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Application of Agile Development Methods in the Development of Integrated Systems for Vehicle Body Repair

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Abstract

Auto Body Repair Enterprise is a company that focuses on repairing and servicing vehicles, especially cars that have been involved in accidents or disasters. Currently, data processing still uses physical forms, which has proven to be inefficient because it takes significant time, labor, and resources. Collecting and inputting data from various forms requires a large effort, while systems that are not integrated cause delays in providing the required information. These challenges impact the company's ability to make decisions quickly and on time, especially in the face of increasingly tight and complex business competition. Therefore, an efficient and integrated solution is needed. Seeing this problem, it was decided to develop an integrated vehicle repair system by applying agile development methods, especially the Extreme Programming model. This approach allows development in an iterative, fast, adaptive manner, and actively involves users at every stage of development. Experience has shown that applying the Extreme Programming model can produce an integrated system that meets user needs in a short time. With this system, companies can produce reports quickly without reduplication or repetitive data processing. All parts involved in the vehicle repair process will be connected to one company server, creating the efficiency and accuracy needed to support business growth in a dynamic business environment.

Keywords: *Integrated System, Extreme Programming, Auto Body Repair*

1. Introduction

The implementation of information systems in companies, especially in the vehicle service sector, is considered crucial for improving operational performance [1]. Information resulting from regular, fast, and precise data processing can make a positive contribution to the smooth management and operational activities of the company [2]. The ability to make informed decisions also becomes more possible with the availability of accurate information [3].

At Auto Body Repair Enterprise, efforts need to be made to modernize the information management system, especially in terms of archive and file management [4]. Implementing an integrated system can overcome challenges faced by companies, such as delays in presenting information and the risk of human error in the data processing process [5].

By implementing an integrated system, Auto Body Repair Enterprise can ensure that every part involved in the vehicle service process can operate more efficiently and effectively [6]. This includes the process of receiving the vehicle, estimating costs, carrying out repairs, and handing over the vehicle to the consumer. In this way, companies can provide better and more responsive service to customers, increase customer satisfaction, and strengthen their position in the vehicle repair industry [7].

The sections that handle the vehicle service process starting from the service process, and repairs, until the vehicle is completed, and then handed over to the consumer, are carried out sequentially and still use archives or files in stacks [8]. Currently, there is no implementation of an integrated system at Auto Body Repair Enterprise, which can increase efficiency and accuracy in managing information related to vehicle service. The parts that handle this vehicle process consist of:

1. Front Desk
   This section will serve consumer vehicle repair complaints when they first come to the company, then the data will be written in file form.
2. Claim
   After the consumer data is entered into the form by the front desk, it will then be written again in the claim form, starting from the vehicle owner data, vehicle data, and photos of the parts to be serviced. The results of the vehicle that has been entered or filled in on the claim form will be submitted to the insurance company, which is specifically for the vehicle being insured. If it has been approved, the vehicle data will be given back to the front desk for re-checking and approval that the vehicle will be repaired at the company.
3. Workshop Coordinator
   The vehicle data that the claims section has filled in will be returned to the front desk, then the front desk will double check and agree that the vehicle is approved for repairs, then it will be handed over to the workshop coordinator to determine which mechanics will repair the vehicle. This vehicle repair data will be filled in again on the workshop coordinator form as proof of registration that the vehicle has been approved for repair.
4. Material
   The repair data provided by the workshop coordinator will be submitted to the materials department to check whether there are additional materials, including spare parts and paint, that will be used. All data will be filled in again in the material form provided.
5. Warehouse
   This section will ensure the availability of spare parts, paint, and other materials needed by the company.
6. Cashier
   Vehicles that have been repaired will be made a payment receipt for the type of vehicle that was repaired without insurance. If the vehicle is insured then the cashier will make a billing receipt which will then be submitted to the insurance company, in this section again all data starting from the vehicle, and the consumer's personal data will be Fill it in again on the receipt form provided.
7. Administration
   This section will make wages or salaries for employees which are paid weekly, then approve the application for purchasing goods from the warehouse department.

2. Research Method

In the context of short-term system development, this process is carried out efficiently by reducing unnecessary documentation, utilizing experts, and ensuring product development is always controlled in daily routines [9]. The agile approach acts as a mindset that emphasizes collaboration between teams throughout the product development process [10].

