Reporting of Hospital Facility on Smartphone

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Abstract. In the context of achieving Good Corporate Governance (GCG) in hospitals, among others, it is carried out with control and supervision, including in the case of hospital facility maintenance installations. Besides that, the hospital needs to improve its services. The asset reporting system is one of the high needs in this field, so it requires a solution that can deal with existing problems. Unfortunately, the current reporting system so far is more likely to be conventional, such as by telephone. This study proposes a new solution to the hospital facility maintenance reporting process, namely by utilising smartphone-based applications that directly connected to the server. So, the information distributed to the competent parties. This solution can speed up the reporting process and actions. Also, save the historical equipment that is available from each service room — the results of this study used as a hospital facility maintenance reporting system.

1. BACKGROUND
Installation of hospital facility maintenance is an essential part of the services provided by hospitals [1]. This section is the heart of the running of services, especially for crucial equipment and at risk [2], such as medical equipment [1]. These tools are vital to improving the health of many people [3].
Maintenance of hospital recommendations has to include the calibration process, support, training for users, how to use and repair [1]. Responsibility for the maintenance of facilities is usually carried out directly by the designated section [1], [4]. So that if an obstacle occurs, the problem can be resolved quickly [2], whether through repair tools, replacement, or other forms of solutions.

During this time, the reporting process is still mostly done conventionally. Such as by calling the part responsible for the problem of maintaining hospital facilities, then reports are recorded manually or saved into the system.

The presence of various interconnection technology capabilities [5], and the high dependence of smartphone users [6], information is more easily accessible [7], [8]. The application of mobile computing is the solution currently applied [9], [10]. The process of handling reporting related to the installation or maintenance of hospital facilities can accommodate various technology facilities that are widely available [11]–[13]. Viewed from tertiary education [14], [15], unfortunately, there are not many studies that conduct individual studies on Hospital Facility Maintenance Management, both at Research Gate and Google Scholar, moreover related to the use of technology in managing this [16]. Likewise, with the limited number of applications available on the market [17].

This research is a solution for hospitals to manage hospital facilities maintenance based on mobile devices such as smartphones. So that hospital workers can immediately report if there are things that need to be a concern for the manager of the hospital facility maintenance. Likewise, from the manager's side, they can see information when a notification appears on their smartphone device. Besides the management can monitor via a computer by the information provided by the system.

2. LITERATURE REVIEW

The hospital carries out its vital tasks is a complex organisation, consisting of various sub-organisations and interconnected. The critical part of which consists are stakeholders, facilities, and materials [3].

Hospital facility problems are generally managed through building information modelling (BIM) as implemented in Iran for improving facility management in hospitals [3]. Facilities in hospitals consist of several types, such as physical infrastructure and buildings and buildings [4], including facilities that are immovable [18]. Besides, the equipment used in hospitals consists of medical and non-medical equipment [19].

Management of hospital facility maintenance reporting used as material for decision making, such as research on the location of hospital facilities [18]. Such as the application in managing facilities in the operating room [20]. Implementation Management of medical facilities in hospitals influenced by various factors such as resources, quality control, documentation, education, services, inspection, and preventive maintenance (HDI), design, and implementation [1].

Various factors that influence the management of hospital facilities have considered by hospital management. Hospital management applied different solutions for hospital facility management. Research on the application of ICT technology is still relatively little revealed through various research articles in the journal [16], [21]. Meanwhile, the challenges and opportunities for the application of information technology are quite extensive in the health sector [21].

For example, the presence of a Hospital Management System that has assisted various aspects of hospital management. Such as the health system, and critical facilities, in-hospital services, including procedures and clinical information [22].

Other research also tried to adopt technology for facility management, including by using CMMS (computerised maintenance management system), CAS (communication automation system), and BAS (building automation system). Besides that, the use of CAFMS (computer-aided facility management systems), SAS (security automation system), FAS (firefighting alarm system), and the application of BIM (building information modelling) technology [4].

General technologies have existed for the past few decades. The presence of the Internet of Things (IoT) has brought network technology between devices that can communicate with one another to form ecosystems [23], one of the contributing factors is the high human dependence on technological devices such as smartphones [24], [25].
IoT is a necessity in the world of health [21], [26], although it is still rare, IoT has begun to enter several sides to meet the needs of the system in the field of health and hospital, such as the application of IoT to monitor patient health in real-time [27][28]. The existence of technology has become an integral part of human life for the time being [29]. Unfortunately, the application of IoT is still rarely found based on the results of scientific publications [16].

The presence of information and communication technology (ICT) research [15] including from university [14] has provided a variety of opportunities for system development in hospitals, especially with webform technology capabilities combined with various system sensor capabilities, cellular phones, remote interchange, administration systems, and cloud advancements [9], [10], [12], [13], [29]. The basic structure of ICT developed with various forms of devices connected to the cloud, such as humans, medical devices, computers, smartphones, PCs, and telephones [30]. The architecture developed through ICT considers various technical layers, such as the business layer, application layer, middleware layer, network layer, and perception layer [30].

