

Code of Conduct Information System Using Simple Multi-Attribute Rating Technique (SMART) Method at SMK XYZ

Sistem Informasi Tata Tertib Menggunakan Metode Simple Multi Attribut Rating Technique (SMART) Pada SMK XYZ

Received:

21 August 2020

Accepted:

28 December 2020

Published:

1 February 2021

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Abstract—SMK XYZ is a vocational high school with approximately 2550 students with various majors and backgrounds, so there are many problems. For subscribers, each student gets a notebook on discipline and order; if a student commits a violation, it will be written by the discipline taught in the book. Furthermore, the counseling guidance teacher, together with the class teacher, conducts coaching; this activity is a manual system that has not been computerized. It hinders the performance of these teachers. From these problems, an order information system's analysis and design are carried out, which can facilitate and accelerate teachers in planning, directing, and monitoring. The SMART method's application to the discipline information system is based on the science of facts, which states a criterion with value; each weighted value can show and reflect comparisons between standards related to planning, direction, and supervision of students carried out by teachers. Subscription to violations using the discipline information system with the SMART method is carried out computerized, including determining sanctions and their actions to support the performance of teachers.

Keyword—SMK XYZ, Information System, Code of Conduct, SMART

Abstrak—SMK XYZ yaitu sekolah menengah kejuruan dengan jumlah peserta didik kurang lebih 2550 dengan berbagai jurusan dan dari latar belakang yang berbeda, sehingga banyak permasalahan. Untuk penanganannya setiap peserta didik mendapatkan buku catatan tentang kedisiplinan dan ketertiban, jika peserta didik melakukan pelanggaran maka akan ditulis oleh guru tata tertib dalam buku tersebut. Selanjutnya guru bimbingan konseling bersama guru kelas melakukan pembinaan, kegiatan itu merupakan sistem manual yang belum terkomputerisasi sehingga menghambat kinerja para guru tersebut. Dari permasalahan tersebut dilakukan analisa dan rancang bangun sistem informasi tata tertib yang dapat memudahkan dan mempercepat para guru dalam melakukan perencanaan, pengarahan, dan pengawasan. Penerapan metode SMART pada sistem informasi tata tertib didasari atas ilmu fakta yang menyatakan sebuah kriteria-kriteria yang memiliki nilai, setiap bobot nilai dapat menunjukkan dan mencerminkan perbandingan antar kriteria yang berhubungan perencanaan, pengarahan, dan pengawasan terhadap peserta didik yang dilakukan oleh para guru. Penanganan pelanggaran menggunakan sistem informasi tata tertib dengan metode SMART dilakukan secara terkomputerisasi termasuk penentuan sanksi beserta tindakannya sehingga dapat menunjang kinerja para guru.

Kata Kunci—SMK XYZ, Sistem Informasi, Tata Tertib, SMART



I. INTRODUCTION

For everyone who has a vision and mission to make human beings more qualified, schools need a rule or rules that are useful to achieve this goal. In the school environment, especially the vocational education level, students are at the starting age who are in a transitional period of specific negative behavior. Therefore, to limit every student's behavior, it is necessary to have rules and laws that need to be carried out and implemented in the school environment. Kemendikbud, in the report [1], mentioned that the discipline in the school environment is a rule or legal system that limits all student behavior in taking education at school to create an atmosphere that supports the teaching and learning process.

SMK XYZ is an educational institution with approximately 2550 students divided into nine (9) majors from various backgrounds. There are often multiple kinds of problems in terms of students' behavior, craft, and neatness. SMK XYZ still uses the manual system in handling cases of violations of student discipline, namely using all students being given discipline and order books. If students commit violations, it will be written by the discipline officer in the discipline and order book to the rules that are violated. Furthermore, the counseling teacher and the homeroom teacher carry out problem-solving or coaching for students. This activity certainly hinders the counseling guidance teacher's performance with discipline officers in handling problems, not only slowing performance; it is feared that data manipulation will occur by students and damage or loss book of discipline and order.

Calculating the point of violation will enforce efforts to enforce the discipline of XYZ Vocational School students in the future by calculating the issue of a breach based on the rules of the East Java Provincial Administration, the form of a violation, and the number of points referring to the disciplinary regulations of the East Java Provision SMK students. The total score of errors obtained by students will then be processed and will result in punitive actions that students will accept.

Seeing the problems that occur at SMK XYZ, so it needs an application to make automated decisions. It is an information system for implementing student discipline using the SMART Method, aiming to help solve existing problems and make it easier for teachers in counseling (BK) guidance with administrative officers. Orderly and homeroom teachers in planning, directing, supervising students, and accelerating the reporting of personal data and the level of delinquency of students to homeroom teachers and guardians by counseling guidance teachers, and minimizing the level of data loss on student violations and data manipulation. The method of decision making that can be applied to develop student discipline systems is the SMART method.

The selection of the SMART method in the discipline information system is based on the suitability of the science of facts, which states a criterion that has value, where each weighted

value can show and reflect comparisons between standards related to planning, direction, and supervision of students carried out by teachers.

Computerized carries out automation for subscribing to violations using the discipline information system with the SMART method. It includes the determination of sanctions and their actions so that it is expected to support the performance of teachers in planning, directing, and supervising students in implementing school discipline XYZ SMK[2].