Several software development models included in the agile software development method include 1) Extreme Programming, 2) Adaptive Software Development, 3) Dynamic Systems Development Method, 4) Scrum Model, and 5) Agile Modeling. In this research, the model chosen to develop an integrated information system for vehicle body repair is Extreme Programming (XP). This approach was chosen to ensure that system development can be carried out efficiently, quickly, and responsive to user needs, by the principles applied in the agile methodology [11].

Extreme Programming (XP) is a software engineering that tends to use an object-oriented approach and the target of this method is teams formed on a small to medium scale. This method is also suitable if the team building an integrated information system for vehicle body repair is faced with requirements. unclear or rapid changes in requirements [12].

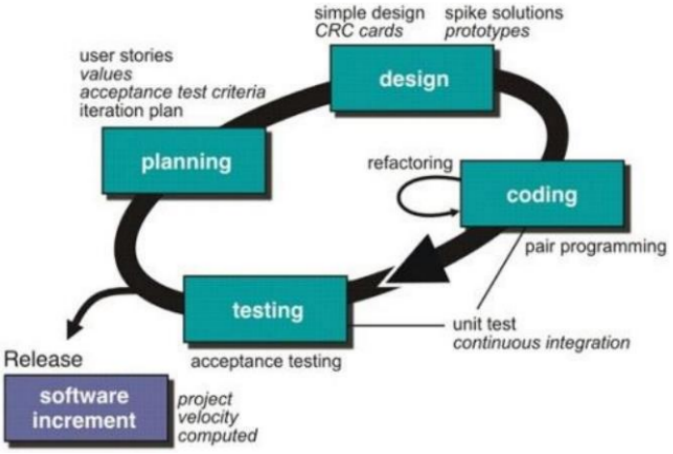

Figure 1. Extreme Programming (XP) Practices Scheme

The stages in creating this integrated information system using the Extreme Programming (XP) model are as follows:

1. Planning (Planning)
   In this initial stage, it starts with the first step in creating the system, where several planning activities are carried out. These planning activities include identifying problems, analyzing needs, and determining a schedule for implementing system development [13].
2. Design (Designing)
   The next stage is design, where modeling activities are carried out comprehensively, starting from system modeling to architecture and database modeling. This modeling process involves the use of Unified Modeling Language (UML) in creating system, architecture, and database diagrams [14].
3. Coding (Coding)
   In this step, the modeling is applied which has been prepared in the form of a user interface using the VB Net programming language, and database management is carried out using MySQL [15].
4. Testing
   After completing the coding stage, the next step is to carry out system testing to identify errors and deficiencies that may arise when the application is running. The main goal of this testing is to ensure that the system being developed meets user needs. The testing method applied at this stage is black box testing, where testing is carried out on a form with several inputs to ensure that the system functions and features run according to user needs [16].
5. Software Increment (Software Improvement)
   This stage refers to the gradual development of the system which is carried out after it is implemented in the organization, with the addition of services that increase the functional capabilities of the system [17].

The advantages of the Extreme Programming Method include focusing on the relationship between programmers and users in developing simple software with a quality system development process [18]. The Extreme Programming method is combined with the bootstrap framework which is an intuitive and powerful front-end framework for faster and easier web application development [19]. Bootstrap uses HTML, CSS, and JavaScript with several features of the Bootstrap framework, namely web browser compatibility, supports Responsive Web Design, flexible CSS, and ready-to-use JavaScript [20].

2.1. Research Flow

Stages of research flow in community training information systems start from the planning process, system design, system coding, and system testing and will produce a system as a research result. The stages of the research flow can be seen in Figure 2.

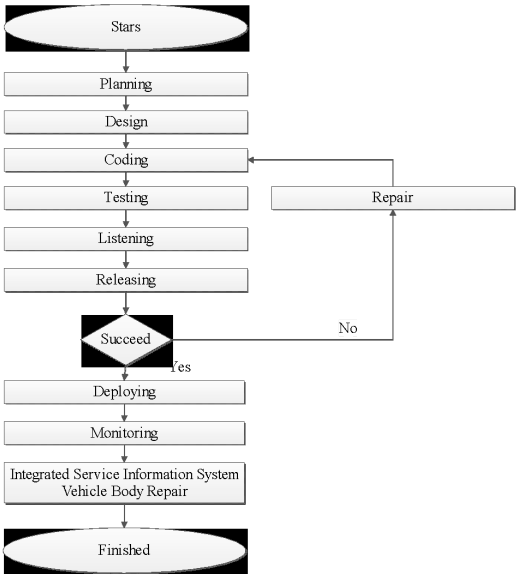

Figure 2. Research Flow Stages

2.2 Planning.

At this stage, the software development team works closely with the client to plan the project. They create a plan that consists of things like project goals, user requirements specifications, and delivery schedules. This plan is then updated regularly throughout the development cycle.

