

## Design of a Web-based Traffic Accident Information System Using the Extreme Programming Method

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### Abstract

The rapid development of technology in this era has prompted various sectors to undergo digitalization, including hospitals. The primary objective of this research is to create a web-based traffic accident information system that will enhance the efficiency of processing and reporting traffic accident patient data. Data was collected through interviews, observations, and literature studies using a descriptive qualitative approach. The software development method employed is extreme programming. The system is built using the Laravel v10 framework with the PHP v8.1 programming language, complemented by MySQL v8 as its database. The results of the study at Hospital X indicate that traffic accident data reporting is still conducted manually using Microsoft Excel. This research aims to provide a reference for healthcare facilities, especially hospitals, to develop such a system. The information system is built and tested using black-box testing. Based on the functional aspects tested, the system operates effectively. It can be concluded that the system is suitable for use. Thus, medical record officers no longer need to sort emergency department patient data by admission date, diagnosis, and external cause, thereby facilitating the aggregation process and producing more comprehensive information.

Keywords: Extreme Programming; Laravel; Reporting System; Traffic Accident

### 1 Introduction

Population mobility or population distribution, is partly driven by the increase in population each year. Fueled by a growing economy and population, Indonesia's motor vehicle industry is expanding, leading to a surge in demand for transportation and increased purchasing power within the community. As a result, one of the issues that arises is traffic accidents (Hernawan, 2022). Traffic accidents are random events based on two main factors, namely time and place. According to researchers, traffic accidents are always preceded by situations where drivers or road users are considered to have failed to adapt to their environment (Asidiqi et al., 2022).

According to the Traffic Corps of the Indonesian National Police, in the Republic of Indonesia, during the period from January to September 13th, 2022, there were 94,617 traffic accidents, an increase of approximately 34.6% from the 70,000 accidents in 2021. These accidents

resulted in 25,266 deaths in 2021 and 26,100 deaths in 2022. Severe and minor injuries are not included in this data (Publik, 2023).

Given the high number of accidents, traffic accident victims are usually taken to hospitals for assistance (Rian Irwansyah et al., 2023). Hospitals are essentially responsible for providing health services, including treatment, rehabilitation, and disease prevention (Maryani et al., 2022).

Traffic accident patients are taken to the emergency department upon arrival at the hospital for immediate care. The Emergency Department is one of the service units in the hospital that provides initial (for patients who come directly to the hospital) or follow-up (for patients referred by other healthcare facilities) care for people suffering from illnesses or injuries that may be life-threatening (Merliyanti et al., 2024).

The rapid development of technology in this era mandates that all healthcare services implement information technology to improve the quality of



services to the community (Abdalla Maslyta et al., 2023). One example of the advancement of information technology in healthcare is electronic medical records, which significantly impact the improvement of healthcare service quality (Asih & Indrayadi, 2023). In line with the Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022, which replaces Regulation Number 269 of 2008, electronic medical records have become mandatory for healthcare facilities to use (Albar, 2023).

As a healthcare facility, hospitals not only provide treatment to traffic accident patients but also must report patient data to the Health Department (Rian Irwansyah et al., 2023). The data reported to the Health Department monthly only includes the number of traffic accident patients, while the specific data of these patients is stored in the patients' medical records and not reported to the Health Department (Saputra & N, 2016).

This study identifies a shortcoming in the data reporting process. Traffic accident patient data is still entered using Microsoft Excel as the database. Consequently, medical record officers must sort emergency department patient data by admission date, diagnosis, and external cause. This process is considered inefficient and prone to errors, or human error.

Irma et al. developed a web-based traffic accident reporting system to assist reporters, featuring accident location points displayed on maps (Nurdianingtyas et al., 2021). Nina and Samodra conducted a study on a web-based traffic accident application built with the Laravel framework. This application aimed to inform traffic policy and educate the public about traffic accidents, utilizing accident-prone maps powered by the Google Maps API (Setiyawati et al., 2017). Assidiqi et al. designed a web-based traffic accident reporting system for the traffic unit of Purworejo Police to facilitate public reporting to authorities (Assidiqi et al., 2022). Siti Maryani et al. on traffic accident reporting using the V Model method still involved suboptimal data processing (Maryani et al., 2022). Deden Rian Irwansyah et al. designed a traffic accident reporting system using the agile method with the Visual Studio programming language (Rian Irwansyah et al., 2023).