ICT widely used for various forms of research, including the development of reporting systems [11]. The reporting system is built based on the smartphone-based system and hardware-based system [30]. Human dependence through smartphones is high. Implementation of reporting by utilising smartphones and IoT technology is a solution for the development of low-cost technology, especially supporting devices on the client side directly attached to the smart devices of its users [24], [25]. The utilisation of various applications with the use of smartphones also began to grow in the world of health [17].

3. METHODOLOGY

This study uses stages of activity, including analysis, design, construction, and implementation. The investigation was carried out with various steps, both from collecting literature, selecting sections related to the research topic. Also, observations were made by observing, gathering diverse documentation on traditional processes and reporting systems and management, along with the stages applied.

Furthermore, at the design stage, after the data is collected, a design related to the system is built. The plans include diagrams, application work methods, use case diagrams, and logic flow in the form of flowcharts or algorithms [31]. Next is application development. After the system application tested, the system implemented.

In this study, the system was made based on a case in one of the hospitals in Indonesia, namely Majalaya Regional Hospital, West Java Province. This hospital owned by the government, which began to build since 1951. This hospital has a building with an area of 7,069 m2, with an area of 27,890 m2, which equipped with medical and non-medical equipment [19].

The minimum device requirements for where the application installed based on Android with the operating system version is Android 8.1 Oreo, kernel version 4.9.77+, with hardware CPU speed/processor 1.2 GHz, 8GB Storage, 1GB RAM, Horizon Pixels 320x480 while the server used by the software installed in this research is PHP version 5.6.30, PHPMyAdmin version 4.6.5.2, Apache server 2.4.25, and MySql version 5.6.1.

4. FINDING AND DISCUSSION

After the necessary data is collected, then an analysis of the system is made, then proceed with planning, testing, and implementation.

The design results include facility maintenance flow, facility flow overview with system implementation in this study, flow charts and business processes, and object-oriented diagrams, including use case diagrams, class diagrams, activity diagrams, and sequence diagrams.

Figure 1 shows the flow of maintenance facilities that were running when the system implemented. Whereas in Figure 2 is the flowchart reporting facilities by application users if there are facilities that need to be improved.

System flowchart, as shown in Figure 2, users of this system service reported damage through an Android smartphone that has the application installed. Furthermore, the system notifies the officer.
Officers take action on the incoming report by property conditions. The results of actions taken by officers reported back to the system.

The method used for developing this application is the prototype method. With this method, the developer can interact during system development. The design used for object-oriented systems. Based on observations, the design made based on object-oriented, which is described using UML, including use case diagrams, class diagrams, activity diagrams, and sequence diagrams [16] as shown in Figure 2.

The implementation of the interface consists of various features. The features according to the stages of the process or the type of procedure used by the user. This interface includes the start page, the login form, and the menu after logging in according to the access rights. The registration form for those who have not registered the system, the maintenance schedule is filling page, the room option selection, the tool option selection, the page for reporting damage, the page for viewing maintenance schedule, view incoming reports, and a menu of work results [16].
Application testing used the black box testing method. Tests carried out on all functional requirements that have designed at the application design stage.

Table 1: Black-box Testing

| Test Item          | Testing        | Type of Testing |
|--------------------|----------------|-----------------|
| Login              | Input validation | Black box       |
|                    | Suitability of the Process |             |
| Registration       | Input validation | Black box       |
| Report             | Input validation | Black box       |
|                    | Suitability of the Process |             |
| Schedule           | Input validation | Black box       |
|                    | Suitability of the Process |             |
| Incoming reports   | Input validation | Black box       |
|                    | Suitability of the Process |             |
| Maintenance Schedule | Input validation | Black box       |
|                    | Suitability of the Process |             |

Table 2: System Functionality

| No | Questions                             | Selected Answer |
|----|---------------------------------------|-----------------|
|    |                                       | SS  | S  | C  | TS | STS |
| 1  | Ease of use of the system             | 4   | 6  | 0  | 0  | 0   |
| 2  | Conformity to needs                  | 0   | 9  | 1  | 0  | 0   |
| 3  | Ease of process compared to the previous system | 5   | 5  | 0  | 0  | 0   |
| 4  | Speed of reporting through the system | 3   | 7  | 0  | 0  | 0   |
| 5  | Ease of filing reports               | 1   | 7  | 2  | 0  | 0   |
| 6  | Easily view incoming reports         | 2   | 8  | 0  | 0  | 0   |
| 7  | System benefits for users            | 1   | 7  | 2  | 0  | 0   |
| 8  | Prefer the manual method compared to this system | 0   | 0  | 4  | 6  | 0   |
| 9  | This application makes my task even harder | 0   | 0  | 0  | 8  | 2   |
| 10 | This system makes me frustrated      | 0   | 0  | 0  | 6  | 4   |
| 11 | I will use this system               | 1   | 9  | 0  | 0  | 0   |

Through this system, the process of reporting if damage to existing facilities in the hospital environment is open to all layers of application users. While the actors in the system consist of service users, technicians, and hospital heads.

5. CONCLUSION

The presence of communication and information technology has provided various alternatives and solutions to the reporting system, including various forms of reporting in hospitals. This study provides a reporting solution to reporting assets in support of service activities in hospitals.

For further research, various forms of reporting implemented in various forms of work through technology that is currently available.

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