II. RESEARCH METHOD

A. Basic Theory

1. Education Office Policies

The basic guidelines for the rules that have been made by the East Java Provincial Government Education Office [3] entitled "Code of Conduct for Vocational High School Students (SMK)."

Code of conduct refers to a set of rules. School management applies it in the school environment both in the school environment and in the community. School rules and regulations are rules and guidelines intended for school members, students, teachers, staff, and administrative regulations that must be implemented to create a clean, comfortable, safe, and orderly school environment. Every school member is obliged to obey the school rules because discipline is one of the main things but not only as a complement to the school. [4].

Creating regulations in the school environment have the primary purpose and objective: school members, both school students, and teachers and staff know what their respective duties are both in terms of rights and obligations, and how to do this to create school activities. Implementing the rules is to create a safe, clean, and comfortable environment without fear for all residents or school residents. The school environment regulations are obliged to have penalties for everyone who violates these rules [5].

Violation is a flawed human attitude, whether done intentionally or unintentionally. Breach of school discipline is an act of wrongdoing in the school environment, whether committed by students, teachers, or other staff. Some examples include cheating, smoking in the school environment, bullying fellow friends, playing on their cellphones when the teacher explains, dressing not by school rules, being immoral, and so on. [6].

2. Decision Support System

Decision Support System, GDSS Group Decision Support System, a computer application that can help an individual or group make decisions that have joined the same task or goal. However, not only that, but it also has a useful tool to be able to connect someone who is in the group [7][8].

According to [9], the Decision Support System is an intellectual partner who comes from SDA who can help make decisions with computers to make it easier for decision-makers to deal with a problem. This lymphatically can be defined or assumed to be a computer system used to solve problems for users.

GDSS has an important concept to support each stage in determining a decision. It starts with identifying problems, selecting data, and evaluating them to determine a decision. In a decision support system, the main objective is to help each party determine a well-structured and semi-structured decision. [10][11].

3. SMART Method

This method is a method that has been published by Edward (1997). According to science's inclusion, this method states a criterion with a value where each weighted value can show and reflect that the measure is significant if other criteria make a comparison. The researchers carry out the weight assessment to provide a value for each alternative to obtain maximum results [12].

According to [13] stated, the SMART Method is more often used because of its simplicity in responding to every desire to make decisions and analyze and respond.

According to A.S Honggowibowo in the Journal [14], the SMART method has several advantages over other methods. The SMART method calculation also has a more straightforward analysis because it can make it easier to make decisions and analyze data responses that can be accepted by decision-making. According to [15] stated that the form used in the SMART method is described in the following formula :

$$SMART = \sum_{j=1}^k W_j * U_i \quad (1)$$

In which:

- a. W_j is the weighted value of the j th criterion of the k criteria.
- b. W_{ij} is the alternative utility value i on the j th criterion.
- c. Decision selection is to identify which of the n alternatives has the most excellent function value.
- d. The value of this function can also be used to rank the alternative n .

Calculating the normalized weight value is shown in the equation below:

$$NWJ = \frac{W_j}{\sum_n^k = 1 W_n} \quad (2)$$

In which:

- a. NW is the normalization of the weight of the j criterion
- b. W_j is the weight of the j th criteria
- c. k is the number of criteria

d. When is the weight of the n-th criteria

Calculating the utility value is shown in the following equation:

$$W_{ij} = f(V_{ij}) \quad (3)$$

In which :

- a. W_{ij} is the utility value for the jth criterion for alternative i
- b. V_{ij} is the value of the jth criteria for alternative i
- c. $f(V_{ij})$ is jth criteria function for alternative i
- d. According to Kustiyaningsih et al. (2013) in the Journal [16] implied that there are several steps to the SMART method, which include the following:
 - 1) The first step is to determine the number of criteria that will be used for the research.
 - 2) The second step is that the system by default will provide a scale range between 0-100 based on the priority that has been entered or input then normalized using the formula in the equation (2)
 - 3) The third step is to provide a criterion value for each alternative.
 - 4) The fourth step is to calculate the utility value for each of the criteria. By using the formula in the equation (3)
 - 5) The fifth step is calculating the final value of each alternative. By using the formula in the equation (1)

B. Research Methodology

The stages of software research and development start from planning, analysis, design, implementation, testing, and maintenance, which are carried out repeatedly until the research and development needs of the software are met, as shown in Figure 1.

