Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2023
DOI : https://doi.org/10.33395/sinkron.v8i2.12290
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Android-Based RCSM Application for Implementation of Preventive Maintenance on CNC Production Machine

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Submitted : Mar 26, 2023 | **Accepted** : Apr 13, 2023 | **Published** : Apr 14, 2023

Abstract: Preventive maintenance implementation is scheduled to follow the lecture schedule so that the implementation of activities does not interfere with the lecture process. Even though the scheduling of preventive maintenance activities has been made quite well, there are problems in its implementation, including some activities that were not detected in the previous preventive maintenance implementation, both in the form of activity reports and machine history updates. This can confuse subsequent pm, and implementers, as it can result in mishandling. As for the cause of the problem, there are two possibilities, namely the implementation of preventive maintenance is not carried out or the implementation of preventive maintenance has been carried out, but reports on the implementation of activities are not prepared and stored by procedures (human error). To overcome this, the researchers developed an Android-based application that functions as a reminder, recorder, and controller, for the pm process, named Reminder & Control System Management. Reminder & Control System Management will remind, the implementers, to be on schedule, carry out reminder mechanisms, and information broadcast and validation until the completion of preventive maintenance activities is acceptable to the relevant authorities. Likewise, for reporting and recording engine history a system will be created with a similar mechanism. The results that have been achieved are the application software prototype reaching 100% and several field trials have been carried out. This application can direct preventive maintenance implementers to avoid misuse of pm implementation procedures so that preventive maintenance implementation data can be recapitulated.

Keywords: Maintenance Scheduling, Reminder System, Android Application, Industry 4.0

INTRODUCTION

Maintenance is a combination of various actions taken to maintain an item or repair it to an acceptable condition. In the context of a manufacturing company, maintenance is the act of maintaining a factory machine or equipment by renewing its service life and machine failure/damage. Maintenance has the objective of prolonging the usefulness of assets; maintaining quality at the right level to meet what is required by the product itself and uninterrupted production activities; Maintenance can also have an impact on extending the economic life of existing production machines and equipment and ensuring that these production machines and equipment are always in optimal condition and ready to use for the implementation of the production process.

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Implementation of maintenance or machine maintenance activities at Bandung Manufacturing Polytechnic has been carried out since the Machine Maintenance study program was established. Bandung Manufacturing Polytechnic applies the ISMO principle or stages which stands for Inspection, Small Repair, Medium Repair, and Overhaul. These stages are still running quite effectively and are logically very suitable to be applied in both educational and industrial environments. Preventive Maintenance is maintenance that is carried out on a scheduled basis, generally periodically, in which several tasks such as inspection, repair, replacement, cleaning, lubrication, and adjustment are carried out. Therefore, regular and periodic inspections and servicing are needed. Preventive maintenance is very important to support production facilities that are included in the "critical unit" category. This maintenance technique is carried out by inspection of equipment assets to predict damage/failure that will occur.

The implementation of preventive maintenance at Bandung Manufacturing Polytechnic is carried out on a scheduled basis for one year following the lecture schedule so that the implementation of activities does not interfere with the lecture process. Planning maintenance activities is a strategic matter because it involves various conditions in the field. The importance of a maintenance plan, developing a maintenance planning system based on Reliable Centered Maintenance (RCM). Even though the scheduling of preventive maintenance activities at Bandung Manufacturing Polytechnic has been made quite exceptionally, there are problems in its implementation, including in some activities where previous preventive maintenance was not detected, whether in the form of activity reports or updating machine history. This can confuse the executor of subsequent preventive maintenance activities because it can result in mishandling ranging from mild to severe. As for the cause of the problem, there are two possibilities, namely the implementation of preventive maintenance is not carried out or the implementation of preventive maintenance has been carried out, but reports on the implementation of activities are not prepared and stored in accordance with the procedure. Thus that the errors that occur are mostly caused by human error. Using a technological approach, it is easy to control the implementation of preventive maintenance. Implementing Android applications with what can be done by carrying out preventive maintenance. Android application based on real-time monitoring of the electrocardiogram (ECG) from the mother's stomach EKG signal (Yuan et al., 2019). Other monitoring that can be used as a reference is monitoring cloud computing technology using ROCCA (Roadmap for Cloud Computing Adoption) to accommodate the needs of internal application systems at the University of Semarang (Christanto & Sani Suprayogi, 2018). In other fields, namely buildings, inventories can be carried out and monitored on an Android-based mobile basis to reduce the need to go through administrative formalities to obtain information and documents related to earthquake-prone buildings. (Işık et al., 2018).

