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| RESEARCH ARTICLE

System Analysis and Conceptual Design to Automate Administrative Functions Using Waterfall Method: A Case of Public University in Bangladesh

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| ABSTRACT

The purpose of this study is to analyze systems requirements and conceptualize designs to automate the traditional administrative functions of public universities in Bangladesh. Before implementing any software or website, system analysis and design are the core functions to formulate. In this paper, Requirement analysis is done with interview and observation, and conceptual design is done with Microsoft Visio software to identify a use case model, activity diagram, sequence diagram, and UML diagram to automate the administrative functions of Noakhali Science and Technology University situated in Bangladesh. The first two phases of the waterfall method are used in this paper to validate the result. The result shows the number of users of the systems, user requirements, and sequential tasks to automate administrative functions.

| KEYWORDS

System Analysis, Automation, Administrative Function, Waterfall Method, University

| ARTICLE INFORMATION

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1. Introduction

In this modern era, technology has been used in every sector, such as business (Drnevich et al., 2013), pharmacy (DiVall & Zgarrick, 2014), engineering (Wang et al., 2018), medical (Yan et al., 2018), education (Hawkridge, 2022) and so on. The use of technology has a tremendous impact on the daily activities of such sectors in minimizing cost, reducing error, and maximizing profit efficiently and effectively (Eckel et al., 2019; Pava, 1983). In the education sector, technology creates innovative learning environments such as distance learning, e-libraries, fastest result processing and improves communication and engagement (Wang et al., 2018) through automation (Nickerson & Zodhiates, 2013). Introduction to automation in administrative functions creates less paperwork and less clerical work, reduces bureaucracy, saves time, and leads to greening in education institutions (Nickerson & Zodhiates, 2013; Sima et al., 2019).

Automation in the education sector is not new, but there are still many education sectors where full automation is not practiced in Bangladesh. The administrative functions of Noakhali Science and Technology University, a public university in Bangladesh, practice traditional data processing systems. When any student, staff member, or teacher wants any service from the administration, such as seeking leave or joining after leave, etc., the entire process takes much time as it is done manually.

In traditional processing, the student, staff, or teacher submits the manual application to the department office. The department chair finds the application, checks it, gives the sign, and forwards the application to the faculty dean. The faculty dean finds the application, checks it, and then signs and forwards the paper to the registrar's office. The registrar checks the application, signs it, and sends the application to the dean to chair the applicant. The entire process is very lengthy and time-consuming, and sometimes, the document's location is not correctly identified as it is done manually.

In this paper, the legacy system of these administrative functions has been designed so that those tasks can be done electronically. Before implementing a website to do such an administrative function, an analysis should be performed (Hoffer et al., 2008) to find the actor (stakeholders), activities, and sequential steps to formulate the automation of the traditional administrative functions. This paper finds the system analysis and conceptual design to automate the traditional administrative function of Noakhali Science and Technology University in Bangladesh.

2. Material and Methods

To develop any system, there is an initial stage where the activities of the whole system are broken into activities in a sequential manner, like a flowchart, which is called the waterfall model (Hoffer et al., 2008). The waterfall model is broken into five sequential steps: requirement, design, implementation, verification, and maintenance in system analysis and design (Royce, 1970).

1. Requirement Analysis: In this stage, the initial data is collected from the stakeholders, such as students, teachers, staff and registrar, about what kind of automation is needed and what types of service they need.
2. Design: In this stage, the initial requirement of the design has been identified. Firstly, the use case model is designed with Microsoft Visio Software. Secondly, an activity diagram is identified from the use cases that describe the activities that each stakeholder has individually done. Thirdly, the sequence of each task has been identified. Finally, unified modeling is done to visualize the systems before implementation.
3. Implementation: In this stage, the actual automation should be done by coding the system as specified in the design phase.
4. Verification: In this stage, the web should be verified that everything is going fine.
5. Maintenance: Proper maintenance should be done to accelerate the automation (Rumetna et al., 2022).

In this paper, the first two steps of the waterfall model have been used to analyze and design the automation of the administrative functions of Noakhali Science and Technology University.

3. Result and Discussion

3.1 Requirement Analysis:

The requirement analysis phase identified the user of the administrative functions for whom the system is to be automated. Unstructured interviews and observations are used to find the system requirement for automation. The interview was conducted with 10 teachers, staff, students, and administrative officers. Physical observation is done individually by the author.

