production Machine Troubleshooting Information Systems (SITMEP) in a relational database environment. SITMEP was developed by integrating several disciplines such as: Group Technology (GT) to help design the SITMEP database architecture, a relational database to build the SITMEP database system, and the Structured Query Language (SQL) language to speed up the search for the right TS method. Thus, the application can be accessed by anyone, anytime and anywhere, SITMEP is placed on the web. Tools used are Microsoft Access along with Visual Basic for Applications (VBA). The SITMEP application level is still at the prototype level, and has great potential in the future to become an application that is sold in the Playstore. This research produces a prototype SITMEP database that is ready to be developed into an application.

2. Material and Research Methodology

This research used method of group technology (GT). GT is a philosophy in manufacturing that identifies similarities of components and groups them together by taking advantage of similarities in design and manufacturing. The basic concept of GT is to simplify and standardize the process [17]. Handling troubleshooting is by integrating several relevant methods such as Maintenance management science. It is to find out data on cases of damage to the machine. Thus, it can be integrated with the GT method that performs codification grouping of data that will later be stored in the database in SQL language to simplify the troubleshooting search process by creating a prototype with Ms. Access.

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2.1 Machine Data

Plate heat exchanger machine is a heat exchange medium consisting of a plate (plate) and frame (frame). Plate heat exchanger, which is arranged in a certain arrangement, so that two lines are formed called the hot side and the cold side. Flush the hot side with a liquid with a relatively hotter temperature and the cold side is flowed with a liquid with a relatively cooler temperature. The liquid used as a medium can be of the same or different types, for example water-water, water-oil, etc. The heat exchange that occurs from the hotter liquid to the cooler liquid is in the plate plates that are both paths. Thus, the Plate Heat Exchanger can be used as a medium for heating or cooling liquids. The machine to be researched is the PHE machine that can be seen in Figure 1.

2.2 Troubleshooting Knowledge

Results of tacit knowledge collection from the expert about PHE machine troubleshooting as GT polycode can be seen in Table 1 and examples of collecting explicit knowledge from the manual book is in Table 2.

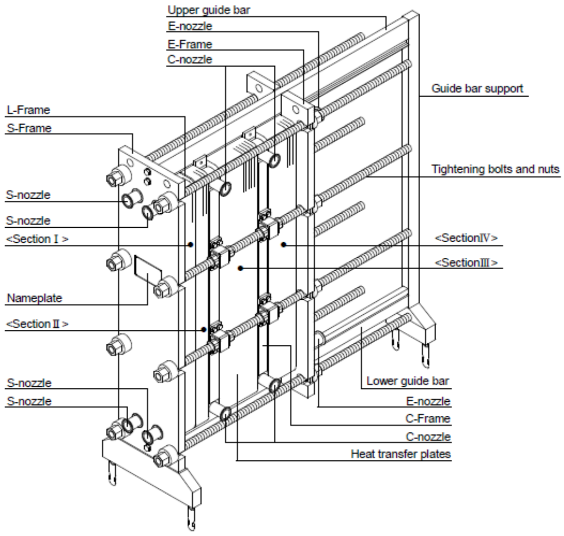

Figure 1 Machine PHE

Table 1. Tacit Knowledge (expert)

Sign	Possible Cause	Solution
sound drrr drrr sound, low performance and normal temperature and vibration.	There is a leak in the pipeline	Rubber (gasket) on the PHE engine must be replaced
	The plumbing is clogged	The sugar dirt that is stuck on the pipe cause clogged the pipe, thus, the grille had to be cleaned.

Table 2. Explicit Knowledge (manual book)

Sign	Possible Cause	Solution
Heat transfer performance decreases	The heat transfer surface is dirty	Disassemble the Heat Exchanger and clean the heat transfer plate. Make sure to check if any pipes connected to the PHE inlet and outlet are clean.
The differential pressure increases or the flow rate decreases	Fouling on the heat transfer surface makes a narrow plate gap	
	Port holes or surface heat transfer is clogged	
Fluid leaks out from between the heat transfer plates	The sealing performance decreases due to the lack of insufficient fastening.	After the internal pressure of PHE, there must be pressure and tighten the pack plate sufficiently. However, don't be shorter than the minimum length.

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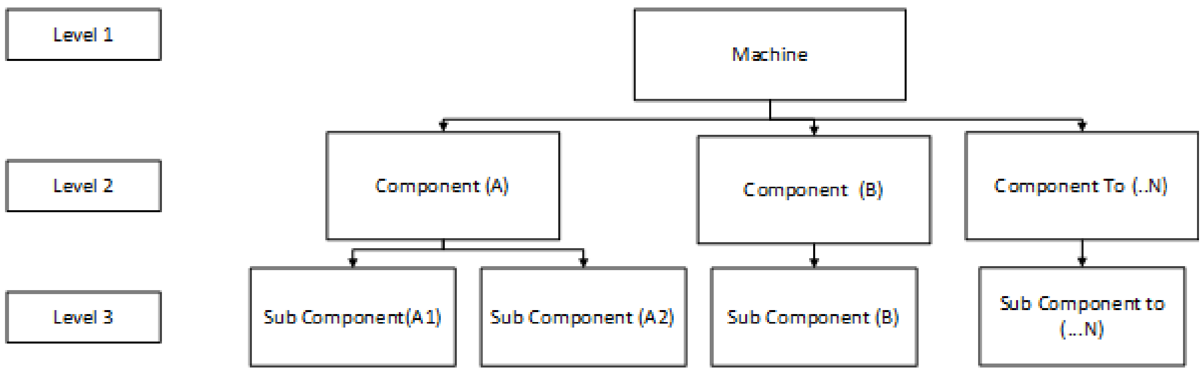

