Leaderboard Application as A Ranking Media for Internet Users

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Abstract – The technology of utilizing hotspot networks has developed quite rapidly. In its development, internet technology uses a more flexible Mikrotik hotspot because it provides convenience for administrators and users. The object of this study is the hotspot network of Hayam Wuruk University (UHW) Perbanas. The goal is to develop a leaderboard design as a medium for monitoring internet use through the UHW Perbanas hotspot. Its application is through the integration of mikrotik with the web service API as a ranking of internet users against three categories of activities, namely downloads, uploads and internet usage times on each day and month. Each of these categories has 20 users. The test method uses a black box. Hasil testing states that the system is successfully operating, so that it can be implemented in the context of decision making by the management of UHW Perbanas.

Keywords: leaderboard, hotspot, mikrotik, API.

I. INTRODUCTION

The industrial revolution 4.0 became the forerunner of the rapid development of internet network technology. The technology supports various sectors of life such as the industrial sector, government without exception in the education sector as well. In its development, internet technology has experienced innovation in line with the increasingly diverse needs and desires of these various sectors, one of which is the education sector.

Internet technology in the education sector is currently a must to be used, because it is very useful, highly efficient and supports all business processes operated. In its development, wireless technology has an impact on changing the use of information networks and telecommunications. The network offers security against data transmissions that are fully shared and can be used anywhere and without time limits. Wireless connection is a means of internet access that is the main choice of internet users with fairly high mobility. Its main advantage is convenience on its use.

Hotspot is a service that provides internet access in a certain area such as cafes , campuses, offices and other public places. In general, its implementation using wireless media is complemented by user authentication [1]. Hotspot technology with Mikrotik routers is a network technology that currently utilizes the captive portal feature and asks users to send login information in the form of usernames and passwords as authentication and data security before connecting to internal and external networks [2]. In general, captive portals are used in wireless network infrastructure such as hotspot areas. Nevertheless, captive portals can also be applied to wired network infrastructure. The hotspot technology provides an interesting option that stays connected with the user, besides that it can also track user activities as well as various user and/or device information with third parties through the use of captive portals and websites [3].

The use of internet technology in a certain area through hotspots can be evaluated using a leaderboard known as a leaderboard, which is a record board in the form of scores and user names sorted by rank from highest to lowest [4]- [6]. The form is in the form of a table with the display of usernames, badges and a number of points from each user so that it can trigger positive competition among users and can be used for ranking analysis of each user [7]. Several previous studies have tested and analyzed leaderboard which is more widely used in the application of electronic learning media (e-learning [5], [8], [9].

Unlike some of the previous studies, this study focuses on developing leaderboard media as monitoring for administrators and users on the use of bandwidth activities and their time when connected to the internet wifi network. The leaderboard system developed in this study uses a web-based programming language, namely PHP, commonly known as Hypertext Prepocessor. The programming language is used in conjunction with Hyper Text Markup Language (HTML) [10]. Its placement and process on the server to generate a leaderboard web page view.

The design of the web leaderboard is then tested using black box testing, which is a testing system that focuses

on the functional specifications of the software [4], [11]. Its operational system ignores the control structure so it focuses more on domain information. Black box testing allows developers toensure that all program functions [12] are precise and correct [11].

Based on the background and several previous studies, the purpose of this study is to develop the leaderboard system as a medium for monitoring the use and ranking of internet users through hotspot networks. The specific purpose of this study is to obtain information related to internet use for a number of users and administrators in the context of decision making.

II. METHOD

This research is a qualitative research using the Software Development Life Cycle (SDLC) Waterfall approach method. The method is a method with a gradual or sequential software development cycle starting with the advancement of the system at the stage of analysis, design, system development (coding), testing and maintenance as the final stage [13]-[15]. The stages of developing the leaderboard system in this study include 1) System analysis; 2) Design sistem; 3) System development; 4) Implementation and Evaluation. The four stages are listed in Fig. 1.

Functional system analysis was carried out through the analysis of the WiFi network infrastructure of Hayam Wuruk University (UHW) Perbanas through direct observation and interviews. Interviews were conducted to network administrators and server administrators (server administrators) using the unstructured interview method. The questions asked were not in order of topic and adjusted to the respondents [16]. The results of the two activities were further analyzed and obtained information that UHW Perbanas had implemented a captive portal on the hotspot network system with centralized authentication in the Information System database (Sisfo) lecturers, educators (tendik) and students [2]. Based on the Mikrotik database of information systems and UHW Perbanas technology, it is known that the average numberof internet network users (users) via WiFi is 1,000-1,300 people.