Table 1 The Actors (Users) and System Requirements to Automate

Actor	System Requirements
1. Teacher/Student/Staffs	Login, Uploading Files, Checking Documents Status.
2. Department Chair	Login, Checking Documents Status, Sign & Forward, Backward Reply.
3. Faculty Dean	Login, Checking Documents Status, Sign & Forward, Backward Reply.
4. Registrar Officers	Login, Sign and/ Backward, Uploading File.

3.2 Use Case Modeling:

The use case model finds the stakeholders, which are called actors in system analysis and design (Bello et al., 2021; Bittner & Spence, 2003). In this paper, there are four actors, namely, the teacher/student/staff, the department chair, the faculty dean, and the registrar's office. There are six cases such as login, submit the document, check document status, sign and forward, backward reply, and sign and backward.

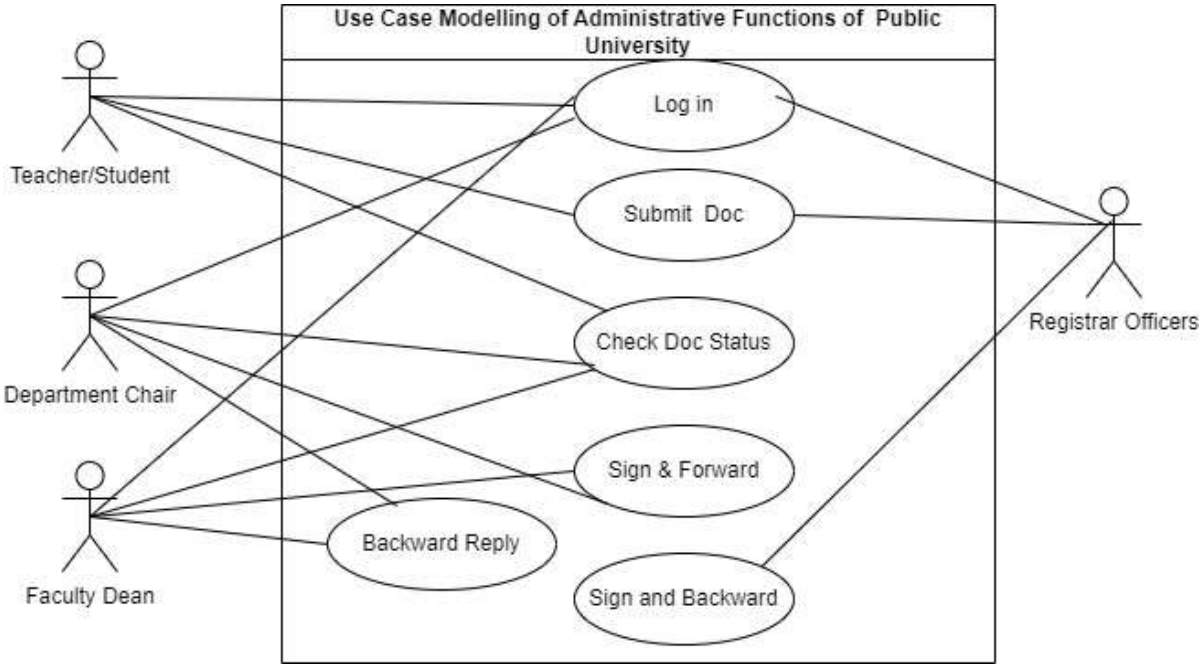

Figure 1 Case Modelling to Automate Administrative Functions.

3.3 Activity Diagram:

First, the teacher, staff member, or student must log in to the system to submit any document. If they provide a wrong or invalid password, then they should log in again with an accurate password. After logging in, they will submit or upload the document, for example, submitting a leave application. They can check the status of the document procedure.