Figure 2 Concept of GT monocode hirarchhy

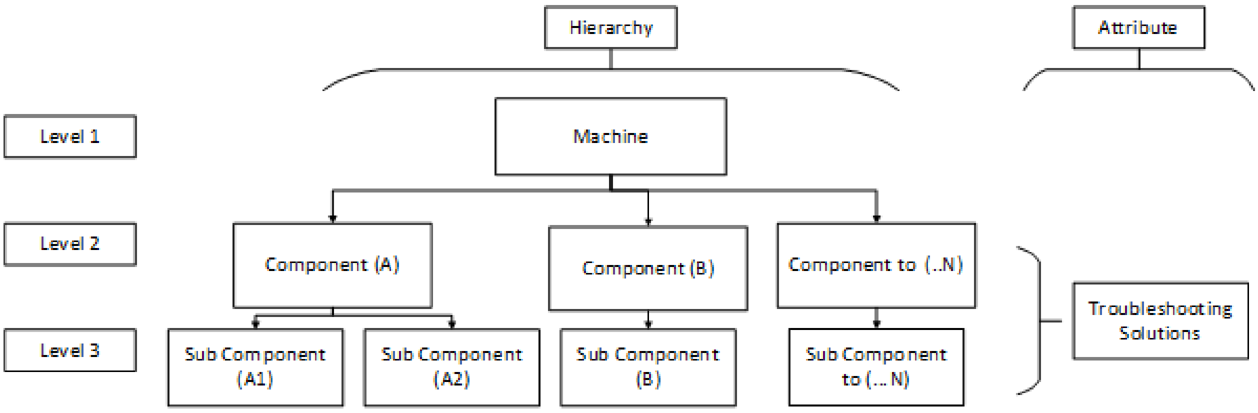

Figure 3 Concept GT hyibird

2.3 Group Technology

Designing troubleshooting database with GT. Classification and coding Group Technology (GT) used in database design design was a hybrid codification system that combined monocode and polycode methods with details of monocode hierarchy GT code to describe the structure from the machine to the sub-components shown in Figure 2. Polycode GT code for storing troubleshooting cases was related to components in the intended component's horizontal hierarchy level. It can be seen in Table 3 that there is troubleshooting knowledge originating from tacit and explicit in Table 1 and Table 2. The concept of hybrid GT is a combination of monocode and polycode GT with a hierarchical coding system that will be created in Figure 3.

Table 3. Concept GT polycode

Damage of components	Troubleshooting		
Component A	Sign	Cause	solution

2.4 Database Relational

Relational database is to storage information based on a user-defined schema describing data types, keys and functional dependencies [18]. A relational database is required to manage the required TS. For the database design stage in general, analyst needs to first identify the files required by the information system. The steps for designing a database are logical database design. The logical model was obtained from the results of the GT-based TS grouping above. Logical model cpuld be drawn using ERD (Entity Relation Diagram). ERD described the entities and attributes involved in the system with the stages of making list entities, relations and normalization. The stage after the logical database was the physical database design to determine the data components in the information system. The next stage was to create a user interface design.

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2.5 Designing Program to SQL Based Search

Query design using Structure Query Language (SQL) was to find TS solution based on damage or desired component. The SQL description in the TS search process for a machine failure was as follows: The basic SQL statement contained the following elements: SELECT, FROM, WHERE, the following is a little illustration of a TS search for a component failure: SELECT component X, How to Troubleshooting FROM from Machine Table, from Table TS WHERE Damage Type = Z.

2.6 Building SITMEP Prototype

SITMEP prototype with Ms. Access 2019 [19] is relational database system for workstations running Microsoft Windows operating systems. MS Access is usually used by individuals for or a department in this research is used for the care division. Besides, Visual Basic Application (VBA) programming language available at Microsoft Office is to be able to integrate with related applications for example Ms. Office [20].

3. Result and Discussion

3.1 System Requirement

System requirement is categorized by two types, there are functional requirements and non-functional requirements, [21]. Functional requirements must exist in the system, such as input, output, process, and stored data. Non-functional requirements are other features on the system that make users more satisfied in running the system. The examples of non-functional requirements are, performance, ease of learning and operating the system, and control. In this study, system requirements are divided into five categories, namely, input, output, process, performance, and control. The design of SITMEP requires an admin who is in charge of managing the administration of machine troubleshooting data in the maintenance and engineering division in charge of repairing machine damage with the help of SITMEP. System requirements for admins in Table 4 and technician system requirements in Table 5.

Table 4. System requirement for admin

Component	Description
Input	Admin can enter the following data: Machine name, machine component, sub-component, machine failure, machine troubleshooting
Output	Checking information on machines, engine components, sub components, engine breakdowns and engine repairs
Process	It can provide information on how to repair a damaged machine
Performance	The system is able to work 24 hours a day and the system can be accessed anywhere
Control	The system can be accessed if it has a username and password as a server or client and each user has restrictions on the use of information systems in accordance with the user's authority.