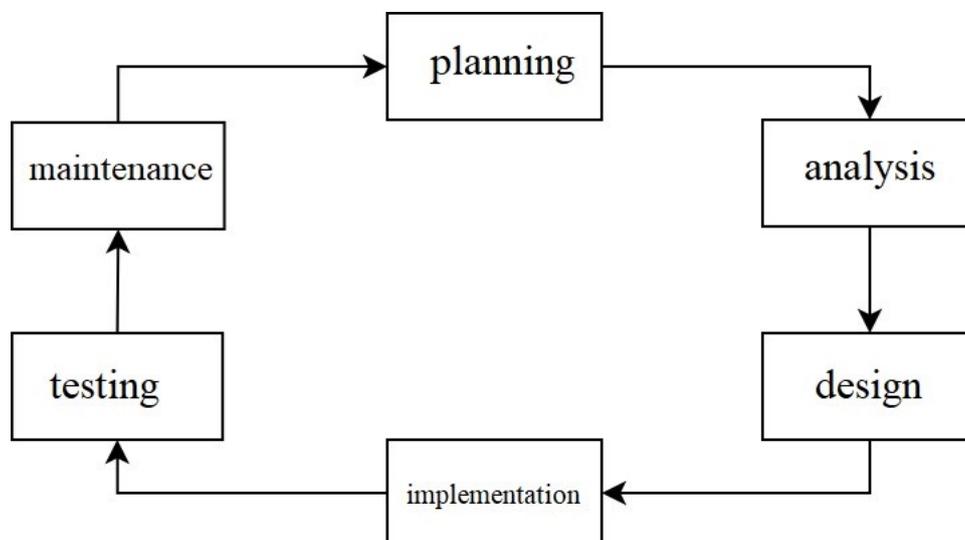


Figure 1. STAGES OF RESEARCH ACTIVITIES

1. Planning (*Perencanaan*)

This stage includes:

a. Literature review

Literature review refers to studying journals, books, articles, and the internet, which are related to the discussion of research.

b. Interview

Researchers communicate and ask questions in stages with counseling guidance teachers (BK), discipline officers, and homeroom teachers.

c. Document Analysis

The analysis document aims to determine the needs by studying the counseling guidance teacher (BK), the XYZ Vocational School rules such as primary education data, violation data forms, and the required files later.

2. System analysis

a. Old System Analysis

Analyzing the system that runs at XYZ Vocational High School, namely handling violations of discipline, the flow of addressing violations of rules as shown in Figure 2, wherein the old system the flow of subscriptions for student violations has been well structured, the weakness is that it is still run manually, thus slowing down the performance of the teachers in planning, subscribing and also supervising students.

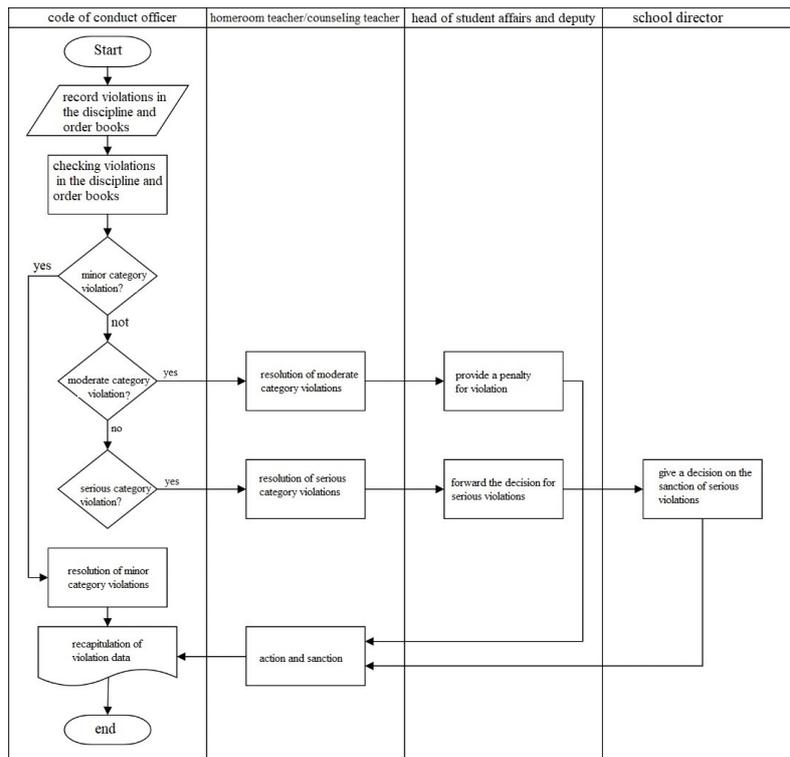


Figure 2. FLOWCHART EXISTING SYSTEMS

b. New System Analysis

Applying the school Code of Conduct Data

The school Code of Conduct data refers to the Education Office, 2018, the Java provincial government, which includes data on violation criteria, forms of violations, and actions, which are listed in the following table :

Table 1. CRITERIA DATA

No	Criteria
1.	Attitude Behavior
2.	Diligence
3.	Neatness

Violation Forms data that contains kinds of violations of each criterion in the criteria data table.