To address the challenges in this digital era, this research aims to develop and implement a web-

based traffic accident information system at Hospital X. As defined by experts, a website is a collection of interconnected web pages containing various content like documents and photos, all stored on a web server (Suryana et al., 2023). This system is designed with the main objective of improving the efficiency and effectiveness of traffic accident data management with an attractive visual interface. Extreme programming is a software development technique or method used due to its flexibility in handling changing requirements and active user involvement in the development process. Furthermore, this system will be built using the Laravel v10 framework with PHP v8.1 as the programming language and MySQL v8 as the database, allowing the system to be accessed directly through a web browser and supporting mobile use.

## 2 Methodology

### 2.1 Data Collection Methods

This study was conducted at Hospital X in Bandung using a qualitative descriptive approach. This approach analyzes the situation, explains problem-solving with data, and interprets the findings (Renjani et al., 2023). Qualitative research methods involve studying natural characteristics and analyzing field data using descriptive elements. Descriptive research, on the other hand, aims to investigate various conditions to generate reports (Yeti Sulastri et al., 2023).

#### 2.1.1 Observation

Observation is a technique for collecting data or information where the issues to be discussed are directly observed and then systematically recorded.

#### 2.1.2 Interview

One useful method for obtaining additional information is the interview, as the informants provide direct answers to the researcher's questions. The researcher conducts interviews with related parties such as doctors, emergency room staff, and medical records staff directly.

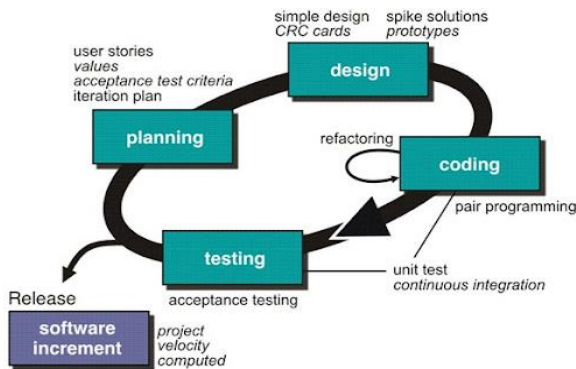
#### 2.1.3 Literature Study

A literature study is a method of collecting data for research based on literature, books, and previous studies to find information related to the issue to be addressed. To generate updates,

researchers also seek information from relevant journals.

## 2.2 System Development Method

Extreme Programming (XP) is one of the agile software development or project management approaches (Fitri Andriani, 2023) that emphasizes flexibility, communication, and responsiveness to changing needs.



Picture 1. Extreme Programming Method

In the extreme programming method, there are four stages that must be carried out, namely:

### 2.2.1 Planning

The first stage involves understanding the system requirements and outputs, developing services that will run on the system, and understanding the features and functionalities of the system being developed.

### 2.2.2 Design

The second stage involves planning system modeling activities based on the results of needs analysis and database modeling that depicts the relationship between data.

### 2.2.3 Coding

The third stage is the coding phase, where the system is translated into an interface using a programming language.

### 2.2.4 Testing

The final stage is the system testing phase, which is implemented during the coding phase to understand various errors that occur during system operation and to verify that the system meets user requirements.

## 3 Results and Discussion

This section will provide explanations and discussions about the research and system testing conducted by the researcher.

### 3.1 Result

Picture 2 depicts the output that will be reported to the Health Department through the traffic accident reporting system provided, and this output can also be used for other purposes. The output of this report is in the form of a PDF file.

Laporan Kecelakaan Lalu Lintas								
01-01-2024 s/d 31-12-2024								
No	No Rekam Medis	NIK	Nama Pasien	Jenis Kelamin	Tanggal Kecelakaan	Lokasi	Diagnosa Utama	Sebab Luar
1	1715738961225	3204004209050002	Aini Sahara	Perempuan	10-04-2024	Cibaduyut	V03.1 Pedestrian injured in collision with car, pick-up truck or van	
2	1715743101505	3204124509860002	Rozika Alfani	Perempuan	09-05-2024	Cinunuk	V24.4 Motorcycle rider injured in collision with heavy transport vehicle or bus	
3	1715740061980	3204006609850003	Harvey Nois	Laki - Laki	12-04-2024	Cicalengka	V25. Motorcycle rider injured in collision with railway train or railway vehicle	
4	1715742508068	32041265098606712	Haifa Amalia	Perempuan	02-05-2024	Kiaracondong	V23.4 Motorcycle rider injured in collision with car, pick-up truck or van	