Table 5. System requirement for technician

Component	Description
Input	Technicians can enter data: Username and password, Select machine, Select signs of damage and machine components
Output	Machine malfunction and troubleshooting information
Process	The system can inform about how to handle machine failures or troubleshooting
Performance	The system is able to operate anywhere and it can be accessed using the internet
Control	The system can be accessed if it has a username and password and each user has restrictions on the use of the information system in accordance with the user's authority

Based on Table 4 and 5, system requirement has been identified to determine information system troubleshooting, a summary of information system requirements can be used to input, update, or delete data that can ease to repair production machines, especially on PHE machines. The system can search for data needed

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by users. It can provide reports needed by users. Each user has different access rights in processing data according to the needs of the party concerned in order to avoid misuse of data. Access capabilities that can be conducted are adding data, changing data, deleting data, and updating data conditions. Information system security created allows users not to have the same access rights. Each user has a different username and password.

3.2 Group Technology Based Codification

Machine codification that will used is hybrid coding system. This type of coding was chosen because in its application, a hierarchical coding is needed to determine the location of the damage component on the machine. In the initial hierarchical coding system, machines are categorized by type of machine and machine components. The code for components is determined by grouping components with the same machine name. Meanwhile, the sub-components are grouped by machine and component names. The following is Figure 4 the concept of a monocode GT hierarchy. A PHE machine hierarchy is created with a hierarchical coding system to be created. GT polycode is in Table 1 and Table 2 that the attribute data are taken from tacit and explicit knowledge.

GT hybrid is the combination of monocode and polycode. The combination named machine in level 1 is grouped into some components in level 2. The components have Level 3 components combined with engine failure problems starting from signs, causes and solutions. GT hybrid eases troubleshoot a machine located on the components of a PHE engine. The example in Figure 5 explains the GT hybrid concept of grouping components at level 2 on a PHE machine to find out the troubleshooting that occurs, for example, in the guide bar component there is a damage integrated with the symptom of liquid leaking out between the S-Frame D-Plate and the causes and solutions are in Table 6.

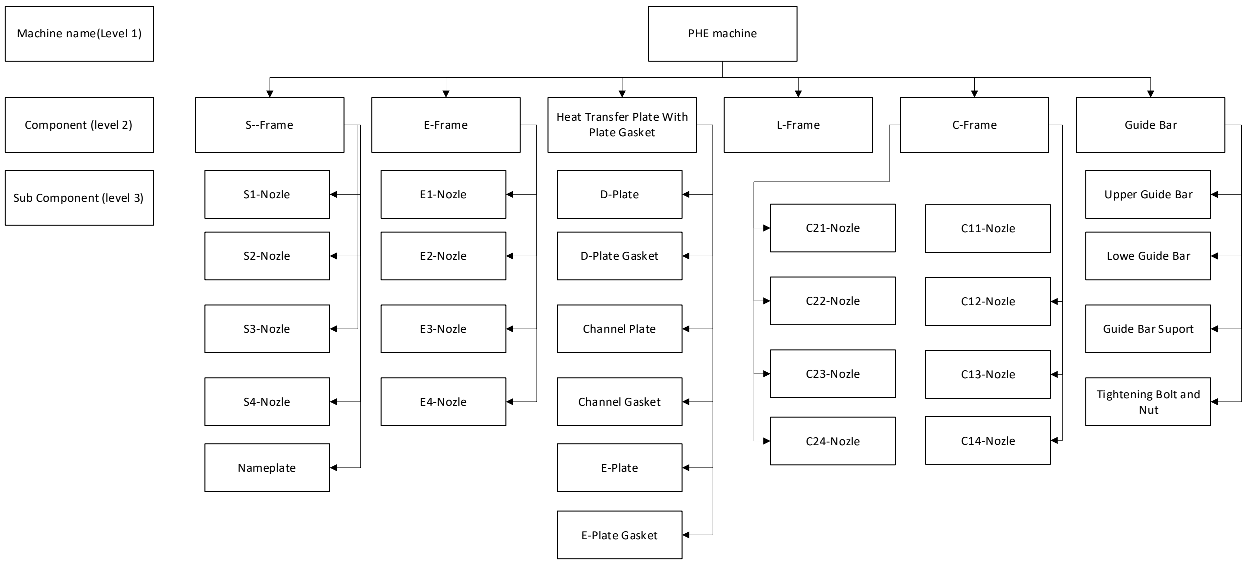

Figure 4 GT monocode PHE Machine

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Table 6. The Example of GT Hybrid

Component	Sign	Cause	Solution
Level 2 Guide bar is in level 3 Tightening Bolt and Nut	Fluid leaks out from between the S-Frame and D-Plate.	The sealing performance decreases due to the lack of adequate fastening	After the internal pressure of PHE there must be pressure and tighten the pack plate sufficiently. Yet, don't be shorter than the minimum length.
At level 2 Heat Transfer Plate with Plate gasket at level 3 D-plate gasket		The sealing performance has decreased due to damage to the D-plate gasket.	Disassemble the PHE and replace the damaged D-plate gasket with a new one.