Table 2. FORM OF VIOLATION OF BEHAVIORAL CRITERIA

NO	TYPES OF VIOLATION	PENALTY SCORE
1.	Bringing no book on schedule.	10
2.	Making noise in class or at school.	10
3.	Scribbling or defacing walls, doors, tables, chairs, school fences.	10
4.	Bringing or playing cards and dominoes at school.	10
5.	Parking the bike/motorbike out of place.	10
6.	Playing ball in the corridors and the classroom.	10
7.	Cheating	10
8.	Protecting wrong friends.	15
9.	Turning on the cellphone when KBM.	20
10.	Dating at school.	20
11.	Behaving dirty or immoral both inside and outside school	20
12.	Celebrating birthdays excessively	20
13.	Misusing tuition fees.	25
14.	Carrying or setting firecrackers.	30
15.	Making a fake excuse letter	40
16.	Jumping through the school windows and fences.	40
17.	Damaging school facilities and infrastructure.	40
18.	Acting disrespectful / harassing the Principal, teachers, and school employees.	50
19.	Threatening or bullying classmates or schoolmates	75
20.	Threaten or intimidating the Principal, teachers, and employees.	100
21.	Carrying or smoking while still wearing school uniform	100
22.	Misusing social media to the detriment of other parties related to the school	100
23.	Gambling at school.	150
24.	Bringing sharp weapons, firearms, etc., in school.	150
25.	Being involved directly or indirectly in fights/brawls at school, outside of school, or between schools.	150
26.	Joining forbidden sects / associations / gangs / LGBT communities and radicalism	150
27.	Carrying, using, or distributing alcohol and drugs	250
28.	Bringing or making porn VCDs, porn books, pornographic magazines, or anything that has pornographic and pornographic characteristics.	200
29.	Stealing at school and outside of school.	200
30.	Falsifying school stamps, school circulars, or signatures of principals, teachers, and school employees.	250
31.	Being involved in criminal acts, defaming the right name of the school.	250
32.	Proven to be pregnant or impregnate	250
33.	Proven to be married	250

Table 3. DATA FOR VIOLATION OF DILIGENCE CRITERIA

NO	TYPES OF VIOLATION	PENALTY SCORE
1.	Coming too late.	10
2.	Skipping class without permission.	10
3.	Leaving class without permission.	10
4.	Visiting the cafeteria during class hours.	10
5.	Not following and implementing 7K pickets.	10
6.	Sleeping during the class	10
7.	Not bringing books related to lessons	10
8.	Going home prematurely without permission from school	20
9.	Not attending school without information.	20
10.	Not attending the weekly ceremony	20
11.	Not participating in school activities	20
12.	Not participating in extracurricular activities	20

Tabel 4. DATA FORM OF VIOLATION OF NEATNESS CRITERIA

NO	TYPES OF VIOLATION	PENALTY SCORE
1.	Not wearing uniform according to the provisions.	10
2.	Not tidying up uniform	10
3.	Folding sleeves, and unbuttoning shirt	10
4.	Scribbling uniform.	10
5.	Unraveling long hair (female students).	10
6.	Ripping pants or skirts	10
7.	Not wearing socks.	10
8.	Wearing socks does not match the provisions	10
9.	Wearing a belt.	10
10.	Wearing a belt not following the provisions (black)	10
11.	Incompletion attribute uniform.	10
12.	Not wearing black shoes (other than sports).	10

Action and Sanctions data can be adjusted.

Table 5. ACTION AND SANCTION DATA

No	Point Range	School Action	Types of Penalty
1.	10-20	Warning I, there is guidance and coaching from the homeroom teacher	Not allowed to attend class hours until the time of changing lessons
2.	21-40	Warning II, there is guidance and coaching homeroom guidance with counseling teacher	Make a statement known by the homeroom teacher and parents/guardians
3.	41-60	Summon I; there is a call for a parent/guardian by homeroom/parties of counseling teacher	Haircut for male students and three days suspension
4.	61-70	Summon II; there is a call for parents/guardians by making a letter of agreement known by the counseling teacher	SP 2 is suspended for five days
5.	71-90	Summon III for parents/guardians by making a letter of agreement known to the Principal	Recommendations for No grade
6.	90-above	returned to the parent/guardian	returned to the parent/guardian

3. DFD and ERD design

Figure 3 shows a data Flow Diagram (DFD) level 0 or context diagram of a discipline information system. This system consists of three external entities: homeroom teacher, counseling teacher, discipline officer, and admin.

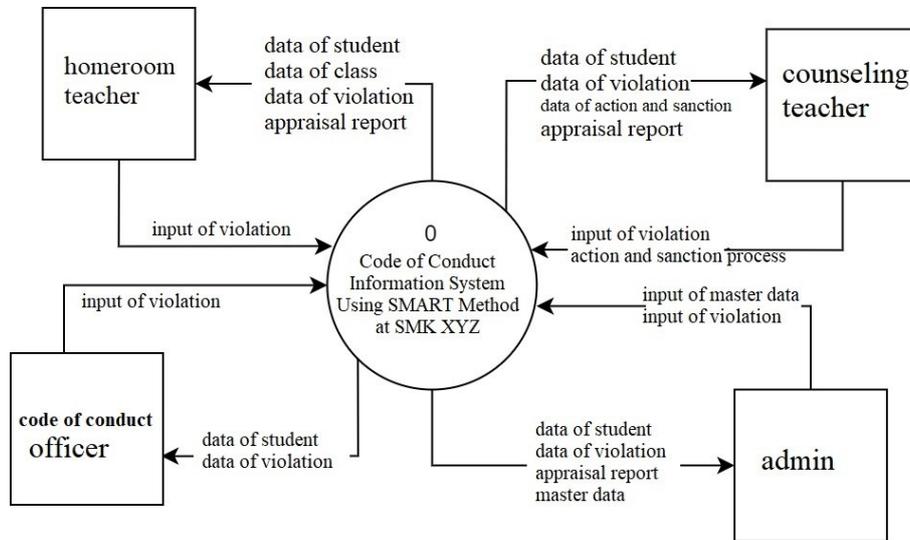


Figure 3. DFD LEVEL 0 OF DISCIPLINE INFORMATION SYSTEM

Entity Relationship Diagram (ERD) is a form of table arrangement in a database, including the relationship between one table and another [17]. Entity Relationship Diagram (ERD) is a model that presents system data with the number of entities and relationships. Entities are particular objects in a system. A relationship is a corresponding object from one thing to another [18][19]. For the ERD, Figure 4 below illustrates the code of conduct information system,