LITERATURE REVIEW

Relevant research related to the development of android-based applications by the research to be carried out, taking into account various types of approaches that are appropriate to the context of the research being carried out, such as those related to scheduling and monitoring (Panda et al., 2022) can use several approaches such as health monitoring sensors that can be used to monitor health based on body temperature and heart rate (Ali et al., 2020). Regarding monitoring in the health sector, this can be developed into an Android-based smart health which has been researched and given the name Mooble (Monitoring for Better Life Experience), a system for monitoring patient health conditions and preventing disease as early as possible. (Yusuf et al., 2019). Development of health applications can also be realized in the form of expert systems (Musthofa Galih Pradana, 2018) as well as predictions with a data mining approach (Musthofa Galih Pradana, 2022).

Monitoring and control are usually used using robots (Azeta et al., 2019) which in its implementation can be cross-sectoral, such as the public sector for security in traffic use to protect vulnerable road users (VRU), especially older adults and people with disabilities to use paratransit services using the android application (Kwakye et al., 2020). On the other hand, apart from the security aspect of monitoring the traffic lights implemented in the Philippines based on an Android application, it can also manage traffic conditions smartly. This study resulted in an average test accuracy of 92.83% and a vehicle detection rate of 85.77% for daytime and night respectively. In addition, overall system reliability of 92.82% and

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85.77% was obtained during the day and night (Nodado et al., 2019). Other vehicle monitoring has been ad to PT. Pura Barutama by implementing Android-based real-time monitoring, by implementing a GPS Tracker, and also an SMS gateway to monitor vehicles in the company area (Somya, 2018). Apart from monitoring vehicles at the company, monitoring can also be applied to the company's employees. The goal is to make employees comply with the regulations and regulations that apply in the company by monitoring the point of location-based employee presence using the LBS (Location Based Service) method using the Android platform (Hayati, 2019). On the production machine side, you can also adopt Android mobile technology in monitoring machine performance by recording production results by applying it to production injection machines (Rubenstein et al., 2018).

The breadth of android users can lead to the utilization of mobile computing (Guo et al., 2019), but also can be used as educational media in the world of education. As in the development of teaching materials for biology subjects, through validation from media experts, linguists, and material experts with results of conformity above 80% (Miarsyah et al., 2019). Middle schools in Pematangsiantar are also doing the same thing by developing science teaching materials based on Android, the level of conformity through validation with an average score of 85% (Siahaan et al., 2021). Breakthroughs through smartphone media, especially the Android platform, can be used as part of learning innovations such as examples of trigonometry android applications and evaluation of the validity and practicality of learning media used for more interesting mathematics learning. (Saputra et al., 2018).

The private sector or individual references for this research show that Android-based can be applied to monitoring and controlling home electric power by implementing the Node MCU module and PZEM-004t sensor with a significant error rate of ± 1.8% (Furqon et al., 2019). The agricultural sector can be seen from the application of watering and monitoring of water spinach plants automatically using an Arduino-based android base by identifying soil and air humidity and water level (Nur Azis et al., 2020).