2.3 Design

At this stage, the development team creates an architectural design for the system to be developed. They also make detailed designs of the features that will be implemented. This design is carried out repeatedly, making improvements or changes to the design if necessary.

2.5 Coding (creation of code)

This stage involves the process of writing code. Teams of developers work in pairs to write code, with one person typing and the other providing feedback and checking for errors. The resulting code is then automatically tested to ensure its quality.

2.6 Testing (testing)

After the code is written, the development team tests the software that has been created. Testing is carried out automatically and manually to ensure that the system runs according to specifications and user needs.

2.7 Listening

The listening stage involves strong communication between the customer and the XP team. The XP team continually updates and improves the software based on feedback provided by customers.

2.8 Release (release)

The release stage involves rolling out the software to customers. The XP team ensures that the software functions well and meets customer needs before it is released to the market.

2.9 Deploying

The final stage in the software development cycle. This stage involves the process of delivering or rolling out software to customers or end users.

2.10 Monitoring

An important stage in the software development cycle. This stage involves monitoring and collecting data on software performance, usage, and technical issues that occur after rollout to end users.

3. Results and Analysis

Within the framework of this research, efforts are made to achieve results in line with the Extreme Programming development process. This method involves a series of stages, including planning, designing, coding, and testing. It is hoped that each stage can be explained in detail in the context of the research being carried out.

3.1 Planning

In this phase, the focus is on creating an integrated system for processing auto body repair vehicle service data based on existing conditions at the PT. From the results of the needs analysis, the need for an integrated system for processing vehicle service data can be described as follows:

1. Manage customer vehicle data that will carry out repairs.
2. Can manage vehicle repair price estimation data.
3. Monitor vehicles that are being repaired from the moment they arrive until the vehicle has been repaired.
4. Manage spare part availability data in the warehouse.
5. Manage payment data for customers who have made improvements.
6. Manage vehicle service customer receivables data.
7. Manage the reports required by the company for each module created.

3.2 Current System Analysis

Currently, the system used for running operations still adopts conventional methods through filing, and then each section is still working on data processing by entering customer and vehicle data repeatedly in each section.

Each section is still working on other sections because no system can help integrate data from one section to another. The following is an overview of the current system analysis in the form of a use case diagram.

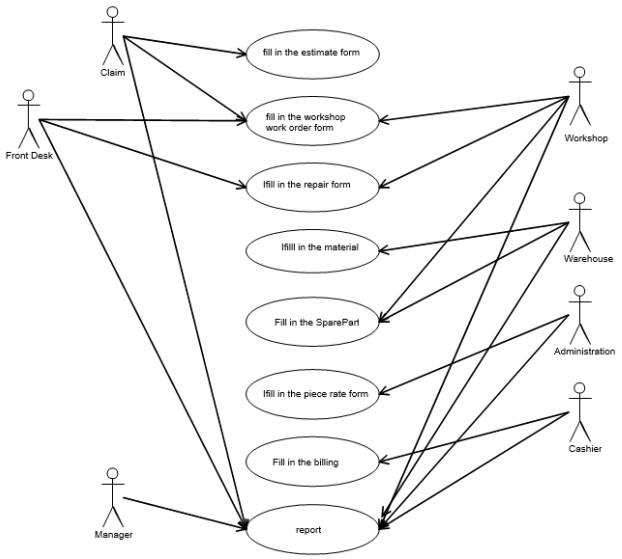

Figure 3. Use case of running system analysis

3.3 Design

The design phase is a process of activities in designing the analysis results and designing the interface of the proposed system created to meet the needs of Auto Body Repair Enterprise.

1. Analysis Results

   In the process of creating this integrated system, an analysis of needs was carried out using the method used, namely Extreme Programming. The design process is depicted in

diagram form, namely use case diagrams and activity diagrams. A use case diagram is a model that describes a functional system consisting of actors and use cases. Meanwhile, activity diagrams are used to model the flow of business processes and the sequence of activities in a software process. Use case diagrams and activity diagrams based on the needs of an integrated information system at Auto Body Repair Enterprise are as follows:

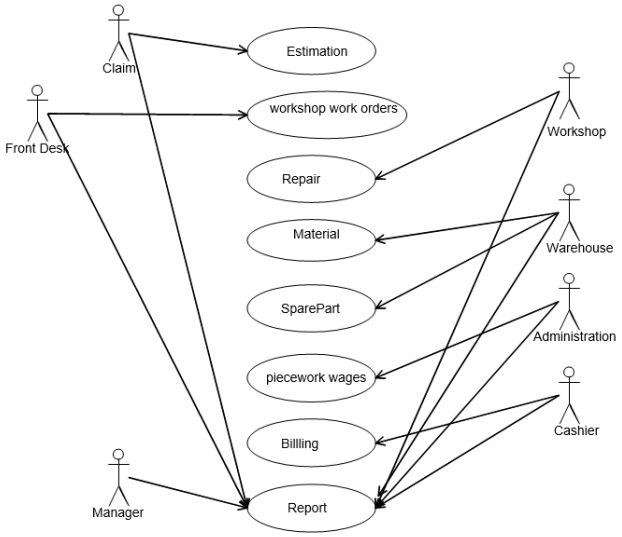

Figure 4. Use Case Diagram of the Proposed System

In Figure 4, for this integrated system use case, the number of actors involved is 6 (six) parts, starting from the vehicle arriving which will be served by the PKB (workshop work order) section or the front desk, then repair estimates are carried out as an estimate or claim, the vehicle will be repaired and monitored by the workshop department, if there are additional materials and spare parts it will be carried out by the warehouse department. The administration department will carry out the payroll process for mechanics who carry out repairs and the cashier will make billing for vehicles that have been repaired. The manager monitors customer data processing starting from income, receivables, and payables.

Next, the activity diagram of the integrated information system for vehicle body repair is as follows:

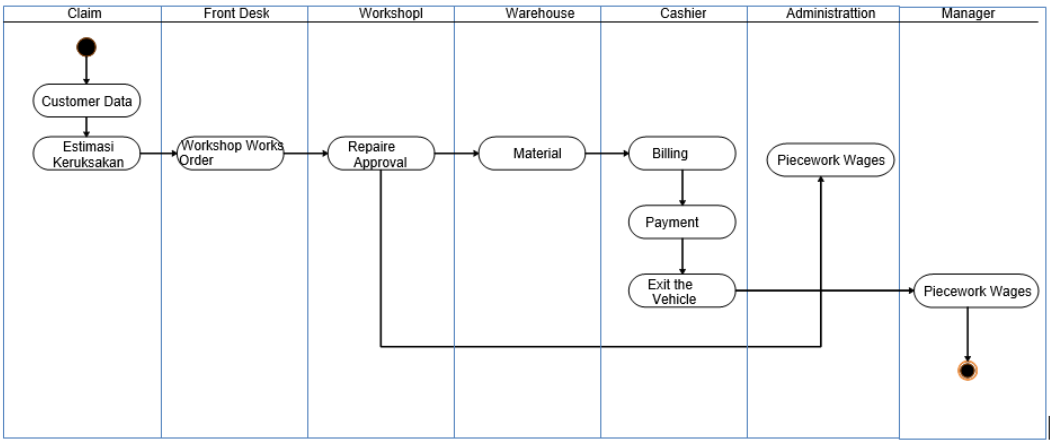

Figure 5. Proposed Activity Diagram

Figure 5. shows the process activities carried out by all parts involved in the integrated information system for vehicle body repair from the time the vehicle arrives until it is repaired.

2. Database Design

Database design for an integrated information system for auto body repair vehicles as shown in Figure 6.