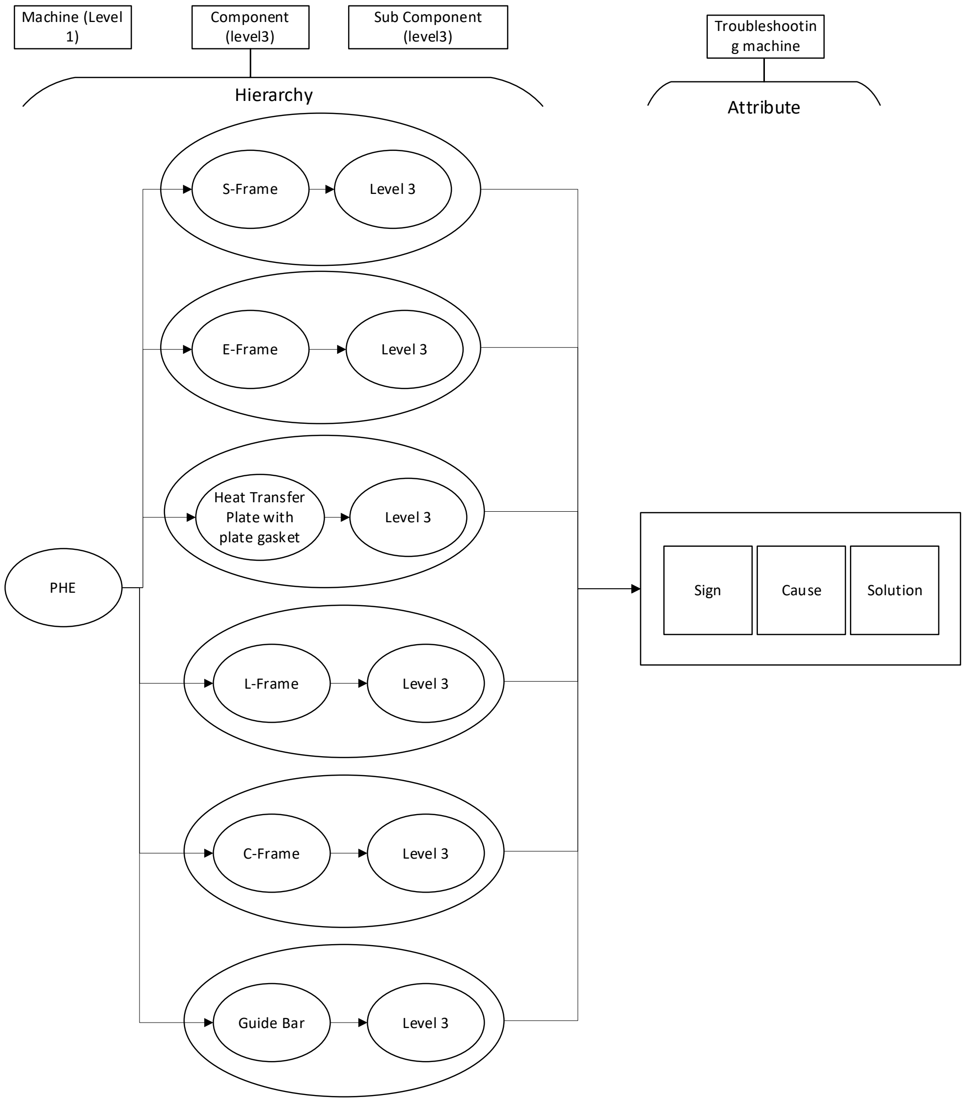

Figure 5 GT hybrid of PHE machine

P	H	E	-	C	F	-	0	1
	Machine			Component			Sub component	

Figure 6 The example of machine codification, component and PHE sub-component

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The following parameters are used in coding machines, components and sub-components that are Machine name (level 1, digits 1-3). The Machine name code is machine names, for example PHE that means Plate Heat Exchanger machine, Component (level 2, digits 4-5) Component code which means the name of the component in the sample machine C-Frame, which means that the component is only owned by the PHE machine and the sub-component (level 3, digits 6-7) means that the component has a level 2 component, namely C-Frame has C1- Frame.

Examples of coding on a PHE machine, components and sub-components can be seen in Table 7. Examples of coding on machines, components and sub-components Figure 6 examples of coding for machines, components and sub-components that the combined code belongs to the C1-Frame sub-component on the component The C-Frame belongs to the PHE machine.

Table 7. Parameter of Codification

Entity	Attribute	Code	Information
Machine (level 1)	PHE machine	PHE	Digit 1-3
Component (level 2)	C-Frame	CF	Digit 4-5
Sub-component (level 3)	C1-Frame	01	Digit 6-7

3.3 Logical Database

The first is list of entity steps involved entities. Each entity is a candidate from the table to be created. In SITMEP, the entities and attributes to be created are in Table 8. The two entity relationships have been determined by other entities to see the relationships or relationships between entities. The list of relationships of entities in the information system is shown in Table 9. The three entity relationships that have been identified in Table 9 are then depicted in the Entity Relationship Diagram model. Entity Relationship Diagram shows entities and relation between entities. The Entity Relationship Diagram from SITMEP is shown in Figure 7.

