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AUTOMATION OF THE PROCESS OF EXAMINING AND REQUESTING MEDICAL CARE BENEFIT COST USING ROBOTIC PROCESS AUTOMATION

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Abstract. *Medical service industry has been developed based on Electronic Medical Records (EMR), Electronic Document Interchange (EDI), and Hospital Information System (HIS) in the e-health era. One of the key tasks undertaken by the hospital's administration department, the request for medical care benefits, even though it is a digitized system, involves manual work by workers, such as comparing medical records. To minimize inefficiencies when applying for medical care benefits, the hospital bills the insurance claims review agency after self-examination. However, when the amount of data to be screened is large, there is a problem that increases the time and error rate of the self-examination process. This study applied RPA (Robotic Process Automation) to the self-examination process, which is the first step in the entire process of the request for medical care benefits. RPA automates the task of dealing with regular and structured data, reducing time and human error and maximizing work efficiency through the relocation of corresponding personnel. The automation of the self-examination process applying RPA reduces the time and error rate required to process work and demonstrates the applicability of RPA in the medical industry.*

Keywords: Robotic Process Automation (RPA), Medical industry, Medical care benefit cost, Self-examination process

1. **Introduction.** Interest in RPA has increased worldwide since 2015, and the introduction of RPA to the financial insurance, distribution and manufacturing industries has increased rapidly [1]. In many industries, RPA reduces costs by automating tasks that have repetitive, regular, structured data and processes.

Medical industry has been developed based on Electronic Medical Records (EMR), Electronic Document Interchange (EDI), Patient Management (PM), Order Communication System (OCS), Hospital Information System (HIS) in the e-health era. The hospital information system consists of a hospital administration department based on PM and EDI, and a medical information department based on EMR and OCS [2]. Recently, researches have been attempted to introduce RPA. As an insurer of health insurance in Korea, the National Health Insurance Service (NHIS) performs such duties as subscriber qualification management, imposition, collection, and payment of insurance benefit costs [3]. The Health Insurance Review and Assessment Service (HIRA), the claims review agency in Korea, examines the cost of medical care benefits requested by hospitals and evaluates the appropriateness of medical care benefits.

Care benefits are managed with great importance for the efficient utilization of medical resources, the prevention of patient concentration into large hospitals, and the financial stability of the medical benefit fund [4]. However, since the application for examination is made by human, there is a possibility of human errors such as entry error, and the

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time required for the entire work is increased during re-examination or re-requesting due to the errors. In the event of an error, such as a cost-setting error or entry error, the bills of request will be returned to the hospital along with the reason for adjustment, and the hospital will suffer time and cost damages until the re-request operation. Therefore, before filing a request with the HIRA, the hospital tries to reduce the error rate through self-examination. Before the hospital requests a bill of medical care benefits to the Review and Assessment Service, it checks data such as patient names in the medical records, finds errors in advance, and reduces the rate of re-examination and re-request.

This study applied RPA to the self-examination process among the requesting and examination process of care benefit costs. Uipath, the most representative RPA implementation tool, enables to check structured data automatically and ensures that it is more accurate and less time-consuming than manually performed.

The remainder of this paper is organized as follows. Section 2 reviews previous studies on RPA applied to various industries. Section 3 shows the problems of the examining and requesting for medical care benefits and describes the automated design of the self-examination process during the work of medical care benefits. Section 4 presents the implementation of the self-examination process automation using an RPA implementation tool. Finally, Section 5 offers conclusions of this study.

2. **Related Work.** This section summarizes previous studies on RPA applied to various industries. [5] compares and analyzes labor force and efficiency by designing and applying the input system of the elderly welfare manager website using RPA. [6] and [7] give an overview of the RPA and give an opinion on industry trends and technology trends and the future direction of the RPA. [1] presents the most efficient application methodology for the introduction of RPA by an entity based on the application performance cases of domestic entities involved in the introduction of RPA. [8] presents important factors for introducing RPA for domestic insurers and identifies priorities through Analytic Hierarchy Process (AHP) and Delphi techniques. [9] proposes a framework-based RPA/machine learning to ensure the standardization and quality of Bhasma which is an end product obtained after multiple activities in the traditional Indian System of Medicine.

The business processes that appear in the medical industry are very complex because of various cares, prescriptions, which consist of unstructured data in different text forms for different patients. Because of this, automation of medical business processes through RPA is much more difficult than in other industries. However, Although the self-examination process is limited, it is possible to apply RPA because structural data such as patient number, disease name, disease code and repetitive work process exist.

In this paper, we identify the possibility of RPA application in the medical industry through the implementation of the self-examination process automation.