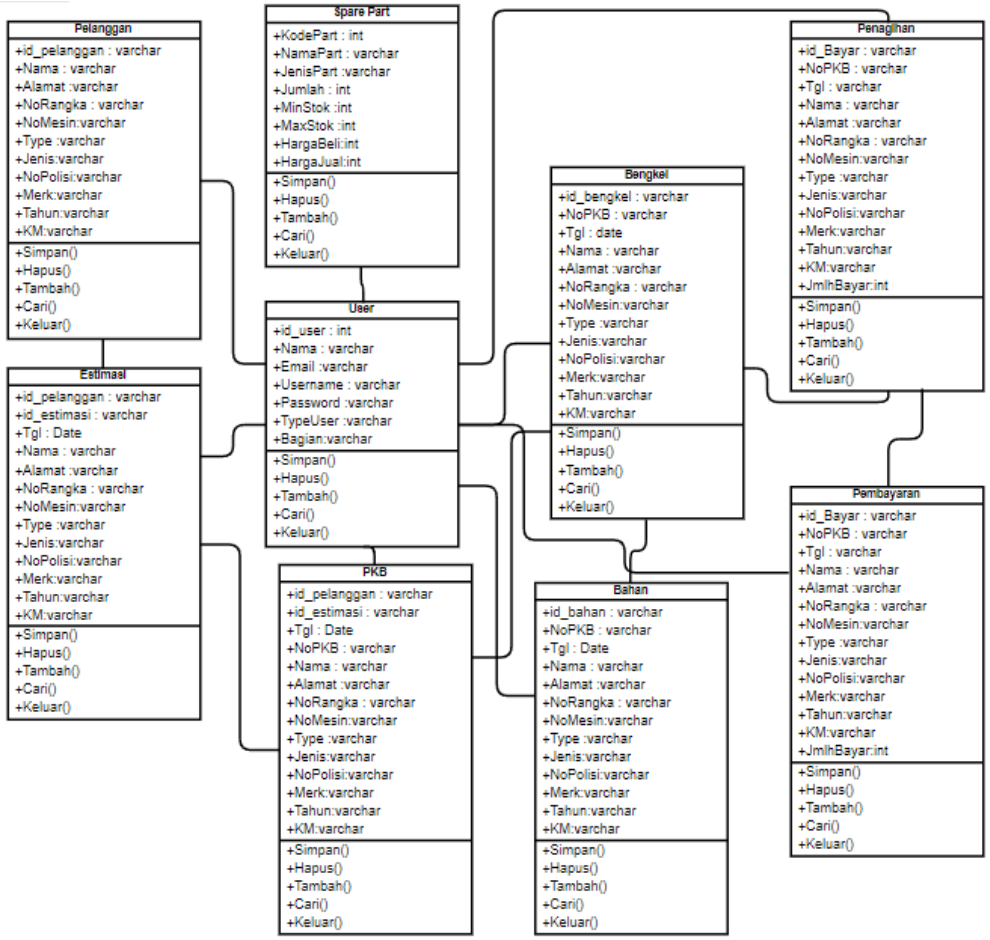

Figure 6. Proposed database design

3. Implementation

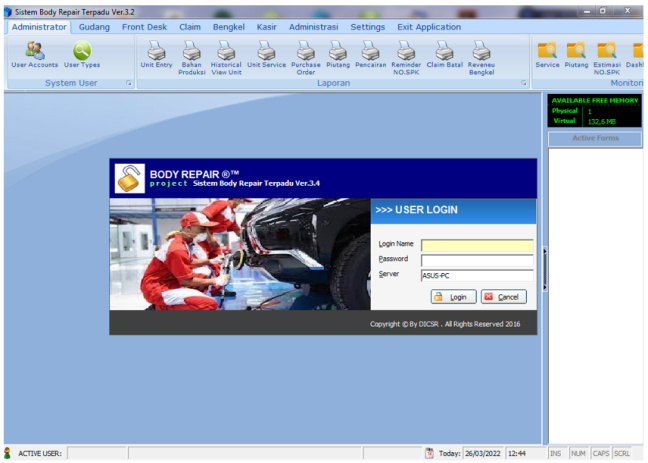

Figure 7. System Login

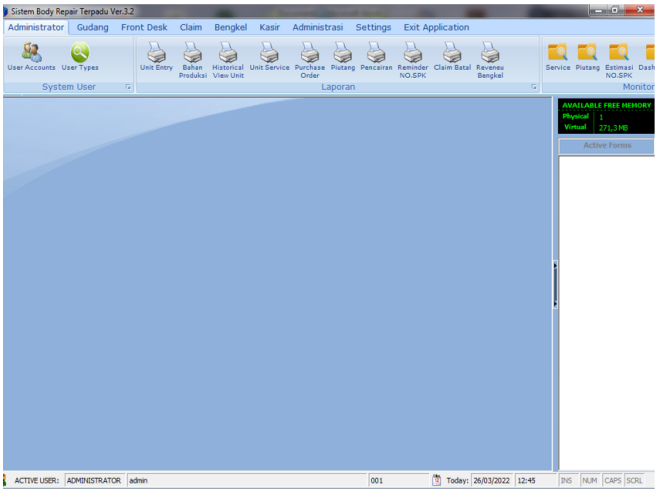

Figure 8. Main System Display

4. Conclusion

By referring to the discussion above, it can be concluded that the proposed Integrated Information System for auto body repair vehicles:

1. Eliminates reduplication or repetitive data input work in each part because the integrated system is made connected or interconnected to all parts involved.
2. Ease of creating reports from all sections
3. Monitoring every work activity of all sections, making it easier to make employee performance reports

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