3.4 Physical Database

Physical design is actualization of the logical database design that is very dependent on the software used. Therefore, at this stage, it begins with selecting the software that will be used first, namely Microsoft Access 2019. After the selection is made, the table structure is designed according to the need for data storage. At this stage, the entities have turned into tables according to the table format in Microsoft Access 2019. Based on ERD and the normalization of the previously created tables, the next step is to design a database table for engine entities, components and symptoms. In the machine entity there are two attributes, namely Machine Code which is the code of the machine and MachineName which is the names of the engine. Data type is the attribute data type in the entity, while the field size is the length of the character of the example attribute according to the data type used, as seen in Table 10 to Table 12.

Table 8 List of ERD Entity and Attribute

Entitas	Attribute
Entity	Machine Code, Machine Name
Machine	Component Code, Component Name, Machine Code
Component	Problem_ID, Machine_Code, Symptom_ID, Symptom, Cause, Solution, Component

Table 9 Relation Identification

Entity	Relation	Entity	Degree of Relation Max-Min
Machine	have	Component	(1 , N)
component	have	sign	(0 , N)

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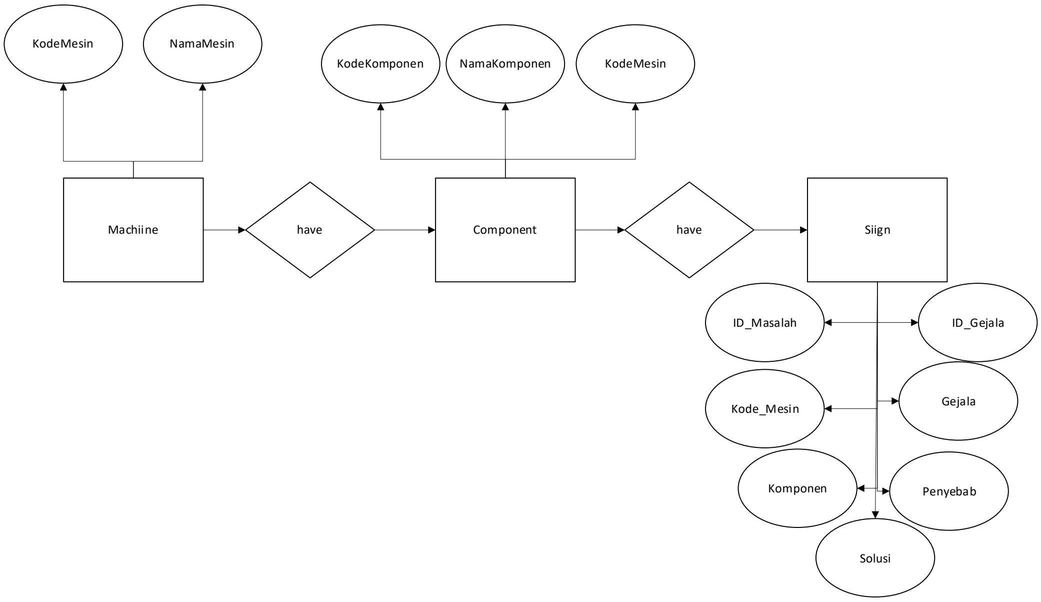

Figure 7 ERD with attribute

Table 10. Database Design of machine entity

Field	Data Type	Field Size	Note	Key
KodeMesin	Short Text	255	Code of machine	Primary Key (PK)
NamaMesin	Short Text	255	Name of machine	

Table 11 Database design of component entity

Field	Data Type	Field Size	Note	Key
KodeKom	Short Text	255	Code of component	Primary Key (PK)
Namakom	Short Text	255	Name of component	
KodeMesin	Short Text	255	Code of machine	

Table 12 Database design of sign entity

Field	Data Type	Field Size	Note	Key
ID_Masalah	Short Text	255	ID of damage problem	Primary Key (PK)
Kode_Mesin	Short Text	255	Code of machine	
ID_Gejala	Short Text	255	ID of sign	
Gejala	Short Text	255	Sign	
Penyebab	Long Text		Cause	
Solusi	Long Text		Solution	
Komponen	Long Text		Component	

3.5 User Interface Design

User interface design. It aims to make the design of the display system that will interact directly with the user. The user interface design must be ready for use and in accordance with user needs because this design is a dialog system design that can be interpreted and implemented. Thus, the user or user can communicate with the system being designed. The design includes the menu hierarchy, admin and technician forms in Figure 8.