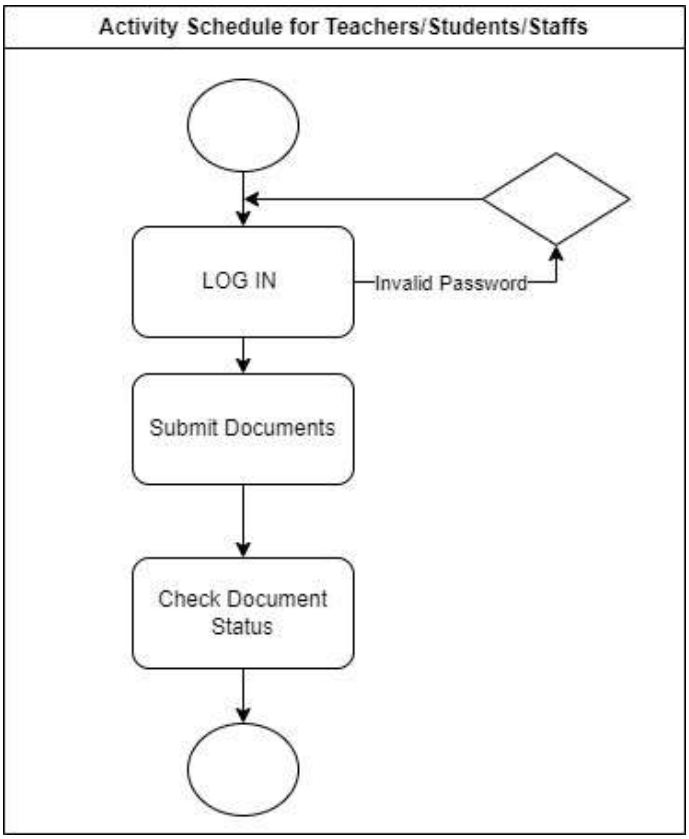

Figure 2: Activity Schedule of teacher/staff/student.

When the department chair logs into the system, she/he will check the document status. If it is valid, then she/he will attach a digital sign and forward the file to the faculty dean. If the document is not valid to forward, then she/he will reply backward to the applicant, mentioning the reason for not forwarding.

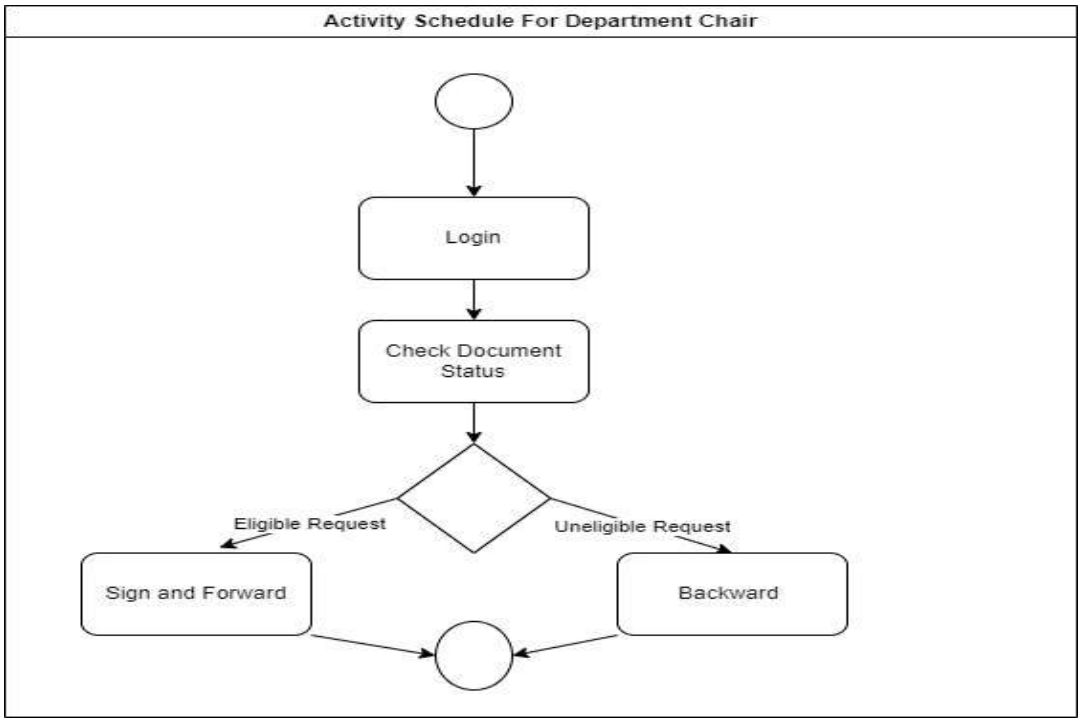

Figure 3: Activity Schedule of Department Chair.