METHOD

The method used in developing software applications is the waterfall method. The waterfall is one of the old or ancient development models, but it is the most widely used model in Software Engineering (SE). The use of this model will match the systematic and sequential stages as in the case of this study. The stages of the waterfall method are shown in Figure 1.

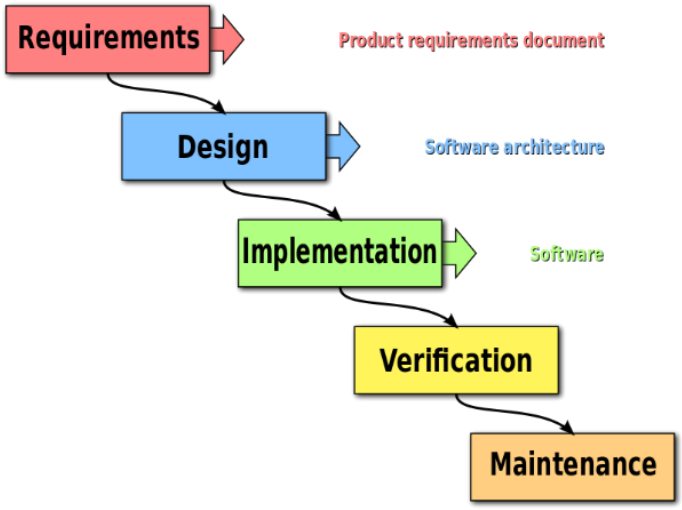

Figure 1. Waterfall Model

The explanation of the model is explained as follows:

a. Software Requirements Analysis.
   At this stage, an analysis of the needs needed in the development of an Android-based application system is carried out. This stage is adjusted according to needs, identifying program characteristics and other basic things, such as application functions.

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b. Design
At this stage, it is a continuation of the previous stage, namely the process of representing the needs that have been identified into a design that is ready to be implemented in a program.
c. Implementation
In the third stage implementation is carried out into the program, after identification of needs, and represented in the design, this stage is the technical stage of implementation into the program according to the selected programming language.
d. Verification
The fourth stage is to verify. This stage is to test the application that has been built and implemented before. The goal of this stage is that the software is error-free and in accordance with the previously identified requirements.
e. Maintenance
The maintenance phase is carried out because the software will not always be perfect, and it is possible to make continuous improvements by providing feature updates in the future.

The way RCSM works is by reading the database which contains the preventive maintenance implementation schedule. If the schedule appears, RCSM will issue a reminder signal to the executors and supervisors. The mechanism is made in such a way that the implementation of preventive maintenance activities is controlled and properly administered. Like-wise with the mechanism or procedure for completing the implementation of preventive maintenance activities in such a way that the end of the implementation of activities is reported and recorded properly. The technology used for this RCSM application is using an Android-based application, MySQL database and other supporting applications.

