

# Problematic Student Identification and Visualization in The Counseling Activites

Evaliata Br Sembiring<sup>1</sup>, Bery Febriyanto.<sup>2</sup>

<sup>1,2</sup> Informatics Engineering Department of Politeknik Negeri Batam, Batam Center, Indonesia

**Abstract**—The counseling activities are procedures carried out by academic advisers to identify problematic students, especially in their academic learning process. Students are categorized as problematic when they do not submit their KRS, have a lower GPA than the college standard, have not yet paid their due, or receive warning letters owing to their misconducts. The current system provides every students' data but academic advisers still need to identify every problematic students' data one by one. A working solution would be to present the data in a visualization, so the problematic students along with their problem category can be identified automatically. The application employs the UML approach in its planning and web-based application development tools in its implementation. Highchart is implemented in the data visualization. The resulted application boasts the student data management feature to help the problematic student identification process. This feature automatically identifies the problematic students on each term by visualizing it in a colored charts and tables.

**Index Terms**—Identification, Visualization, College students, Counseling.

## 1. Introduction

The counseling activities administered in Politeknik Negeri Batam are carried out to assure that the students can readily conduct all of their academic activities. This is one of the methods to help students to finish their education on schedule. Many problems can cause students unable to complete their current academic activities. These problems can be either academic or non-academic. These problematic students should be identified immediately—by the lecturer designated as their academic adviser—to quickly overcome the problem, ensuring the continuity of their subsequent academic activities.

The problematic students can be grouped into three categories: (1) those who have not yet paid their due—therefore unable to fill in their KRS (*Kartu Rencana Studi*, study plan application form), (2) those who have low cumulative grade point average below the college standard—thus, unable to complete their education on time, (3) those with warning letters—caused either by absence, campus regulations violation, or any other reasons.

SIA (Sistem Informasi Akademik, academic information system) has provided every students' data such as their grades and some additional notes about them in the format of forms filled by their adviser. However, this still leaves a problem since advisers still need to check every problematic students' data one by one, which is tedious and time-consuming, and usually leads to the adviser abandoning the routine altogether and only do it when a problem arise,

forcing the problematic student to see their adviser—either to fill in their KRS, to retake previous subjects they have not passed yet, to deal with their warning letters, etc. Moreover, these problems usually emerge after a deadline has passed, so these students must wait for a long time—or even take one semester break—until they are allowed to resume their study. This can be solved by early identification of the problematic students, which facilitates early solution.

To help decision-making, data can be displayed using visualization. This technique is known for its ability transform textual data into their visual or symbolic form, therefore speeding up the data's pattern, tendency, and meaning recognition process [5]. Visualization can enhance its user's cognition because of its capability to shape interactive visual data [6]. Data need to be visualized, so the information can be communicated clearly and efficiently, easily accessed, and used in a logic or analysis [2].

Some previous applications of data or information visualization on different purposes include: information exploration process enhancement using reference machine [1]; data searching [2]; financial report analysis [3]; and responsibility report presentation [4].

It is possible to implement this visualization technique in the development of the problematic student identification system. The visualization utilizes chart and color, by applying Highchart.

## 2. System Description

The developed identification system resembles the current conventional system, as shown in Figure 1.

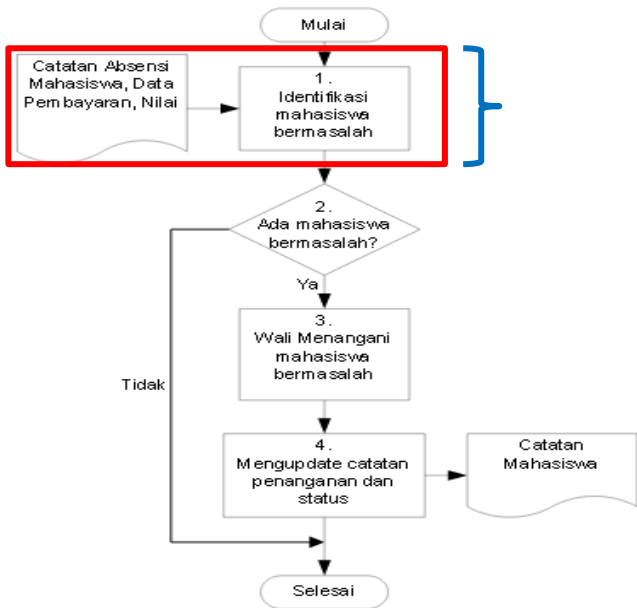


Fig. 1. Problematic Student Identification Procedure (source: <http://intranet.polibatam.ac.id/>)

There are two user categories, Administrator and PA (*Pembimbing Akademik*, academic adviser), illustrated in Figure 2. The Administrator has the authority to access and manage the data required for the problematic student identification process. These data consist of the data of all students, academic advisers, students’ problems and their categories. Academic advisers will identify problematic students based on the data visualization. They can also view the problematic student data recapitulation on each term.

