Application Monitoring and Evaluation using SMART (Simple Multi attribute Rating Technique) Method

Nurhayati Fitriani 1*, Ika Oktavia Suzanti 2, Achmad Jauhari 3, Ach. Khozaimi 4

1,2,3, 4 Informatic Engineering Department, University Of Trunojoyo Madura, Jl. Raya Telang, Kecamatan Kamal, Bangkalan, Madura 69162 Indonesia.
Email: 150411100045@student.trunojoyo.ac.id 1, iosuzanti@trunojoyo.ac.id  2, ahmadjauhari@trunojoyo.ac.id 3, ach.khozaimi@trunojoyo.ac.id 4

Abstract. Monitoring is a systematic process of collecting data from that data to be evaluated to find out the quality of the system, along with the times the monitoring and evaluation process is done using technology that can be web-based or android mobile, so that the process of monitoring & evaluation is easier and more efficient. In addition to getting an accurate assessment, it is necessary to apply a method that can process data into an objective assessment, the SMART method is a simple multi-attribute method that can be used in processing data into an accurate assessment. Trunojoyo Madura University Dormitory has many activities aimed at realizing the education of the dormitory character, the activity data is monitored and evaluated to provide an assessment of the activeness of students living in the dormitory. However, the process of monitoring & evaluation of the dormitory is still carried out manually, so an application for monitoring & evaluating the activities of the hostel which uses the SMART method is needed to facilitate the monitoring process and obtain an objective assessment result.

1. Introduction
Monitoring is a systematic data collection activity regarding ongoing activities, generally carried out to inform the development and achievement of an activity [1]. The results of the data obtained through the monitoring process will be evaluated. Evaluation is an objective systematic assessment of an ongoing project, program or policy [2], an evaluation is carried out to obtain an assessment that will determine the quality characteristics of the system or product [3]. Monitoring and Evaluation aims to get efficiency, evivitas and know the impact of the system, program or activity carried out [4]. Sustainability evaluation places more emphasis on evaluating results and impacts rather than achieving results [5].

Nowadays, technological developments are increasingly rapid, so the application of technology is considered necessary to support the effectiveness and efficiency of the monitoring and evaluation process that can be implemented in the form of Web [6] or mobile [7]. At the same time, monitoring and evaluation are used to track data in real time and dynamically, and can also carry out aggregation, processing, and data analysis as needed, to obtain accurate evaluation results it is necessary to apply methods to process data into results accurate assessment [8][9], one of the methods that can be used is the SMART (Simple Multi Attribute Rating Technique) method which is the simplest method by assigning weight values to each criterion [10][11][12], SMART method is a method of multi-attribute decision making. This multi-attribute decision making technique is used to support decision makers in choosing several alternatives and will not affect other attributes if there are reduction or addition of attributes [13][14][15][16].

Trunojoyo University Dormitory has many activities aimed at realizing the character education of students who live in the dormitory, to optimize character education at the hostel it is necessary to monitor which consists of routine absences, non-routine absences, violations and records. However, the monitoring process in the dormitory is still done manually so that data can be manipulated and affect the results of the evaluation in addition to the unavoidable accumulation of paper. Therefore web-based and mobile applications are needed to facilitate the process of monitoring and evaluating boarding activities so that data processing becomes more quality [4][17] by applying the SMART method to calculate and obtain objective assessments.

2. Methods
SMART method is the simplest decision support method [18] [19] which has several parameters for determining decisions. This parameter has varying values and weights [13]. The weight of the SMART method uses a scale between 0 -1 so that it simplifies the calculation and comparison of the value of each alternative results from the calculation of the SMART method to be the decision maker to be taken [20]. The formula applied in the SMART method is:

\[ u(a_i) = \sum_{j=1}^{m} w_j u_j(a_i) \quad i=1,2,\ldots,m \]  

Explanation:
- \( w_j \) = criteria weighting value to-j
- \( u_j(a_i) \) = utility criterion value to-i

The techniques in the SMART method are:
1. Determine the number of criteria
2. Determine the percentage of criteria weights. (system defaults to a scale of 0-1) based on the priorities that have been inputted and then normalized like equation (2).

\[ \text{Normalization} = \frac{w_j}{\sum w_j} \]  

Explanation:
- \( w_j \) = weighting criteria value to-j
- \( \sum w_j \) = weight total of all criteria
3. Provide criteria values for each alternative.
4. Calculate the utility value for each sub-criteria using equation (3).

\[ u_j(a_i) = \left( \frac{C_{\text{max}} - c_{\text{min}}}{C_{\text{max}} - c_{\text{min}}} \right) \% \]  

Explanation:
- \( u_j(a_i) \) = utility criteria value to-I for to-i
- \( C_{\text{max}} \) = maximum criteria value
- \( c_{\text{max}} \) = maximum criteria value
- \( c_{\text{min}} \) = criteria value to-i

3. Result
3.1. Analysis Calculation of the SMART Method
Data to be processed is the data of students who live in a dormitory, to determine the performance of the assessment of the residents of Trunojoyo University Madura from the Monitoring & Evaluation Process of Dormitory activities, through 4 criteria as in Table 1 namely notes, violations, routine absences and non-routine absences.