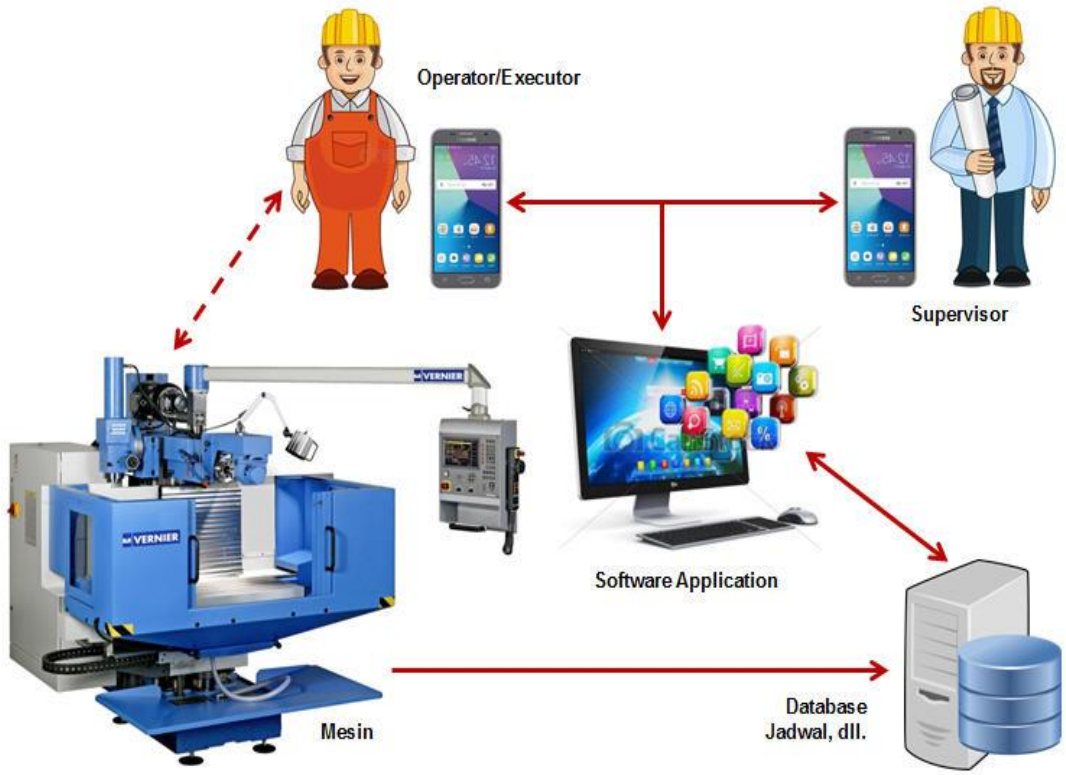

Figure 2. Workflow Application

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RESULT

The results of this study are in the form of an android application developed in the form of a prototype or prototype. Figure 3 shows the user interface for submitting reports (reports) which will be validated by the supervisor.

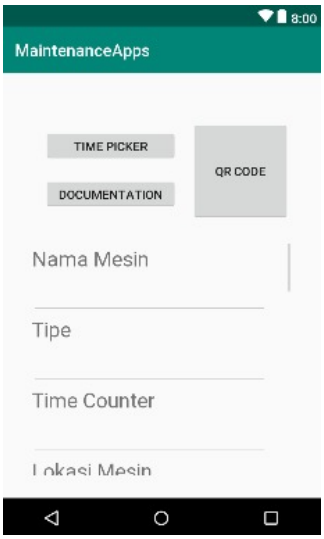

Figure 3. User Interface Report

To maintain and improve application security, an authorization management system is implemented. Each user according to their function is asked to log in with user identification and password. Then the data is encrypted using the md5 method and stored in the database. Login activation lasts for 5 minutes (session). If within 5 minutes the user does not perform certain activities, the system will automatically log out and the user is asked to log in again. Figure 4 and Figure 5 Show features fofan authorization management system and control system

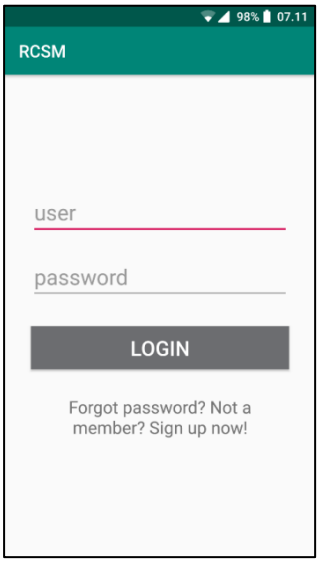

Figure 4. Login Session

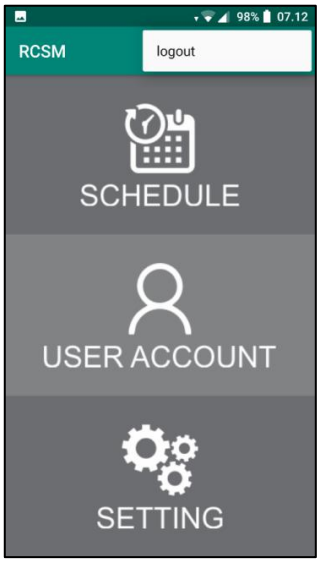

Figure 5. Setting

Status Update system that provides actual information to all users. The following figure shows the Status Update System feature from one of the production machines. The status of the machine has entered the period for maintenance, but the implementation of the maintenance has not occurred so the status is Waiting. This status is an effective reminder for implementers and preventive maintenance supervisors to carry out their duties by applicable procedures.