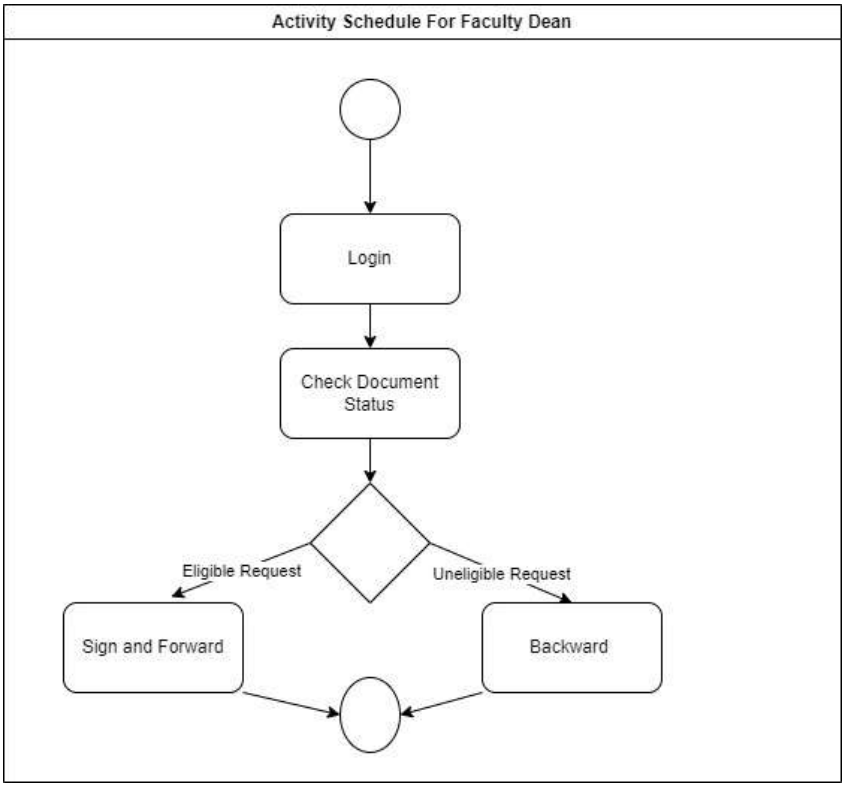

Figure 4: Activity Schedule of Faculty Dean.

When the faculty dean logs into the system, she/he will check the document status. If it is valid, then she/he will attach a digital sign and forward the file to the registrar's office. If the document is not valid to forward, then she/he will reply backward to the stakeholders.