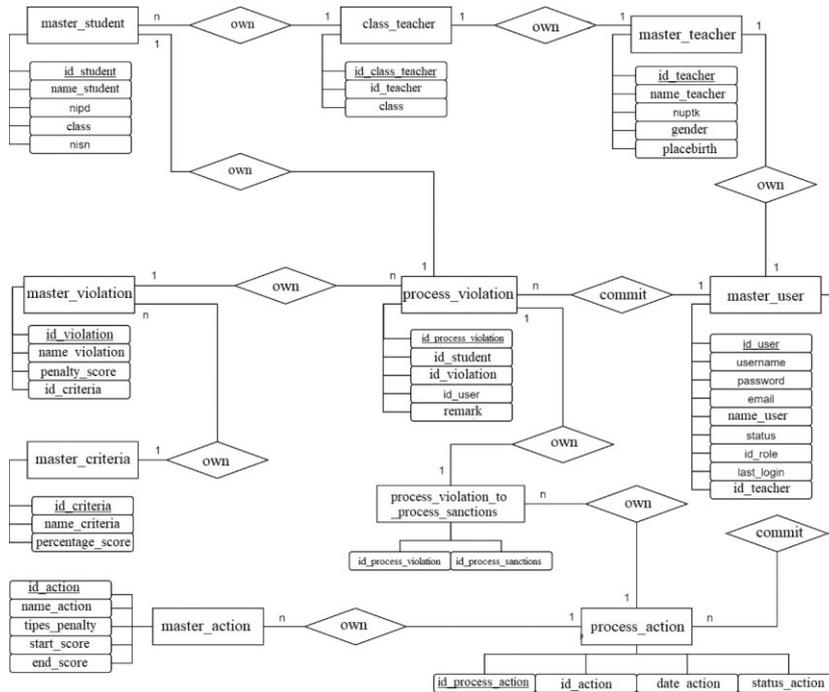


Figure 4. ERD INFORMATION SYSTEM OF CODE OF CONDUCT

4. Graphical User Interface (GUI)

The initial display design to enter the code of conduct information system must log in by entering the correct username and password for each teacher, as shown in Figure 5.



Figure 5. LOGIN MENU CONCEPT

The design of the main page or dashboard of an order information system, as shown in Figure 6, can be accessed if the user successfully logs in by using the username and password according to each user's access rights.

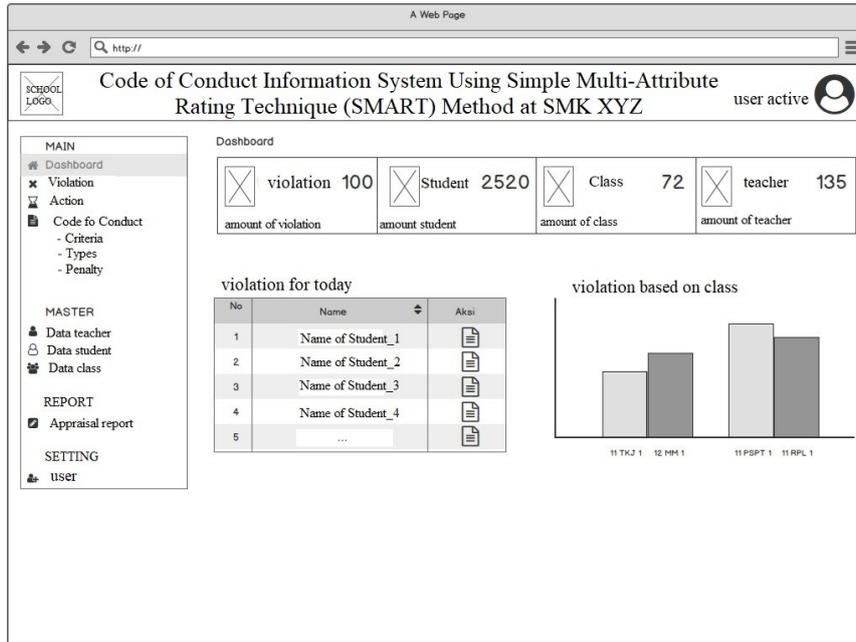


Figure 6. DASHBOARD MENU CONCEPT

Figure 7 below shows the page's design for the management and handling of violations committed by students.