| NO. | ALTERNATIF       | NIM         | ROOM (K1) | NOTES (K2)                  | VIOLATIONS (K3) | ROUTININE ABSENCES (K4) | NON-ROUTINE ABSENCE (K4) |
|-----|------------------|-------------|-----------|----------------------------|-----------------|--------------------------|--------------------------|
| 1   | AINUR ROSIDAH    | 170815100078| 201       | Late night curfew 2 times  |                  |                          |                          |
| 2   | RINI AZLINDA     | 170411100031| 201       | Permission is rare, hard to get up to dawn | 13              |                          |                          |
| 3   | SHELLY FEBRIANTI | 170111100072| 201       | It's hard to collect memorized deposits, never go home without permission | 14              |                          |                          |
| 4   | UMU KULSUM       | 170651100030| 201       | Be tough on friends, late 1 night curfew, tabarruj category, tight clothes, never leave permission home | 7               | Late night curfew 1 time, |                          |
| 5   | FAKHRUDIANA ZAHRROH | 170611100001| 202       | Sleep often in a boarding house | 30              |                          |                          |
Criteria data for each alternative will be converted according to Table 2. The biggest value from Table 2 and Table 3 which will be used as the Cmax value and the smallest value is 1 will be Cmin, then the conversion results will be calculated according to the Utility formula, the calculation results can be seen in Table 3, the results of the utility calculation are then calculated using the SMART method to get a score. The results of the decision are in accordance with the range (0-0.3 "out", 0.3-0.6 "consideration", 0.6-1 "stay") determined by the Trunojoyo Madura University dormitory.

| Table 2 Value |
| ------------- |
| No | Kriteria | Condition | Value |
| 1  | Notes   | red       | 1     |
|     |         | yellow    | 2     |
|     |         | green     | 3     |
|     |         | red       | 1     |
| 2  | Violations | yellow   | 2     |
|     |         | green     | 3     |
|     |         | alpha > 10| 1     |
| 3  | Routine Absences | alpha > 8 - alpha = 10| 2 |
|    |         | alpha = 0 | 3     |
|    |         | 0         | 1     |
| 4  | Non-Routine Absence | 3 - 5 | 2 |
|    |         | >5        | 3     |

| Table 3. Utility value |
|------------------------|
| Alternatif | K1 | K2 | K3 | K4 |
| AINUR ROSIDAH | 1  | 0  | 0.5| 0.5|
| RINI AZLINDA | 0  | 1  | 0.5| 0.5|
| SHELLY FEBRIANTI | 0  | 1  | 0  | 0.5|
| UMU KULSUM | 0  | 0.5| 0  | 0.5|
| FAKHRUDIANA ZAHROH | 0  | 1  | 0.5| 0.5|

| Table 4. Rating result |
|------------------------|
| Alternatif | Skore | Decision |
| AINUR ROSIDAH | 0.325 | CONSIDERATION |
| RINI AZLINDA | 0.325 | CONSIDERATION |
| SHELLY FEBRIANTI | 0.725 | STAY |
| UMU KULSUM | 0.225 | OUT |
| FAKHRUDIANA ZAHROH | 0.325 | CONSIDERATION |

3.2. Backend

Monitoring & Evaluation application is implemented on Android for users and the Web for admins. The SMART method is applied to the Web as in Code Program 1 which is a repetition and calculation of the SMART method from data inputted by students through an android application and stored in a database, then the conversion will be processed through repetition.

```php
for ($i=0; $i < count($tabel_total) ; $i++) {
    array_push($tabel_total_konversi,
        array( $tabel_total[$i]['id_student'],
        konversion_routin ($tabel_total[$i]['v_total_routin']),
        konversion_nonroutin( $tabel_total[$i]['v_total_nonroutin']),
```
3.3. Frontend
Monitoring & evaluation application Frontend application dormitory activities can be accessed via android for students as in Code program 2.

```
package com.dormitory.skripsi.API
import retrofit2.Retrofit
import retrofit2.converter.gson.GsonConverterFactory
class APIResponse {
    val url: String = "http://dormitory.pasarin.web.id/admin/api/
    fun response(): APIClient {
        val retrofit: Retrofit = Retrofit.Builder().baseUrl(url)
            .addConverterFactory(GsonConverterFactory.create())
            .build()
        return retrofit.create(APIClient::class.java)
    }
}
```

**Code Program 2. URL Access**

Android applications connected to the web to process data, it is needed a connection like in code program 3 so that both of them can be accessed easily, after the android and web applications are connected, the android application display on the web will appear as in Figure 1.

```
require_once('../koneksi.php');
$sql = "SELECT * FROM warga where ID_WARGA = '$ID_WARGA' AND NAMA_WARGA = '$NAMA_WARGA' " ;
$check = mysqli_query($koneksi_database,$sql);
if(mysqli_num_rows($check)==1){
    $result = array();
    while($row = mysqli_fetch_array($check)){
        array_push($result, array('ID_WARGA'=>$row[0], 'NAMA_WARGA'=>$row[2]));
    }
    $response['result'] = $result;
    $response['message'] = "login";
    echo json_encode($response);
} else {
    $response['value'] = 0;
    $response['message'] = "gagal";
    echo json_encode($response);
}
```

**Code Program 3. Koneksi android dengan web**
4. Conclusion

Based on the above research it can be concluded that the monitoring and evaluation application of dormitory activities can be used to facilitate the monitoring process of dormitory activities, besides that by applying the SMART method it can facilitate the data processing activities at the Tunojoyo Madura University dormitory providing an objective assessment.

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