3. **Design of Self-Examination Process for Automation.** This section presents the problems of the existing medical care benefit cost examining process and the modification of the process for automation.

3.1. **The problems of the existing process.** The examination system for medical care benefits is designed to examine whether medical care benefits have been performed in a reasonable manner both medically and economically based on the standards and principles set out in the relevant statutes, to curb unnecessary overspending and to prevent the payment of unfair medical costs, and to prevent the underuse, inappropriate use of medical resources.

The overall process of requests for examination is shown in Figure 1. The hospital requests the HIRA to pay medical care benefits for the medical services provided to patients, excluding the self-pay, by attaching a bill of medical care benefit costs. The HIRA examines whether the criteria for medical care benefits and details of medical

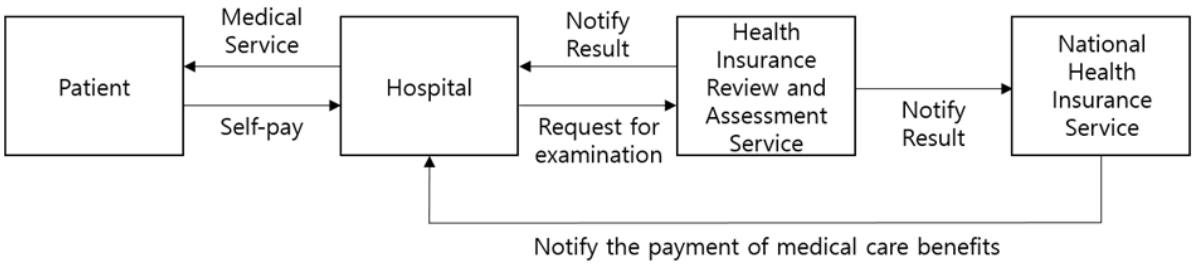

FIGURE 1. The process of request for examination of medical benefit costs

care benefits are appropriate for the contents of the hospital's request for examination. When the examination is completed, the HIRA notifies the hospital and the NHIS of the notification of the examination results. Finally, the NHIS notifies the hospital of a notice of payment of medical care benefits.

The hospital records the details of each act in the medical care benefit costs bills and requests an examination of the medical care provided to the patient. The medical care benefit costs bills input accurately the patient's personal information, the insured, the name of the disease, and the details of medical treatment. Based on this, the examination is conducted in writing or by computer system according to the medical care benefit cost bills.

However, only the items listed in the bills details are examined according to the examination criteria, and if there is an error in the details, an adjustment for the examination occurs. For example, there are cases of administrative errors (missing errors, water application errors, errors in drug calculation, etc.) and omission of the patient's name (such as claims for surgery unrelated to the patient's name). If an examination adjustment occurs, the hospital receives the bills back from the HIRA along with the reason for the adjustment, should revise it, and then re-request. In this case, it will take a considerable amount of time to re-request, and the fatigue of workers will also increase.

3.2. **Process modification for RPA.** In order to reduce the possibilities of adjustment, hospitals conduct self-examination. As shown in the left side of Figure 2, the request bills are made by comparing the medical records with the bills of examination for medical care benefits on the computerized system. Based on the medical records, the worker checks and examines whether the prescription, and treatment of patients are appropriate or not based on the request bills. If there is a mismatch item, it shall be corrected and examined. The figure on the right of Figure 2 represents the automation process for applying RPA. If there is a mismatch, the automation process will only inform a worker that there is an error in the examination process along with the error message window. At that point, automation is terminated and the worker corrects the error by hand and executes it again to re-run the work flow from the initial stage. If all items match, the information of bills is stored and the status of the request is pending.

To automate the self-examination process by applying RPA, the process was redesigned as shown in the right of Figure 2, eliminating the task of identifying clinical records, correcting and re-examining discrepancies. The reason for this is that in the case of medical record checking work, the medical opinion of the doctor or nurse is included, and the data has unstructured or ad hoc characteristics. The RPA technology currently being applied makes it difficult to automate such characteristics and excluded it from this study. Because it is difficult to automate corrective and re-examination tasks for the same reason, it allows workers to correct them quickly and accurately through error notification message windows in case of discrepancies.