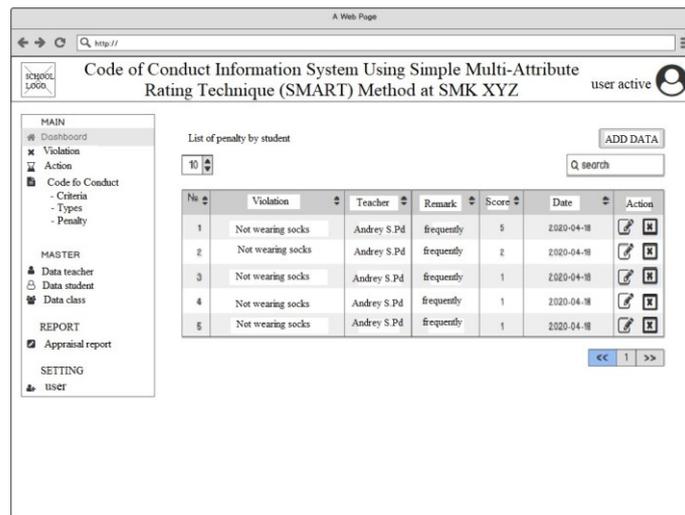


Figure 7. MENU CONCEPT OF VIOLATION

III. RESULT AND DISCUSSION

A. SMART algorithm design

Figure 8 below describes the flow of the discipline implementation process using the SMART method at SMK XYZ.

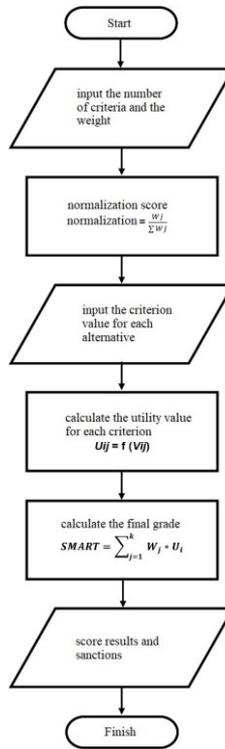


Figure 8. SMART PROCESS

1. The first stage is to determine the criteria for SMK XYZ based on the Code of Conduct for Education Service Policies, namely:

- a. Behavior Attitude Criteria
- b. Diligence Criteria
- c. Neatness Criteria

Weighting the criteria determines in the following table.

Table 6. WEIGHTING CRITERIA

No	Criteria	Bobot
1	Attitude Behavior	80
2	Diligence	10
3	Neatness	10
Total		100

2. Then perform normalization calculations using equations (2) :

Table 7. RESULTS OF NORMALIZATION CALCULATIONS

No	Criteria	Weight	Weight (W _j)
1	Attitude Behavior	80	0,8
2	Diligence	10	0,1
3	Neatness	10	0,1
	Total	100	1

- Determine the value of the criteria for each alternative, which is the utility value. At this stage, the data used is based on the 2018 Education Office Code of Conduct Policy.
- Looking for the Final Result of the SMART Calculation according to [15], at this stage, the data used is the equation (1).
- Determine the punishment of students who violate the rules. The imposition of sanctions is based on the final result of the SMART method's Calculation, which refers to the Education Office Code of Conduct [3].

Next, a simulation of the SMART method will be carried out. The following is the Calculation of the sanction assessment using the SMART way:

Table 8. EXAMPLE OF SANCTION ASSESSMENT

Name	Criteria	Form of Violation	Score
Student One	Attitude Behavior	03	10
		16	40
	Diligence	01	10
		04	10
Student Two	Attitude Behavior	06	10
		01	10
	Diligence	03	10
		07	10
Student Three	Attitude Behavior	27	250

Looking for the Final Result of the SMART Calculation using equation (1) as follows:

Table 9. FINAL SCORE CALCULATION RESULT

Name	Criteria	Form of Violation	Score (Utility value)	Weight (W _j)	The final result Utility*W _j	Total Final Score
Student One	Attitude Behavior	03	10	0,8	8	42
		16	40	0,8	32	
	Diligence	01	10	0,1	1	
		04	10	0,1	1	
Student Two	Attitude	06	10	0,8	8	11

Name	Criteria	Form of Violation	Score (Utility value)	Weight (W _j)	The final result Utility*W _j	Total Final Score
	Behavior					
	Diligence	01	10	0,1	1	
		03	10	0,1	1	
	Neatness	07	10	0,1	1	
Student Three	Attitude Behavior	27	250	0,8	200	200

After obtaining the final results from the violation test data, then the determination of sanctions. The imposition of sanctions is based on the outcome of the Calculation of the SMART method.

Table 10. RESULTS OF SANCTIONS AND ACTIONS

Name	Final Score	School Actions	Types of Sanctions
Student One	42	The homeroom teacher held the first anniversary	Haircut for male students and three days suspension
Student Two	11	Call I for parents/guardians by the homeroom teacher / BK party	Not allowed to attend class hours until the time of changing lessons
Student Three	200	returned to the parent/guardian	returned to the parent/guardian

The following figure shows the workflow design of the student discipline information system:

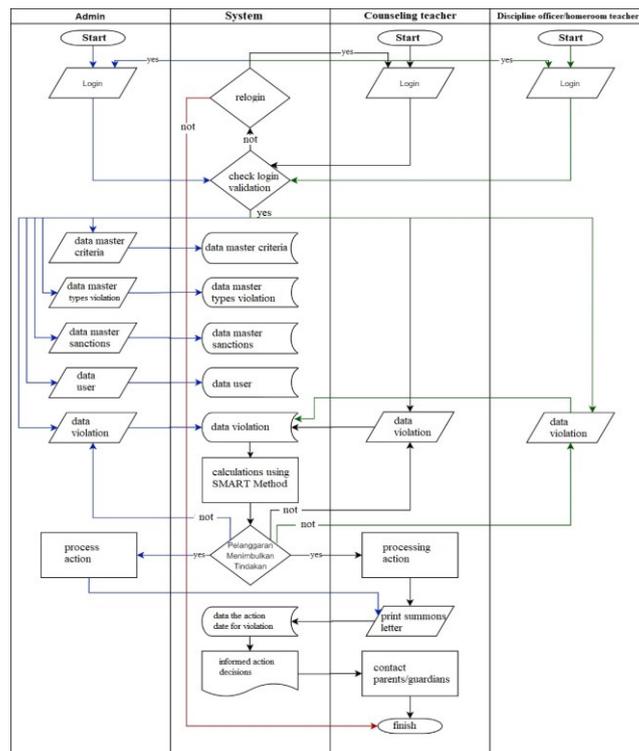


Figure 9. WORKFLOW SYSTEM

B. Implementation of the SMART Method

Figure 10 illustrates how to implement the SMART method's Calculation in the implementation of discipline at SMK XYZ

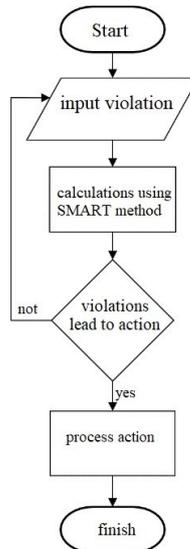


Figure 10. PROCESS OF SMART METHOD

1. Addition of violation criteria data along with the percentage of the weight if the total percentage value is more than 100, then the application will reject it by displaying an error message "The percentage exceeds the limit."

```

1. $persentase = Kriteria::get()->sum('presentase_bobot');
2. $perse1 = $persentase + $request->post('presentase_bobot');
3. if($perse1 > 100){
4.     return redirect()->route('kriteria')->with(['error'=>'Persentase melebihi batasan']);
5. }
6. Kriteria::insert([
7.     'nama_kriteria'=>$request->post('nama_kriteria'),
8.     'presentase_bobot'=>$request->post('presentase_bobot'),
9.     'created_at'=>myTimestamp(),
10.    'created_by'=>Auth::user()->id
11. ]);
    
```

Figure 11. ADDITIONAL CRITERIA DATA

2. Data addition, the form of violations accompanied is according to the criteria that have been made by a score or utility value with grouping.

```

1. public function store(Request $request)
2. {
3.     $validate = $request->validate([
4.         'nama_pelanggaran' => 'required|max:255',
5.         'skor_sanksi' => 'required|numeric',
6.         'id_kriteria' => 'required|numeric'
7.     ]);
8.     Bentuk::create($validate);
9.     return redirect()->route('bentuk')->with('success', 'Berhasil menambahkan kriteria');
10. }
    
```

Figure 12. ADDITIONAL FORM OF VIOLATION DATA

3. The calculation process uses the SMART method.
 - a. Obtain data on violations committed by students.
 - b. Get the percentage weighted criteria based on the requirements contained in the violation data.
 - c. Perform the following calculations:
 - 1) The rate weighted criteria divided by 100 equals the weight value.
 - 2) The weight value times the score of the violation

```
1. $totalScore = 0;
2. $pelanggaran =
Pelanggaran::select('mpel.skor_sanksi','bpel.presentase_bobot')-
->where('id_siswa',$row->id_siswa)
3. ->join(DB::raw('master_pelanggaran mpel'), 'mpel.id', '=',
'transaksi_pelanggaran.id_pelanggaran')
4. ->join(DB::raw('bobot_pelanggaran bpel'), 'bpel.id', '=',
'mpel.id_kriteria')
5. ->whereNull(DB::raw('transaksi_pelanggaran.deleted_at'))
6. ->get();
7. foreach($pelanggaran as $rowPelanggaran){
8.     $scoreSub = ($rowPelanggaran->presentase_bobot / 100) *
$rowPelanggaran->skor_sanksi;
9.     $totalScore = $totalScore + $scoreSub;
10. }
11. $row->total_score = $totalScore;
```

Figure 13. PROCESS OF CALCULATION OF SMART METHOD

C. Implementation of Design Results

The initial display implementation for the discipline information system for the login menu with the SMART method at SMK XYZ is shown in Figure 14, where teachers must enter the system using the correct username and password.