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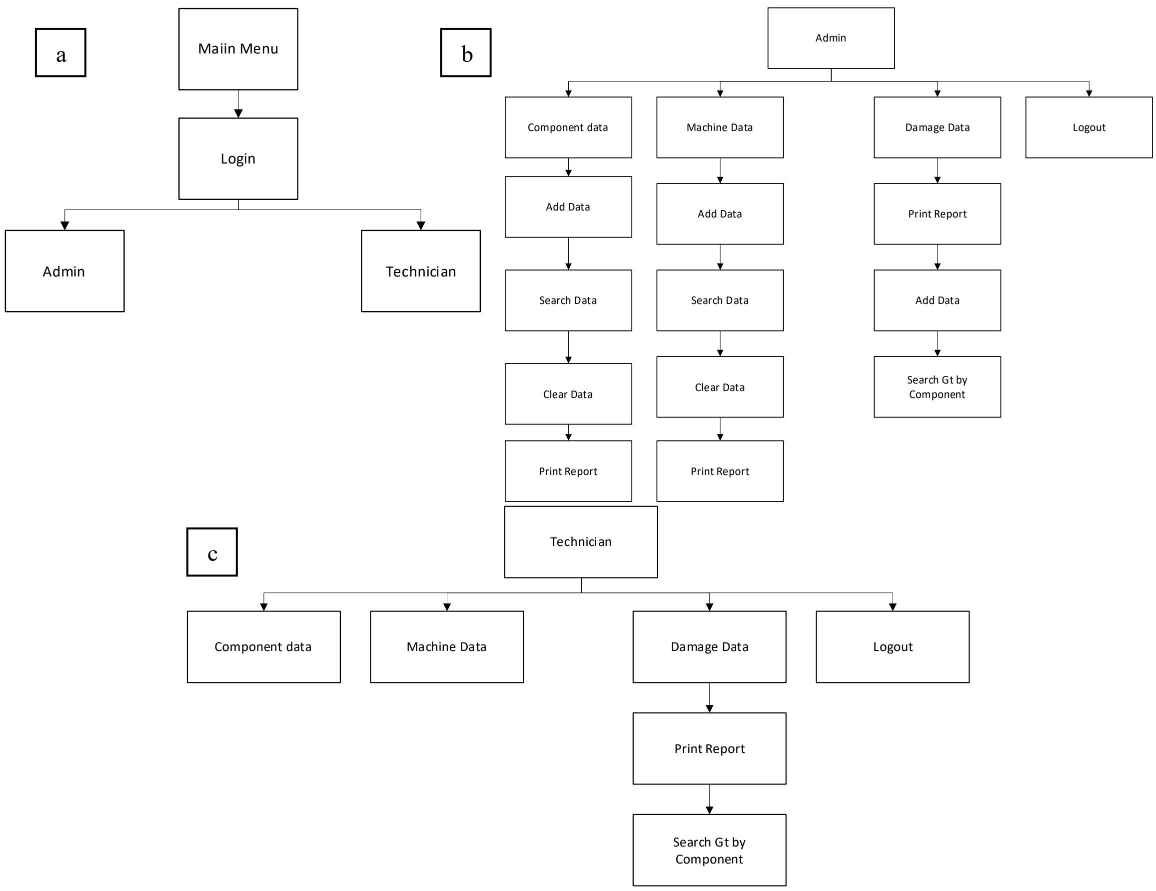

Figure 8 Hierarchy menu (a), form admin (b) and technician (c)

3.6 Implementation

Implementing database is conducted by making table and the relation between tables based on previously made designs. An example of database implementation is shown in Figure 9 as the engine table. Implementation of the user interface is made to make it easier for users to operate information systems. An example of implementing a user interface, namely on the login page is shown in Figure 10, which is the main menu implementation based on the main menu hierarchy design in Figure 8. Report damage data based on components and symptoms, causes and solutions (admin). Figure 11 is an implementation of the damage data report that can be accessed. Figure 12 is the implementation of a database table for symptom entities, after filling in the data for symptoms, causes and engine component solutions. Figure 11 is based on the physical database design of the machine entities in Table 12. There are attributes such as Kode_Mesin to find out the machine name, ID_Gejala code sign for each symptom, the cause of the solution and components.

Tbl_Mesin

KodeMesin	NamaMesin
MSN001	Mesin PHE
MSN002	Mesin Homogenizer
MSN003	Mesin B

Figure 9 The implementation of table machine

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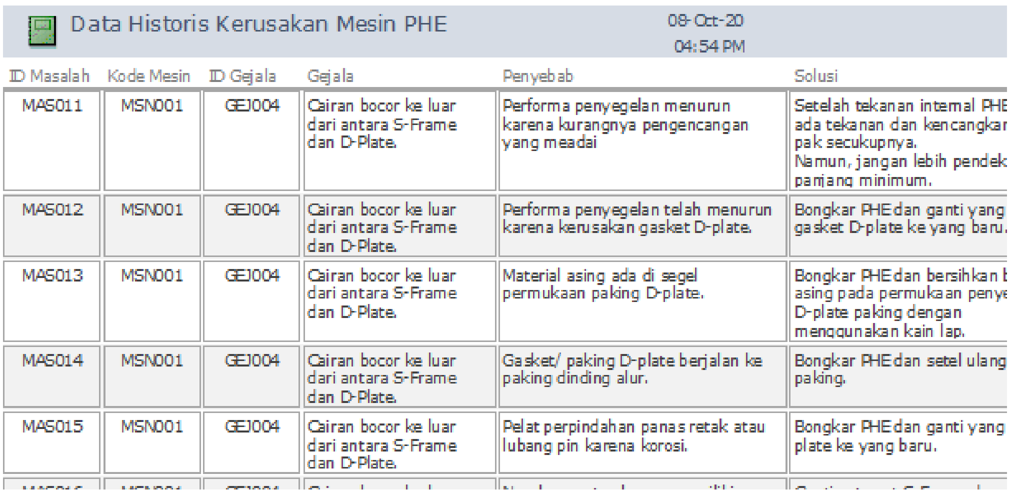
Figure 10 Printscreen Main menu