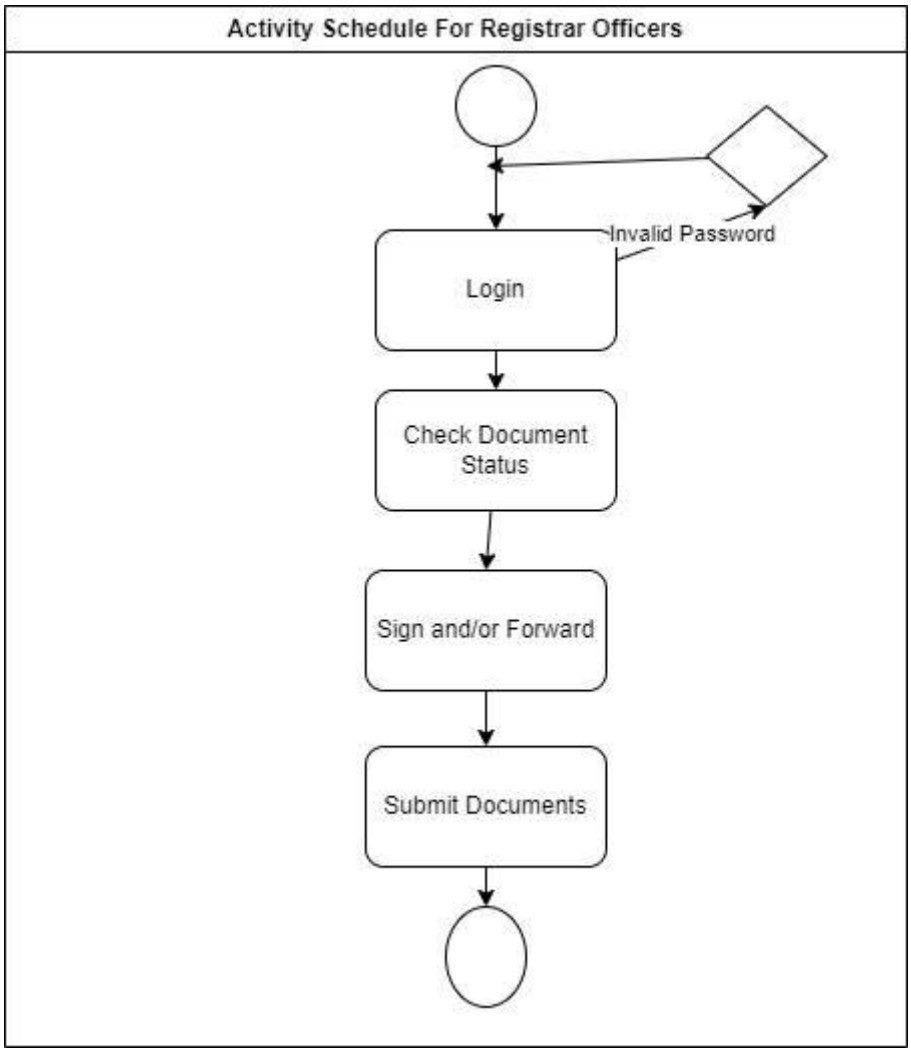

Figure 5: Activity Schedule of Registrar Officer.

3.4 The Sequence Diagram:

The sequence diagram shows the sequence of tasks to do. The vertical lines show the timeline to do a task. Submitting documents from the teacher/student/staff to the registrar's office takes the shortest possible time if it is done electronically.

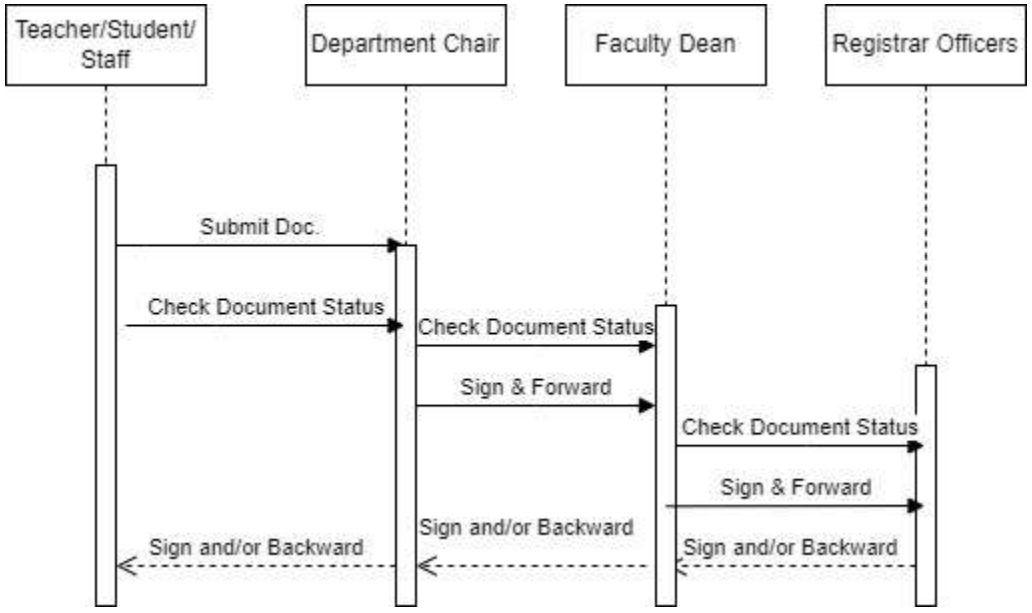

Figure 6: The Sequence Diagram.

3.5 Unified Modeling Diagram (UML Model):

Unified Modeling Diagram is a standardized modeling language consisting of an integrated set of diagrams developed to help system and software developers for specifying, visualizing, constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems (Ambler, 2005; Ozkaya & Erata, 2020).