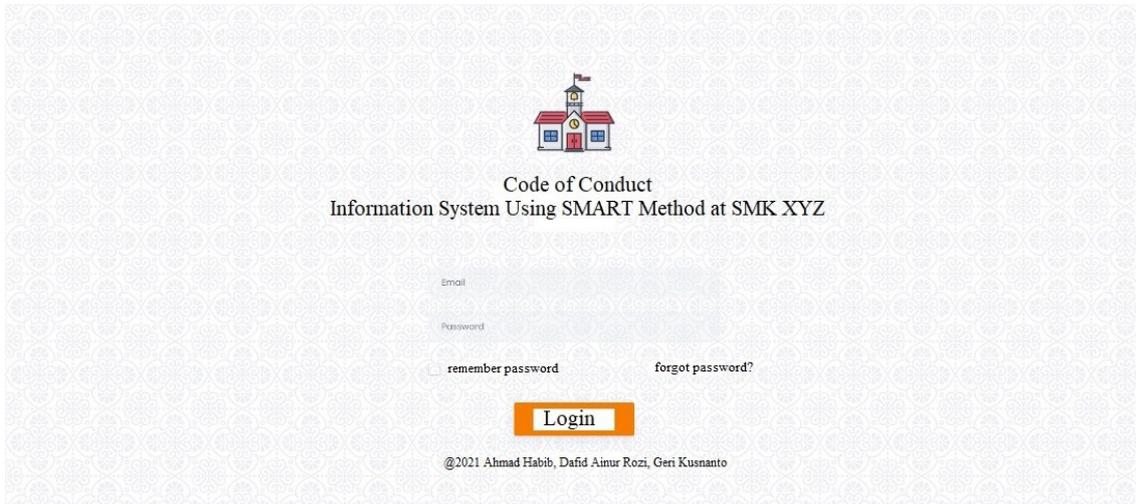


Figure 14. THE FORM OF LOGIN MENU

Figure 15 shows the results of implementing the main page or dashboard of the discipline system at SMK XYZ using the SMART method.

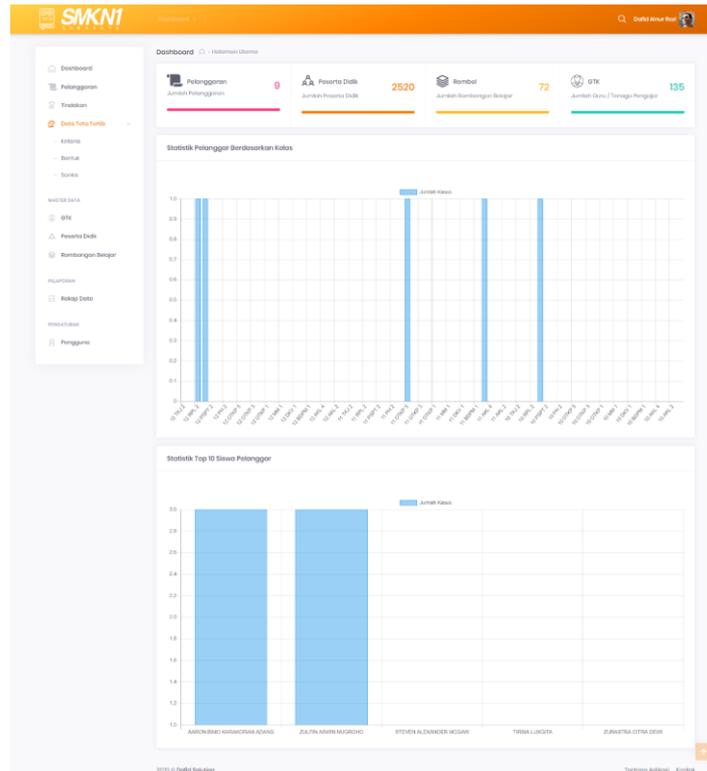


Figure 15. SHAPE MENU DASHBOARD

Meanwhile, Figure 16 illustrates the implementation of the management page and handling of violations committed by students using the SMART method.

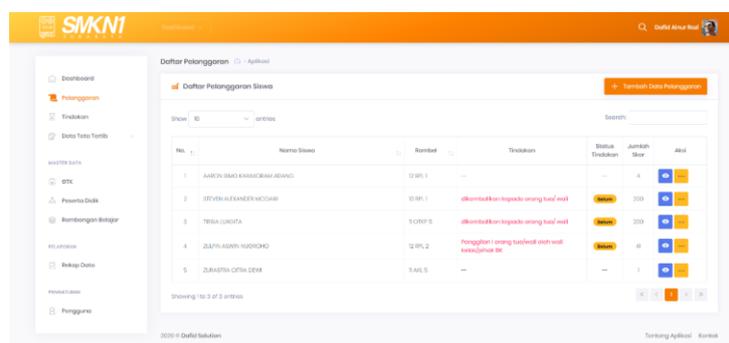


Figure 16. FORM OF VIOLATION MENU

D. System Testing

Testing on the Information System for the Application of Student Rules Using the Black Box Method.

Table 11. LOGIN MODULE TEST ITEMS

Description	Login test	Login test	Login test
Preconditions	App main menu screen display	App main menu screen display	App main menu screen display
Testing Procedure	1. Enter your Username and Password	2. Enter the Username and Password	3. Enter the Username and Password
Input	Username and Password data correct	Wrong username or password	The message "Please fill in this field" appears
Expected Output	Data saved successfully, no error instructions	The message "Your username or password is wrong" appears	The message "Please fill in this field" appears
Outcome Evaluation Criteria	The screen displayed is as expected	The screen shown is as expected	The screen displayed is as expected
Hasil obtained	Data saved successfully, no error instructions	The message "Your username or password is wrong" appears	The message "Please fill in this field" appears
Conclusion	Be accepted	Be accepted	Be accepted

IV. CONCLUSION

With the discipline information system, students can make it easier to recap data on violations in schools compared to conventional methods used previously. Data on the discipline of education service policies used as a guideline in designing student discipline information systems is appropriate and produces output. Students and teachers can automatically calculate the score of violations using the SMART method in the student discipline application. Students can immediately know the determination of sanctions and actions according to predetermined data. To be connected with other information systems, student discipline applications need to be developed with other methods. Further research can develop this application on a mobile basis, such as Android or IOS.

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