3.7. Discussion

Verification, it is examined whether prototype is running as planned. Verification test is carried out in order to test whether the program is running as planned. The verification test is conducted by comparing the database design, user interface, program module at the design stage with the implementation and accuracy of the application program. The comparison of the physical database models designed in Table 10 to Table 12 with the implementation of database development in Figures 9 to 12 is appropriate. Therefore, the information system has passed the verification test. Validation is the process of testing whether the implemented information system is suitable for user needs and Considering that the object of this research is continuing research [22] on troubleshooting with the CBR (AI) approach, SITMEP uses examples of troubleshooting case testing carried out by Hamzah into this research and the results are proven to be the same. The step taken is to make a comparison of the suitability between the system requirements and the system design made that the information system has passed the validation test. The prototype test is a test whether the information system is made in accordance with the initial plan of making the information system. This stage is carried out to test whether the current information system is a solution to the problems and weaknesses of the current system. Repairing the old system with the new one in table 13 can be seen that SITMEP has been able to fix all the weaknesses of the old system. It can perform automated data searches quickly because machines, components, sub-components and damage data along with symptoms, solutions and causes have been grouped and coded using GT in the database. With the database, data in the maintenance division can be well organized, there is no data redundancy, data is always updated and there is no need for manual document recording and document storage so that operational costs and time can be minimized. In addition, with the SITMEP application, the machine repair process is carried out appropriately and production at KUD Batu can run more smoothly and well because the system can help minimize downtime so that repairing machine damage does not take long.


Data Historis Kerusakan Mesin PHE
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ID Masalah	Kode Mesin	ID Gejala	Gejala	Penyebab	Solusi
MAS011	MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-Plate.	Performa penyegelan menurun karena kurangnya pengencangan yang meadai	Setelah tekanan internal PHE ada tekanan dan kencangkar pak secukupnya. Namun, jangan lebih pendek panjang minimum.
MAS012	MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-Plate.	Performa penyegelan telah menurun karena kerusakan gasket D-plate.	Bongkar PHE dan ganti yang gasket D-plate ke yang baru.
MAS013	MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-Plate.	Material asing ada di segel permukaan paking D-plate.	Bongkar PHE dan bersihkan b asing pada permukaan penye D-plate paking dengan menggunakan kain lap.
MAS014	MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-Plate.	Gasket/ paking D-plate berjalan ke paking dinding alur.	Bongkar PHE dan setel ulang paking.
MAS015	MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-Plate.	Pelat perpindahan panas retak atau lubang pin karena korosi.	Bongkar PHE dan ganti yang plate ke yang baru.

Figure 11 Report printscreen of damage data and how to handle

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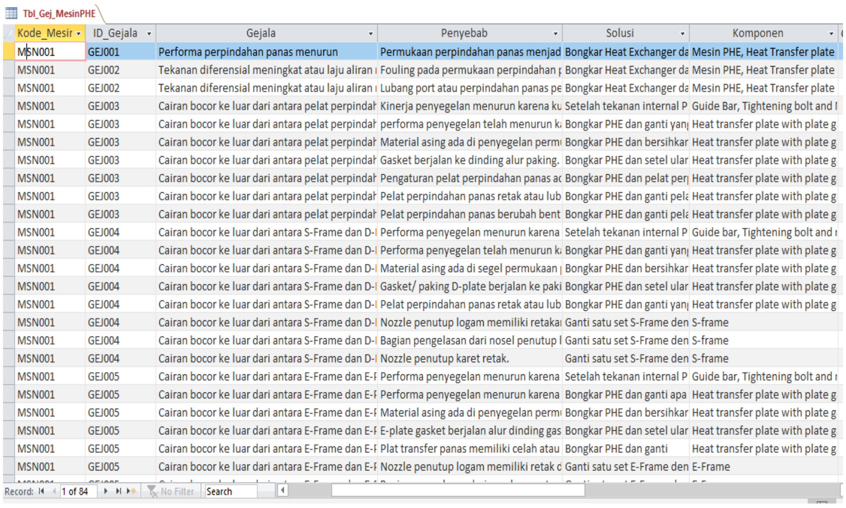