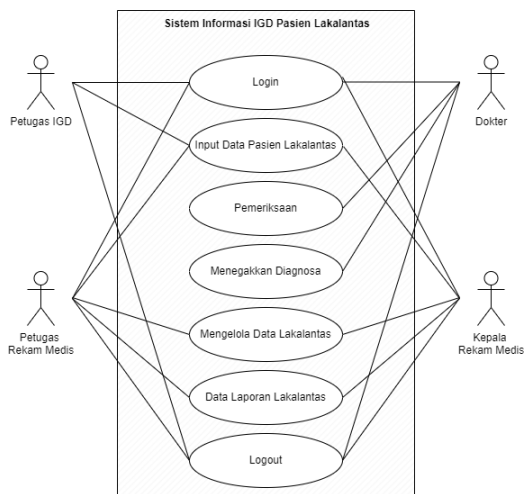
Picture 2. The printout of the traffic accident report

### 3.2 Discussion

The use case diagram can be used to simulate the behavior of the system that will be designed by showing the interaction between various actors who will use the system. The modeling consists of

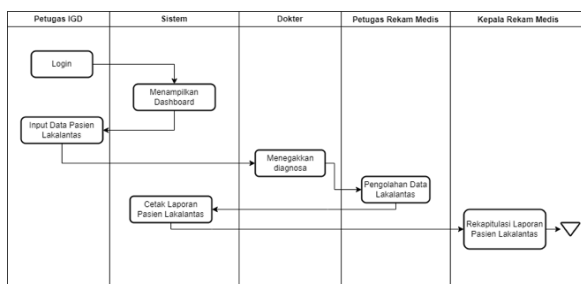
Emergency Room (ER) personnel, doctors, medical record staff, and the head of medical records as shown above. The ER personnel actor can register and input data for accident patients, the doctor actor can perform examinations and make

diagnoses, and the medical record staff and the head of medical records actor can perform all activities in the system



Picture 3. Use Case Diagram

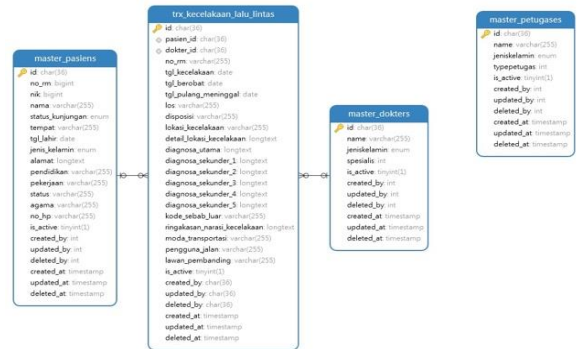
The activity diagram is a component of the use case diagram development, showing the flow of activities within the system. Before being able to perform activities in the system, each personnel must log in by entering their respective username and password so that they can perform their tasks in their respective fields. It starts with the patient arriving at the Emergency Room (ER), then the ER personnel inputs the accident patient data, followed by the doctor making a diagnosis. Subsequently, the data will be processed by the medical record staff to generate the output of the traffic accident report printout. This result will then be handed over to the head of medical records as well.



Picture 4. Activity Diagram

The Entity-Relationship Diagram (ERD) used employs logical data modeling. This model provides more detailed information about entities, attributes, and their relationships compared to the conceptual data model. The logical data model considers data types (such as string, integer, date)

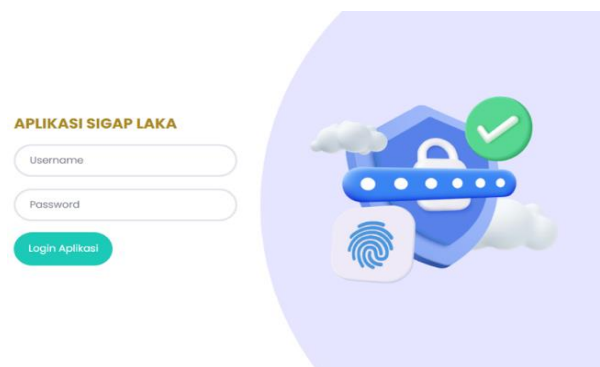
primary keys for each entity, and types of relationships (one-to-one, one-to-many, many-to-many). The logical data model is still independent but provides more detail to facilitate understanding the database structure to be built.