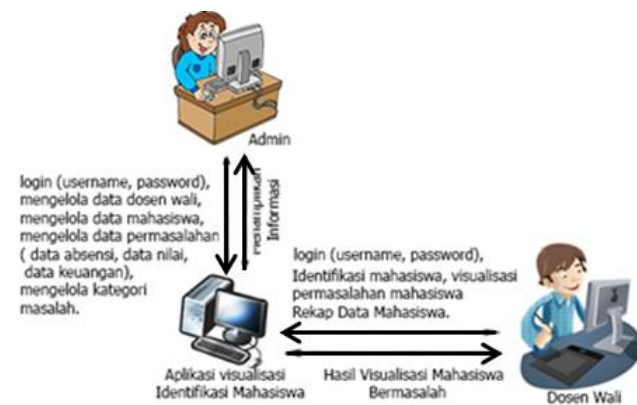


Fig. 2. Description of The Problematic Student Identification and Visualization Application

The functional requirements for the application’s development include the management of data and user’s access and the presentation of data—in colored charts—as well as the recapitulation.

These can be further decomposed into 16 functional requirements as shown in the use case diagram in Figure 3.

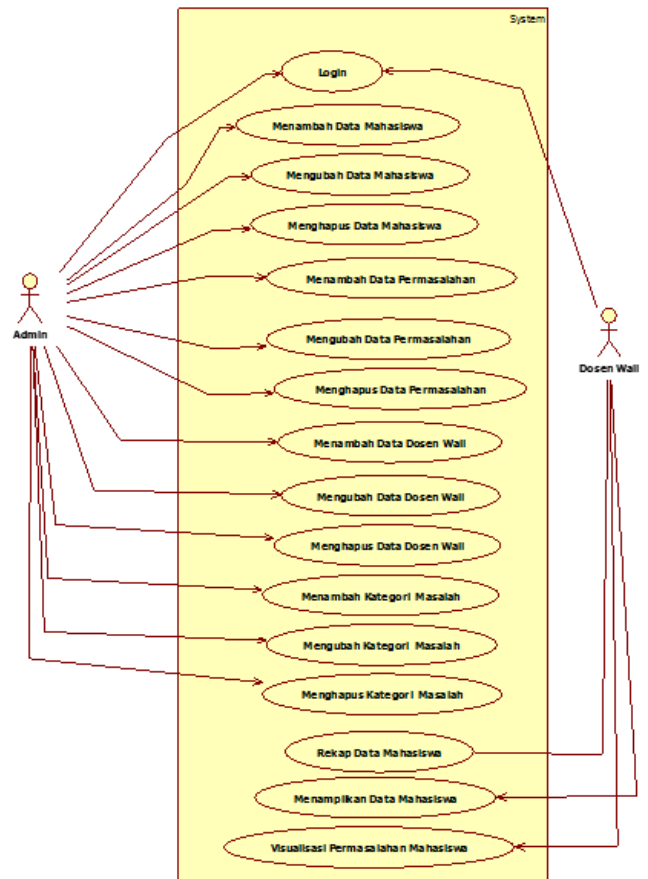


Fig. 3. The Use-Case Diagram of Problematic Student Identification and Visualization Application

Since the UML (*Unified Modeling Language*) model is employed as the method, the use case scenario (Table 1), activity diagram (Figure 4), sequence diagram (Figure 5), and class diagram can also be determined from the use case diagram above.

Table 1  
Problematic Student Visualization Scenario

Use case name	Student’s Problem Visualization
<b>Description</b>	Academic Adviser views the student’s problem visualization
<b>Actor</b>	Academic Adviser
<b>Start Condition</b>	Academic Adviser accesses the student data GUI
<b>End Condition</b>	The visualization is successfully displayed on a table and chart
<b>Scenario</b>	<ol style="list-style-type: none"> <li>1. Academic Adviser moves the cursor to a student’s name</li> <li>2. The system displays the problem category</li> <li>3. Academic Adviser chooses the problematic student(s)</li> <li>4. The system shows the visualization</li> </ol>