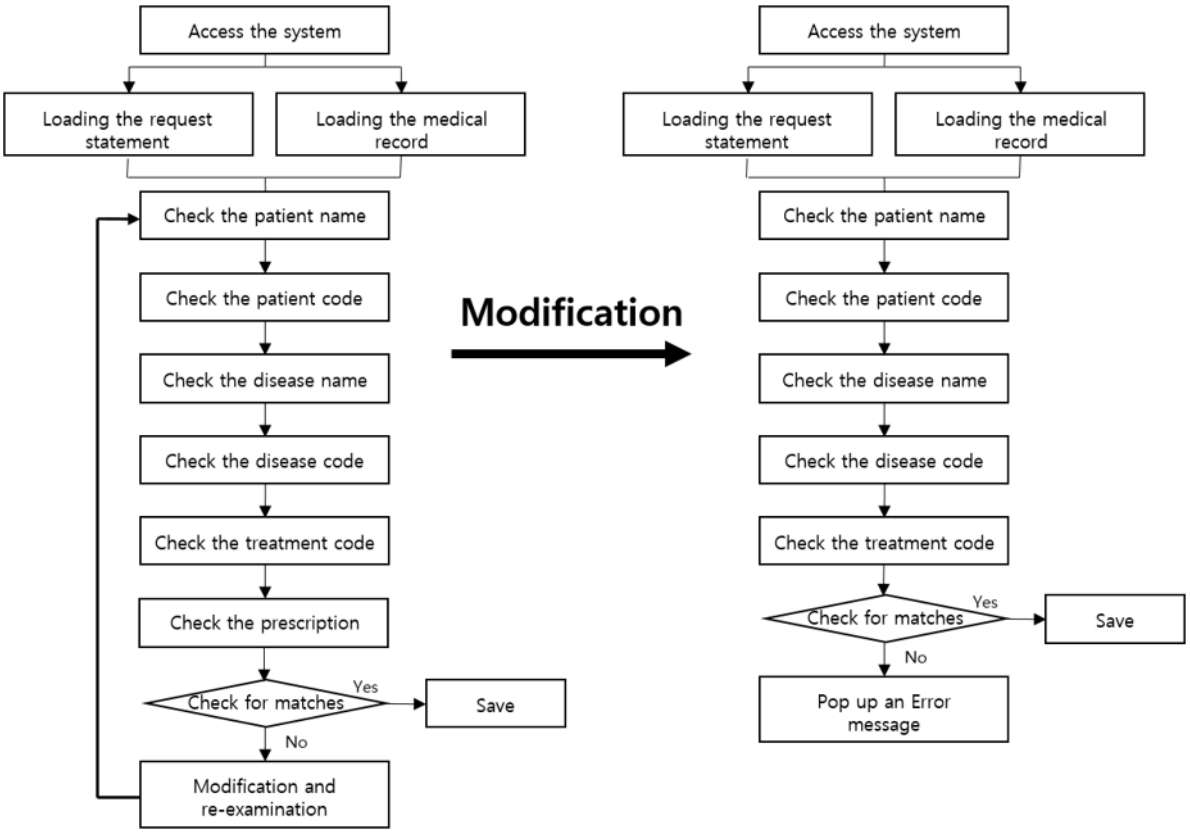

FIGURE 2. The modification of the self-examination process

4. **Implementation.** This section describes the implementation of automating self-examination process using the RPA implementation tool Uipath.

Uipath can be easily installed on a personal PC. To proceed with the implementation, the work flow of the task must be designed in detail without errors or omissions. When the detailed design of a work flow is completed, the designed flow is created in the studio of the RPA solution to utilize the functions such as Recording and Scraping as work flow and to produce Automation Flow through partial programming. Once the Automation Flow has been built in the studio, you can test your own programmed automation process and manage errors or work logs through monitoring.

Figure 3 shows the automated work flow of the self-examination process for care benefits. First, we assume that the Bizagi Studio program is an administration department system. Because implementation is limited on the computer screen unless it is actually related, Bizagi Studio has been used to simplify the actual computer program's bills and the medical record's UI as shown in Figure 4, thereby implementing patient name, patient number, disease name, and disease code data. After that, the program is accessed, the temporary examination request bills and medical records are loaded in order. Structured data such as patient name, number, disease name, disease code, and number code are entered in the examination request bills and medical records.

Assuming that the generated UI is a bill and a medical record that appear in the actual application program, the software robot calls the patient's bill and medical record at the same time when the patient's name is inputted first. Then, the software robot recognizes data corresponding to general matters such as patient name, disease name, and disease code through Screen Scraping and Data Scraping, and compares both to identify any discrepancies.