Picture 5. Entity Relationship Diagram

### 3.3 System Implementation

This Information System is designed using the Laravel framework with the Hypertext Preprocessor language, commonly known as PHP. The first page that appears when accessing this system is as follows:

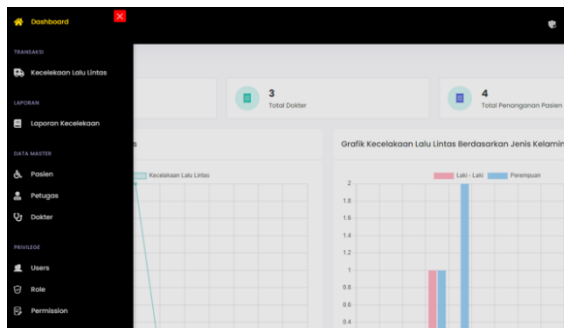


Picture 6. Form Login

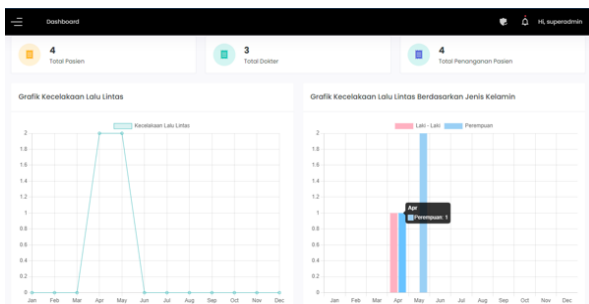
Picture 6 displays the login interface for using the traffic accident application system, and to maintain system security, only personnel with a username and password can access the application. If the username and password are incorrect, an alert will appear, and access to the system will be denied.

Within this traffic accident system, there are several components, including the dashboard, complete data of patients related to traffic accidents, accident reports, patient data, personnel data, doctor data, users, and roles. The sign-out option from the system is located in the top right corner.



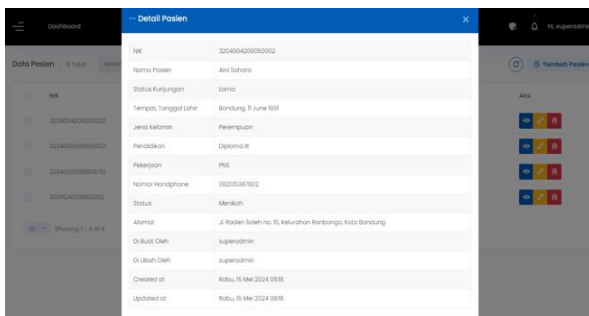


Picture 7. Menu Sidebar



Picture 8. Menu Dashboard

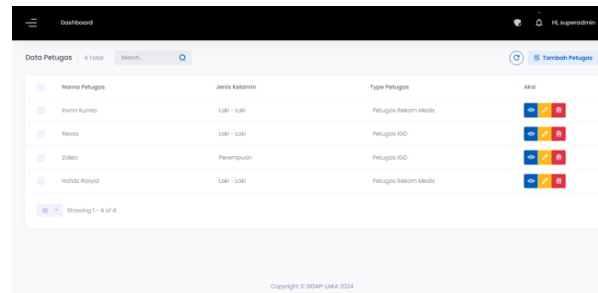
Picture 8 is the first view after logging into the system. In this dashboard menu, there is a sidebar to select options, displaying the total number of patients, total number of doctors, total patient handling, a graph showing the number of accidents each month, and a graph showing gender distribution.



Picture 9. Patient Data Menu

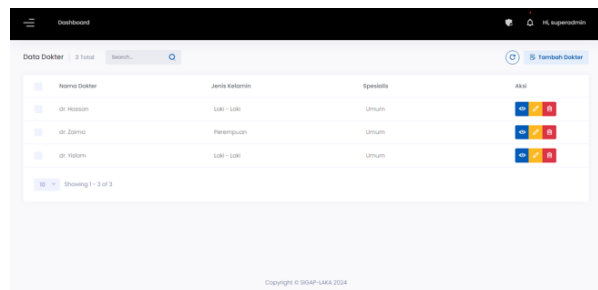
The initial view of the "Patient Data" menu only displays the ID Number (NIK), Name, and Visit Status. Picture 9 shows the detailed patient data view when selecting the "detail" button in the action column. This menu is equipped with a search column, add personnel data button and edit, delete, also detail buttons in the action column. Each detailed view will include additional information

such as creator, editor, creation date, and upload date, ensuring clear monitoring of all actions.



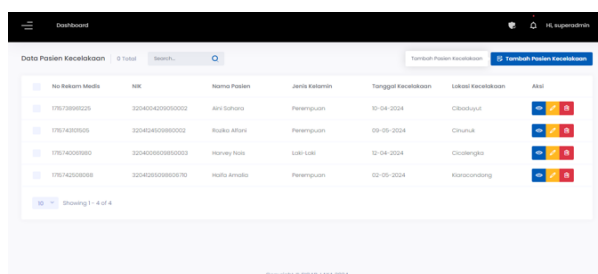
Picture 10. Personnel Data

Picture 10 depicts the personnel data view, equipped with a search column, and containing edit, delete, and detail buttons within the action column.