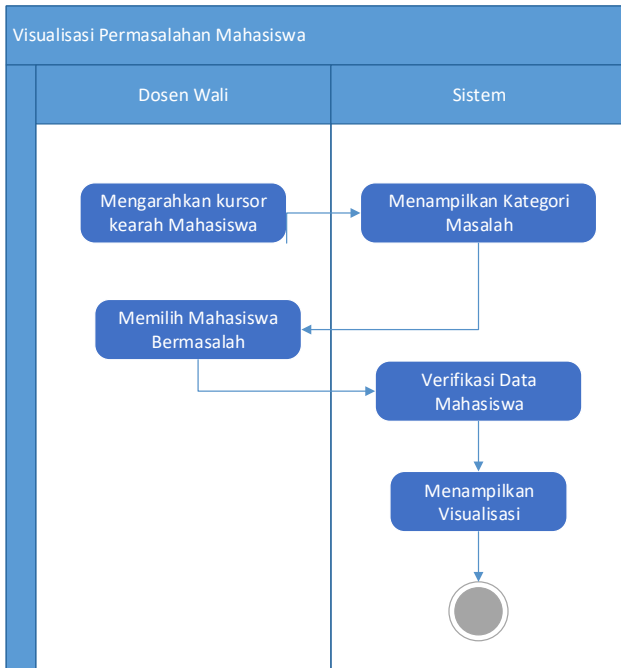


Fig. 4. The Activity Diagram of Problematic Student Identification and Visualization Application

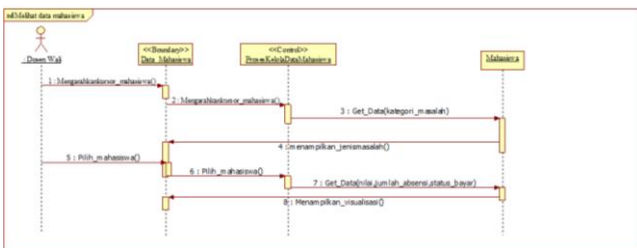


Fig.5. The Sequence Diagram of Problematic Student Identification and Visualization Application

The next step would be to design a database in form of an ERD (entity relationship diagram) and user interface (prototype).

### 3. Results and Discussions

The implementation of the resulted design made use of several programming language software, including HTML, PHP, Javascript (jQuery), and MySQL for the database. Highchartjs library was used in the implementation of the visualization. The realization of the Highchartjs implementation is shown in the source code in Figure 6.

```
<script src="js/jquery.min.js" type="text/javascript"></script>
<script src="js/highcharts.js" type="text/javascript"></script>
<script src="js/jquery-1.10.1.min.js"></script>
<script type="text/javascript">
```

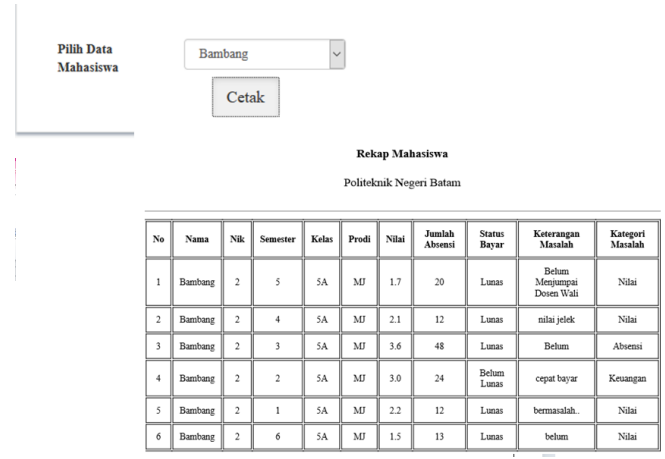
Fig.6. The Problematic Student Identification Highchartjs Implementation Source Code

The implementation of the 16 functional requirements and the database and interface design was then tested using the blackbox method (Table 2). All of them were successfully implemented and the interface also performed as planned.

1. All of the 16 planned functional requirements–consisted of the requirements below–were successfully implemented.
  - a. On the administrator’s side, there are 12 functional requirements: managing student data (adding, editing, and deleting student data), managing academic adviser data (adding, editing, and deleting academic adviser data), managing students’ problem data (adding, editing, and deleting students’ problem data), and managing problem category data (adding, editing, and deleting problem category data).
  - b. The process of inputting student data and commissioning academic adviser was carried out one by one, which was inefficient for data with a large amount. This research found that this can be rectified by integrating these data with the previous data from SIA, for example by uploading them.
  - c. On the academic adviser’s side, there are 4 functional requirements: logging in, viewing student data, viewing problematic student data visualization, and recapitulating student data.
  - d. Every student’s problem could be visualized in a chart. However, it is important to filter the display based on their academic adviser.
2. The system could manage the student data–depending on the user–according to their problem category by employing functions.
  - a. Administrator could input student data as well as commission their academic adviser.
  - b. Administrator could add the problem category, which could be color coded and displayed in a table later.
  - c. Academic adviser could filter the problematic student data based on the term and problem category.
  - d. Academic adviser could view the problematic student data recapitulation from the first until the current term.