If there is a mismatch, the worker refers to the error with the error message window. At that point, automation is disabled and the worker in charge re-runs the flow chart from the

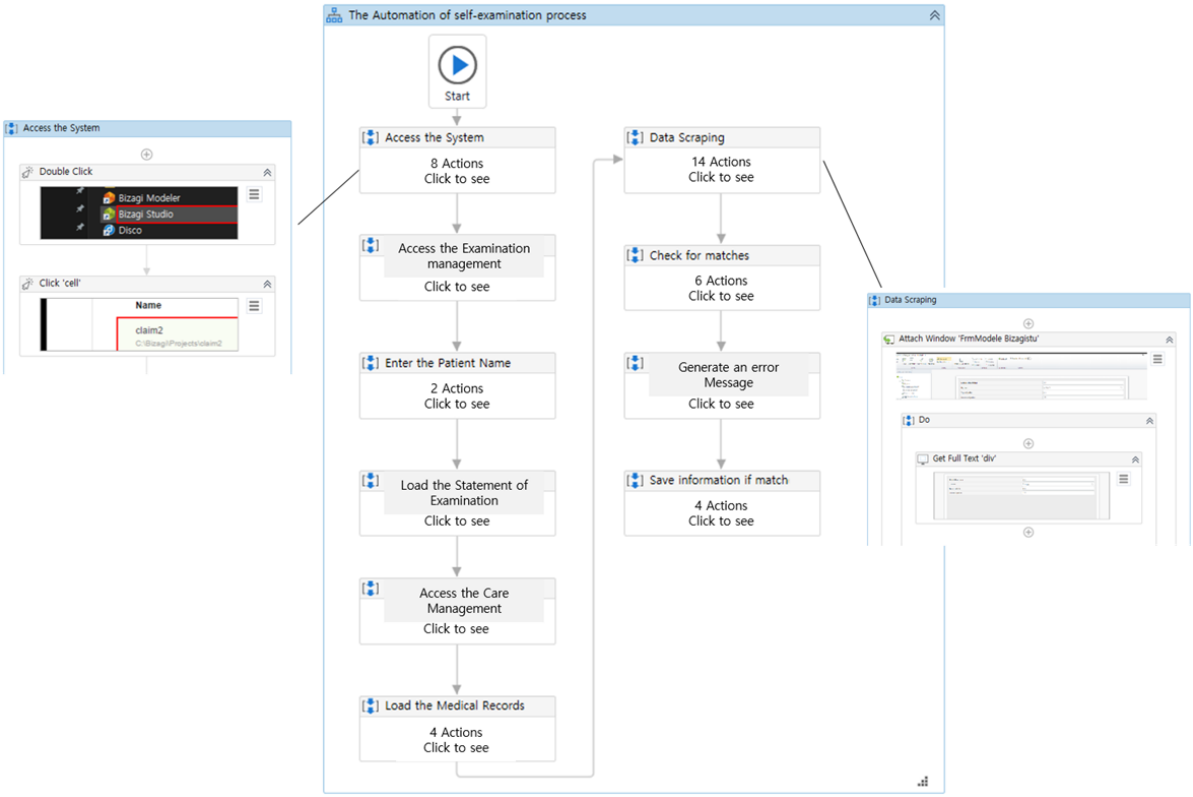

FIGURE 3. The work flow of self-examination process automation

FIGURE 4. The medical record's UI simplified by Bizagi Studio

initial stage by modifying it and executing it again. If both data are matched, the software robot automatically stores the assessment information and the information is waiting for the request. Subsequently, the self-examination work is completed by collecting the files in the waiting status of the examination into one file and sending them to the HIRA.

There are two ways to analyze RPA performances in this study. First, it is possible to compare the performance before and after the application of RPA by using the process mining technique. Pattern analysis and performance analysis are performed using process mining analysis tools such as ProM and Disco based on event log data generated in the process before and after automation. Through this, it is possible to check the performance after applying the RPA.

Second, it is possible to analyze the performance of the automated process by using the performance analysis service provided by Uipath. RPA solution companies such as Uipath provide performance analysis services as well as consulting of RPA application.

5. **Conclusions.** In this paper, automation was implemented by applying RPA in order to increase efficiency of self-examination work that was done manually in hospital. RPA is a technology that algorithms and software automate repetitive and regular tasks so

that tasks can be performed on behalf of humans. When RPA is applied, the software robot follows the recording of the work pattern, so the processing speed is clearly faster and the error rate is lower than that of the workers.

It can be expected that this study will have the same effects as RPA application in other industries, such as increased productivity due to reduced working hours and improved quality due to reduced error rates. It will also allow workers who have spent a lot of time working on other high value-added tasks and reduce the pressure of work in time for proper working hours. Through this, it can be expected to improve satisfaction and performance in the long term, and improve medical service quality through accurate and rapid internal work support.

However, because the nature of the medical industry does not allow individuals to use actual medical data, this study assumes and uses medical data, and the medical work process may differ from the actual one because it refers to relevant books. Therefore, there is a limit to the empirical performance analysis of this study.

In the future, we will examine the applicability of RPA to reservation management, which is one of the most important tasks in the department. Also, further research will be conducted to develop and present guidelines for successful application of RPA in the medical industry which has not been mentioned in other existing studies.

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