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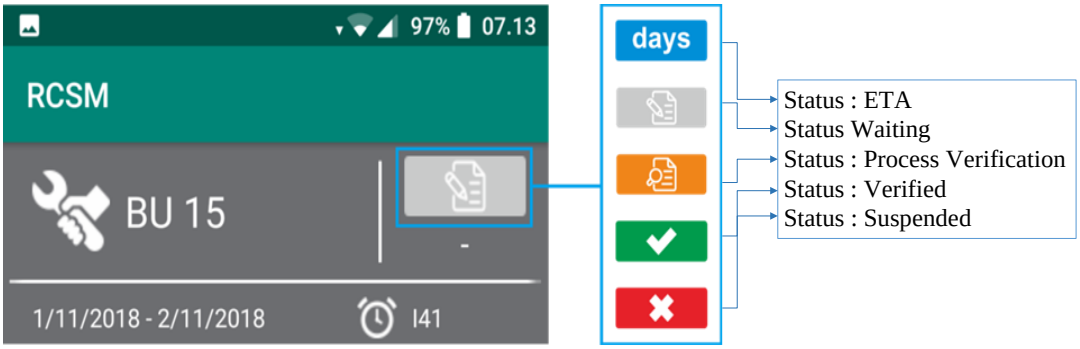

Figure 6. System Update Status

This application is equipped with a reporting system that is synchronized with a real-time status update system so that preventive maintenance implementation stages can be monitored and controlled. Shows the results of synchronizing the reporting system to the status update system. All production machine statuses can be monitored simultaneously and in real-time.