Table 2

The Problematic Student Identification and Visualization Application Test Result

No	Function	Result	Screen Capture																																																																													
1	Access Rights Management	Administrators and academic advisers can log in by using the correct user name and password to access the data according to their user level. A warning will be displayed upon incorrect user name / password input.																																																																														
2	Data Management	Data management consists of data input, deletion, and updating. The data include the data of all students, academic advisers, student's problems, and their categories. As its feature, this application also displays a warning when data would be updated or deleted, or when invalid data are inputted																																																																														
3	Data Visualization	Data are visualized in a table and color coded according to their problem category.																																																																														
4	Data Recapitulation	The problematic student data recapitulation is displayed for each student on each term.	 <table border="1"> <caption>Rekap Mahasiswa Politeknik Negeri Batam</caption> <thead> <tr> <th>No</th> <th>Nama</th> <th>Nik</th> <th>Semester</th> <th>Kelas</th> <th>Prodi</th> <th>Nilai</th> <th>Jumlah Absensi</th> <th>Status Bayar</th> <th>Keterangan Masalah</th> <th>Kategori Masalah</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Bambang</td> <td>2</td> <td>5</td> <td>SA</td> <td>MJ</td> <td>1.7</td> <td>20</td> <td>Lunas</td> <td>Belum Menjumpai Dosen Wali</td> <td>Nilai</td> </tr> <tr> <td>2</td> <td>Bambang</td> <td>2</td> <td>4</td> <td>SA</td> <td>MJ</td> <td>2.1</td> <td>12</td> <td>Lunas</td> <td>nilai jelek</td> <td>Nilai</td> </tr> <tr> <td>3</td> <td>Bambang</td> <td>2</td> <td>3</td> <td>SA</td> <td>MJ</td> <td>3.6</td> <td>48</td> <td>Lunas</td> <td>Belum</td> <td>Absensi</td> </tr> <tr> <td>4</td> <td>Bambang</td> <td>2</td> <td>2</td> <td>SA</td> <td>MJ</td> <td>3.0</td> <td>24</td> <td>Belum Lunas</td> <td>cepat bayar</td> <td>Keuangan</td> </tr> <tr> <td>5</td> <td>Bambang</td> <td>2</td> <td>1</td> <td>SA</td> <td>MJ</td> <td>2.2</td> <td>12</td> <td>Lunas</td> <td>bermasalah.</td> <td>Nilai</td> </tr> <tr> <td>6</td> <td>Bambang</td> <td>2</td> <td>6</td> <td>SA</td> <td>MJ</td> <td>1.5</td> <td>13</td> <td>Lunas</td> <td>belum</td> <td>Nilai</td> </tr> </tbody> </table>	No	Nama	Nik	Semester	Kelas	Prodi	Nilai	Jumlah Absensi	Status Bayar	Keterangan Masalah	Kategori Masalah	1	Bambang	2	5	SA	MJ	1.7	20	Lunas	Belum Menjumpai Dosen Wali	Nilai	2	Bambang	2	4	SA	MJ	2.1	12	Lunas	nilai jelek	Nilai	3	Bambang	2	3	SA	MJ	3.6	48	Lunas	Belum	Absensi	4	Bambang	2	2	SA	MJ	3.0	24	Belum Lunas	cepat bayar	Keuangan	5	Bambang	2	1	SA	MJ	2.2	12	Lunas	bermasalah.	Nilai	6	Bambang	2	6	SA	MJ	1.5	13	Lunas	belum	Nilai
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Based on the implementation, academic advisers could identify the problematic students—grouped into three problem categories (grade, attendance, payment status). This will be visualized through color coding: yellow for grade, red for attendance, and blue for payment status. In addition, academic advisers could view problematic students for each student on each term—visualized in a chart. The technology implemented for the visualization was the Highchart library.

#### 4. Conclusion

- 1) The problematic student identification and visualization application was successfully developed by implementing the design based on 16 functional requirements. There are two user categories for the application with different access rights, depending on how they log in to the application. As the data input utilizes the input form system, an additional feature is needed to integrate data updates to SIA.
- 2) The application facilitates academic advisers to view the problematic student data—visualized as Highchart colored charts. The visualization is color coded—based on the student’s problem category—into three categories: GPA, attendance, and tuition fee payment status; grade is coded as yellow, attendance red, and the payment status blue. The problematic student data charts visualize the data for each student on each term.

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