Picture 11. Doctors Data Menu

Picture 11 represents the medical professionals who handle patients in the Emergency Department, hence the doctor data will be identified.

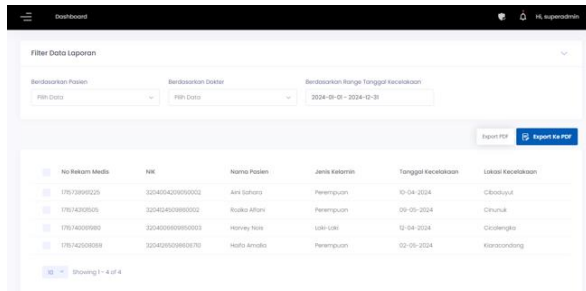


Picture 12. Traffic Accident

Picture 12 represents the initial concise view, and the complete form content regarding this menu is found in attribute Picture 5. This data will be used as the traffic accident report data.

Picture 13 displays data on accident patients that have been previously filled out. This menu includes a search column based on patient name, doctor name, and date range, which automatically

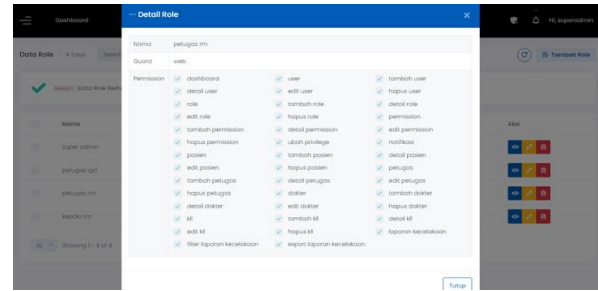
appears in the dropdown, allowing reports to be customized as needed. Additionally, there is an "export PDF" button to download the report file.



Picture 13. Traffic Accident Report Menu

Picture 14 represents the roles or access rights for each user in a system. This aims to maintain security, manage data appropriately, and

ensure that each user only has access according to their respective tasks or responsibilities



Picture 14. Role Menu

Finally, the system undergoes black-box testing to ensure it operates according to requirements and is free from errors, as outlined in the following table:

Table 1 Black Box Testing Result

No	Description of Testing	Output	Explanation
1.	Logging into the system by entering the username and password.	<ul style="list-style-type: none"> <li>If successful, display an alert "login successful" and show the dashboard</li> <li>If unsuccessful, display an alert "incorrect username or password, please try again"</li> </ul>	Already appropriate.
2.	Selecting the traffic accident menu.	Displaying patient data concisely.	Already appropriate.
3.	Selecting the 'add traffic accident patient' button.	Displaying accident patient form and data will be saved.	Already appropriate.
4.	Selecting the accident report menu.	Displaying patient data concisely.	Already appropriate.
5.	Selecting the patient data menu.	Displaying patient data succinctly.	Already appropriate.
6.	Selecting the 'add patient data' button.	Displaying patient data form and data will be saved.	Already appropriate.
7.	Selecting the staff data menu.	Displaying staff data.	Already appropriate.
8.	Selecting the 'add staff data' button.	Displaying staff data form and data will be saved.	Already appropriate.
9.	Selecting the doctor data menu.	Displaying doctor data.	Already appropriate.
10.	Selecting the 'add doctor data' button.	Displaying doctor data form and data will be saved.	Already appropriate.
11.	Selecting the user menu.	Displaying user data succinctly.	Already appropriate.
12.	Selecting the 'add user' button.	Displaying user data form and data will be saved.	Already appropriate.
13.	Selecting the role menu.	Displaying entities authorized to access the system.	Already appropriate.
14.	Selecting the 'add role' button.	Displaying a role form with selectable access rights.	Already appropriate.
15.	Selecting the 'detail button' in the action column.	Displaying data in detail.	Already appropriate.
16.	Selecting the 'edit button' in the action column.	Displaying the form to be edited.	Already appropriate.
17.	Selecting the 'delete button' in the action column.	Deleting the selected data.	Already appropriate.

#### 4 Conclusion

Based on the implementation, the designed information system successfully addresses the existing problems by providing a web-based traffic accident system that is integrated. Doctors and personnel involved can access the system separately, and the system can be accessed via web or mobile, facilitating the involved doctors and personnel, especially medical record staff, to manage data more effectively and efficiently. All data and information within the system will be stored properly in the database, and traffic accident reports can be printed out as needed.

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