Tbl_Gej_MesinPHE

Kode_Mesir	ID_Gejala	Gejala	Penyebab	Solusi	Komponen
MSN001	GEJ001	Performa perpindahan panas menurun	Permukaan perpindahan panas menjad	Bongkar Heat Exchanger da	Mesin PHE, Heat Transfer plate
MSN001	GEJ002	Tekanan diferensial meningkat atau laju aliran	Fouling pada permukaan perpindahan	Bongkar Heat Exchanger da	Mesin PHE, Heat Transfer plate
MSN001	GEJ002	Tekanan diferensial meningkat atau laju aliran	Lubang port atau perpindahan panas pe	Bongkar Heat Exchanger da	Mesin PHE, Heat Transfer plate
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Kinerja penyegelan menurun karena ku	Setelah tekanan internal P	Guide Bar, Tightening bolt and
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	performa penyegelan telah menurun k	Bongkar PHE dan ganti yan	Heat transfer plate with plate g
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Material asing ada di penyegelan perm	Bongkar PHE dan bersihkar	Heat transfer plate with plate g
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Gasket berjalan ke dinding alur paking.	Bongkar PHE dan setel ular	Heat transfer plate with plate g
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Pengaturan pelat perpindahan panas a	Bongkar PHE dan pelat per	Heat transfer plate with plate g
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Pelat perpindahan panas retak atau lub	Bongkar PHE dan ganti pel	Heat transfer plate with plate g
MSN001	GEJ003	Cairan bocor ke luar dari antara pelat perpindah	Pelat perpindahan panas berubah bent	Bongkar PHE dan ganti pel	Heat transfer plate with plate g
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Performa penyegelan menurun karena	Setelah tekanan internal P	Guide bar, Tightening bolt and
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Performa penyegelan telah menurun k	Bongkar PHE dan ganti yan	Heat transfer plate with plate g
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Material asing ada di segel permukaan	Bongkar PHE dan bersihkar	Heat transfer plate with plate g
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Gasket/ paking D-plate berjalan ke paki	Bongkar PHE dan setel ular	Heat transfer plate with plate g
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Pelat perpindahan panas retak atau lub	Bongkar PHE dan ganti yan	Heat transfer plate with plate g
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Nozzle penutup logam memiliki retaka	Ganti satu set S-Frame den	S-frame
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Bagian pengelasan dari nosel penutup	Ganti satu set S-Frame den	S-frame
MSN001	GEJ004	Cairan bocor ke luar dari antara S-Frame dan D-	Nozzle penutup karet retak.	Ganti satu set S-Frame den	S-frame
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	Performa penyegelan menurun karena	Setelah tekanan internal P	Guide bar, Tightening bolt and
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	Performa penyegelan menurun karena	Bongkar PHE dan ganti apa	Heat transfer plate with plate g
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	Material asing ada di penyegelan perm	Bongkar PHE dan bersihkar	Heat transfer plate with plate g
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	E-plate gasket berjalan alur dinding gas	Bongkar PHE dan setel ular	Heat transfer plate with plate g
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	Plat transfer panas memiliki celah atau	Bongkar PHE dan ganti	Heat transfer plate with plate g
MSN001	GEJ005	Cairan bocor ke luar dari antara E-Frame dan E-	Nozzle penutup logam memiliki retak d	Ganti satu set E-Frame den	E-Frame

Record: 1 of 84 No Filter Search

Figure 12 Printscreen of sign in microsoft access 2019

Table 13 The difference of old system and new system

Old system	New system
There is no data processing complexity as well as coding of machines, components and sub-components that causes the collection of data information for machine maintenance and takes a long time.	the system has already used a database to process data complexity based on technology group to classify machines to components so that data collection time is faster.
there is difficulty in tracing the information the technician needed about all machine data, component data and machine failures.	The data are integrated, thus, it is easy to trace all the information the technician needs.
Data storage is still manual. this causes some data to be lost and incomplete when needed.	Data is stored in a database. Thus, it is less likely that data can be lost and incomplete when needed
Data has not been integrated between one data and another, it causes data redundancy.	The data have been integrated into one in the database so that there is little possibility of data redundancy.
The process of recording data is still manual, so it takes a long time and it is prone to errors due to human errors.	The data recording process is computerized and equipped with a drop-down menu that will reduce errors in the data entry process
There is no system that regulates the data, thus, there is a big possibility that there will be misinformation that causes incorrect machine maintenance actions.	SITMEP can manage data and provide reports of all data for admin, thus, they can better determine information about machine maintenance based on existing data.
This has not yet utilized existing technology, data are still recorded manually and manual data storage requires storage.	The new system has used technology by using computers to record and store data.
Services for information needs from some data take a long time because the data have not been integrated into one, thus, the system is not flexible.	The system is more flexible because the data have been integrated into the system, thus, the information needs of all the data needed are faster
It takes time to look for information about how to deal with a damaged machine, let alone look for a manual book.	Search for information on how to make a quick repair because it is already in the database.

Cite this Article As Farhan, A., et.al (2021). PRODUCTION MACHINE INFORMATION SYSTEM BASED ON TECHNOLOGY GROUP IN RELATIONAL DATABASE ENVIRONMENT. Journal of Engineering and Management in Industrial System, 9 (1), p. 45-58.
Paper Accepted : April 30th, 2021

e-ISSN 2477-6025
DOI:10.21776/ub.jemis.2021.009.01.5

4. Conclusion

The Machine maintenance information system should be adjusted to era of Inductrial Revolution 4.0, in which the information system has been digital. Hence, the system runs systematically and quickly. This research makes a prototype of a production machine troubleshooting information system based on a Relational Database using the método GT hybird. Troubleshoot science includes tacit and explicit. The results of verification, validation and prototype testing are in accordance with the system requirements. Therefore, the machine repair process is assisted by the SITMEP application in the process of solving problems that occur and it can be applied at KUD Batu. This model can be further developed for national machine maintenance, for example BLK (vocational training center), or heavy mining equipment using the web.

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Paper Accepted : April 30th, 2021

e-ISSN 2477-6025
DOI:10.21776/ub.jemis.2021.009.01.5

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