Figure 7. Reporting System

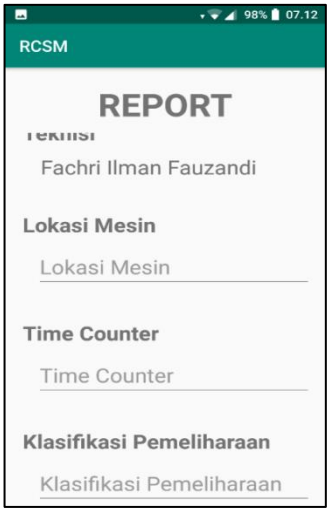

Figure 8. Reporting System 2

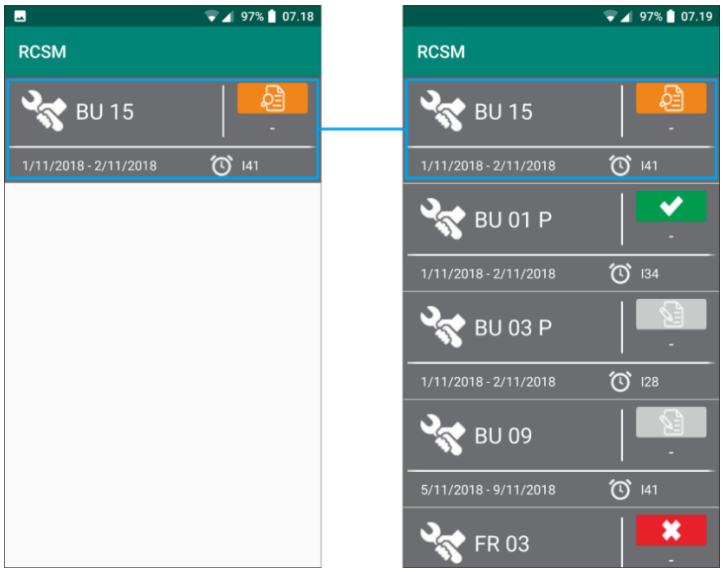

Figure 9. Synchronization Feature

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The features developed are adapted to the needs analysis process. This application is equipped with a reporting system that is synchronized with a real-time status update system so that preventive maintenance implementation stages can be monitored and controlled. Shows the results of synchronizing the reporting system to the status update system. All production machine statuses can be monitored simultaneously and in real-time. The test scenario that will be carried out is using black box testing which will be detailed in the discussion chapter.

DISCUSSIONS

The stage that is quite important here is testing the application that has been made. Testing is done with a black-box testing approach. This test uses program functionality testing. The following are some of the items tested.

Table 1. Scenario Test

No	Type	Section	Result
1	Text Area	username, password	Success
2	Button	Login	Success
3	Icon	Setting	Success

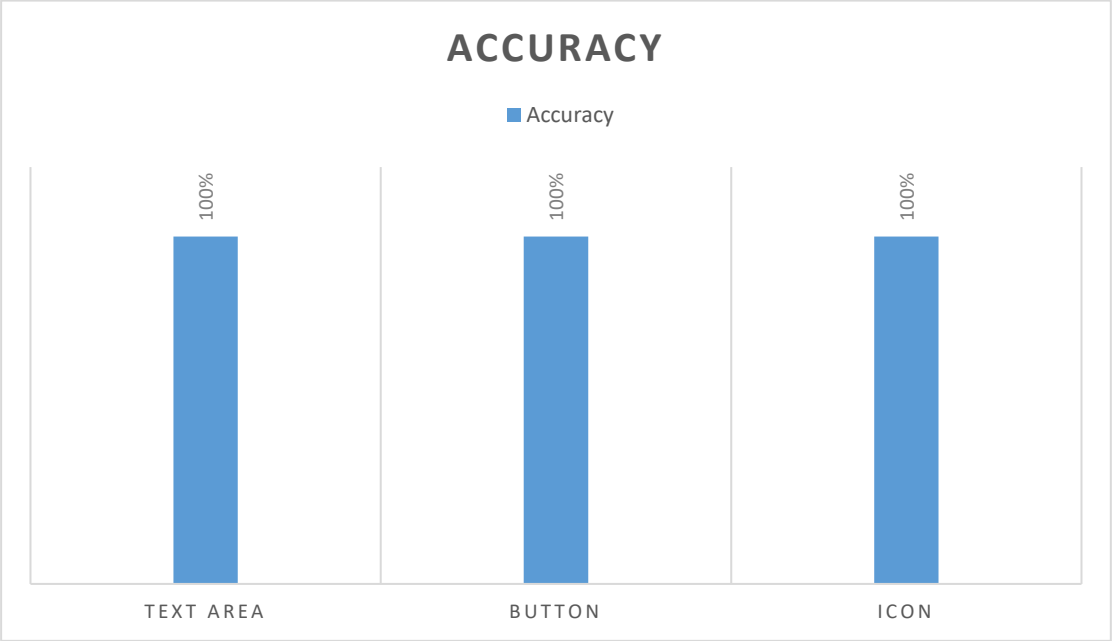

Figure 10. Result Accuracy

CONCLUSION

Based on several experiments in the laboratory and in the field, this application works quite effectively in directing the implementation and preventative maintenance supervisors with accurate 100% testing scenario. Based on the problem, the creation of this android application can be used to minimize errors in handling CNC production machines.

The developed software application is a system that functions to remind and control the implementation of preventative maintenance of production machines. This application has opportunities for business collaboration with industry or institutional partners. In addition, the application is an Android-based application that supports and is in line with the implementation of the industrial era 4.0.

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