There are four entities in the UML model. The connection of every entity has one one relationship because it follows a chain of command to complete a task, such as getting approval for a leave or getting approval to join after leave.

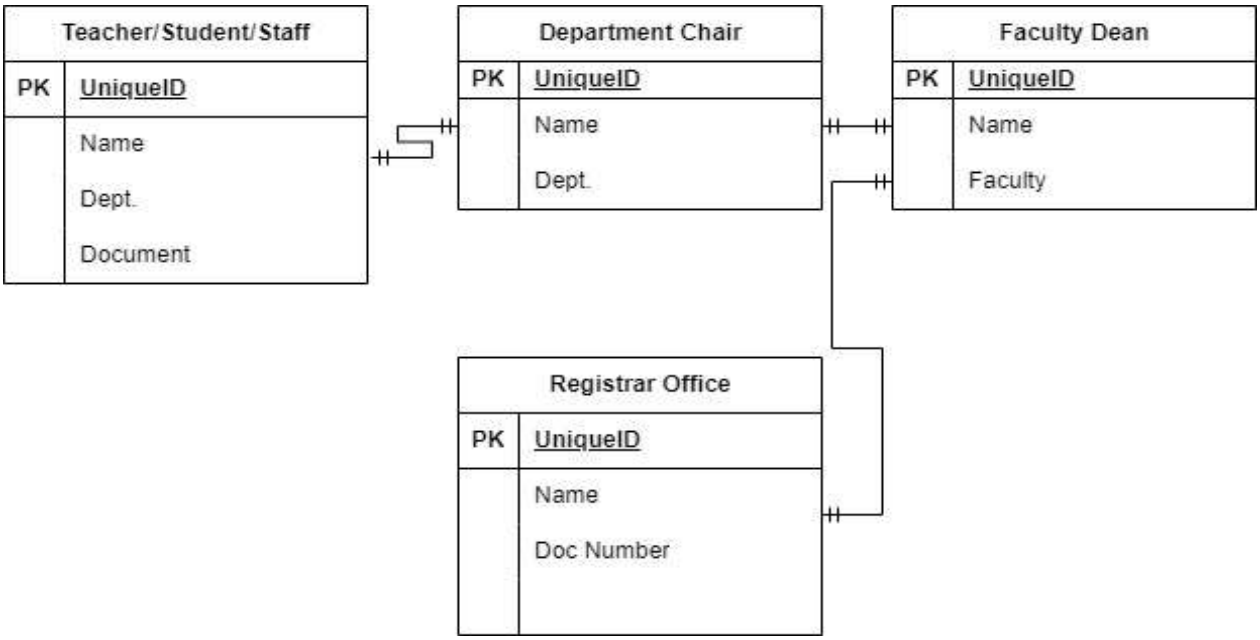

Figure 7: The UML Diagram.

In this paper, system analysis and conceptual design have been performed to automate the administrative function of Noakhali Science and Technology University in Bangladesh. As the administrative tasks are done manually, it takes bureaucracy and time to do any task. But office automation can solve this matter, save time, create efficiency, and make any task easy. Waterfall methods steps are followed to find the analysis and design the administrative legacy functions to automate it by implementing a digital

website. But before implementing the website, the first two steps of the waterfall method, requirement analysis and design, are done in this paper.

4. Conclusion

This paper finds the stakeholders and activities needed to automate the administrative functions of Noakhali Science and Technology University. To automate any system, the first step is to analyse and design it. In this paper, the first phases of the waterfall model from system analysis and design have been adopted to find the use case model, activity diagram, sequence diagram, and UML model. Those modeling identified the major actors (stakeholders) who will use the systems, the activities they will conduct in the systems, the sequence of activities they will perform in the systems and the relation among those actors and activities. This covers an overall understanding of the tasks and requirements needed before implementing the systems to automate administrative functions. As automation creates integration, increases speed and efficiency, saves time, enhances security, enhances compliance, and minimizes bureaucracy, it is necessary to analyze the system requirements and conceptualize the design before implementing the systems in the university.

In this paper, the last three phases of the waterfall model, implementation, verification, and maintenance, have not been analyzed because of the implementation of the systems in the university. These may be the future research areas of this study. By implementing the systems, the actors can actually gain the benefits of automation, where a researcher may analyze the verification and maintenance in future research.

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