Autentification of the hotspot captive portal uses the freeradius server and integrates with the Sisfo user database. Sisfo's database integration with the leaderboard uses the Conceptual Data Model (CDM) design as a representative of the independent technology specification of the data structures stored in the database [17], [18]. CDM functions to describe in detail the database structure in a logical form consisting of objects that are not implemented directly into the database, while the [19] stated that Pysical Data Model (PDM) is a detailed overview of the physical form of the database The hotspot network system [20]. that has been implemented allows integration of the leaderboard through the UHW Perbanas Surabaya hotspot network. The next stage is to analyze thesystem system non-functionally on several supporting devices to integrate the hotspot network with the leaderboard which includes the apache webserver, MySql and PHP API as a link to the Mikrotik router. The final part of the analysis of non-functional systems is the testing of the leaderboard using black box testing.

The stages of designing a leaderboard integration system with a hotspot network after the system analysis is complete are by using the prototyping method as an initial description of the design of the network infrastructure system that will be developed. Prototyping is a two-way medium to interact with each other to exchange information in the system development process. The most important stage in this research is the design of an application with a prototype method approach as a flexible method [21], because it facilitates the process of developing a leaderboard system model on a hotspot network. The design of the prototype is listed in Fig. 2.

Fig. 1 Research framework

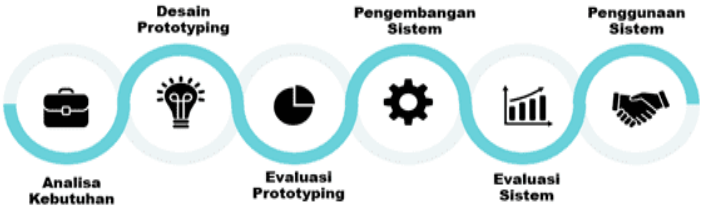

Fig. 2 Prototyping stages

III. RESULTS AND DISCUSSION

The system design of the hotspot network infrastructure that has been running is integrated with the PHP Rest API and the leaderboard database as shown in Fig. 3. The function of the leaderboard is to monitor every user who uses hotspot facilities so that the use of bandwidth activities in the form of downloads and uploads is monitored and ranked on the leaderboard system. The ranking of internet user activities through hotspot with a leaderboard includes three parts, namely top downloads, top uploads and top times. Top download and top upload display users who transmit files or data in the form of requests from each device connected to the hotspot network.

The leaderboard in the form of top time displays the time of internet use or the length of time to use the internet by users. The display of top downloads, top uploads and top time can be monitored every day or every month. The result of the monitoring is the top 20 highest users in the use of time and internet bandwidth while in the UHW Perbanas environment, Surabaya. The next stage is to design a prototype as a form of integration of the leaderboard database and the Sisfo database using the design of relationships between tables conceptually in the leaderboard database with the Sisfo database based on CDM as listed in Fig. 4.

The PDM design in this study is in the form of a design of the relationship between the physical table between the leaderboar and Sisfo for the tables of lecturers, educators and students connected to the leaderboard table. The pdm design overview is listed in Fig. 5.

The workflow of the user activity system on the hotspot network with the leaderboard consists of two, namely user login and user logout, as listed in Fig. 6. The image describes the user's activity at the time of login through the hotspot captive portal. User profile data will automatically be sent to the PHP Rest API leaderboard and stored in the database. Besides, the user logout process from the Mikrotik captive portal which will send the IP Address, Mac Address, Byte In, Byte Out and Uptime. The data will then be stored in the database and used in the calculation of the use of internet activities of each user as listed in Fig. 7. The 20 highest internet users in download and upload activities will appear on the leaderboard.

The integration process in the study connects two applications with the source code API from Mikrotik to the PHP Rest API. The implementation of the leaderboard is carried out on the hotspot network. Each user logs in through the captive portal of internet activity data that will send Mikrotik Hotspot Scripts to the PHP Rest API Leaderboard, including the use of upload and download bandwidth. The configuration on the mikrotik hotspot is placed on each user profile in the script on login and the script on logout as following as Fig. 8. The script on login is a PHP Rest API whose function to send user values (user values), including user name, mac address, and IP address. The function of the script on logout is to send user values which include user name, mac address, IP address byte in, IP address byte out and uptime secs.

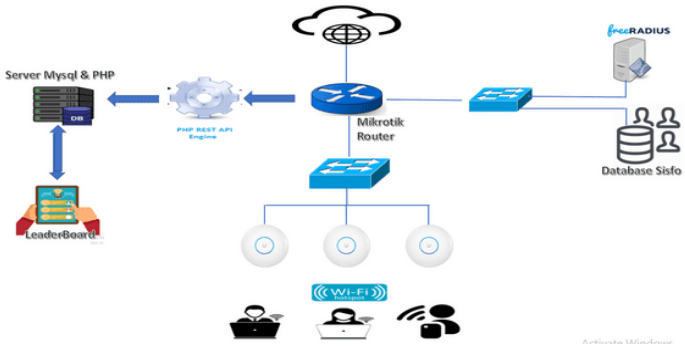

Fig. 3 Leaderboard infrastructure prototype

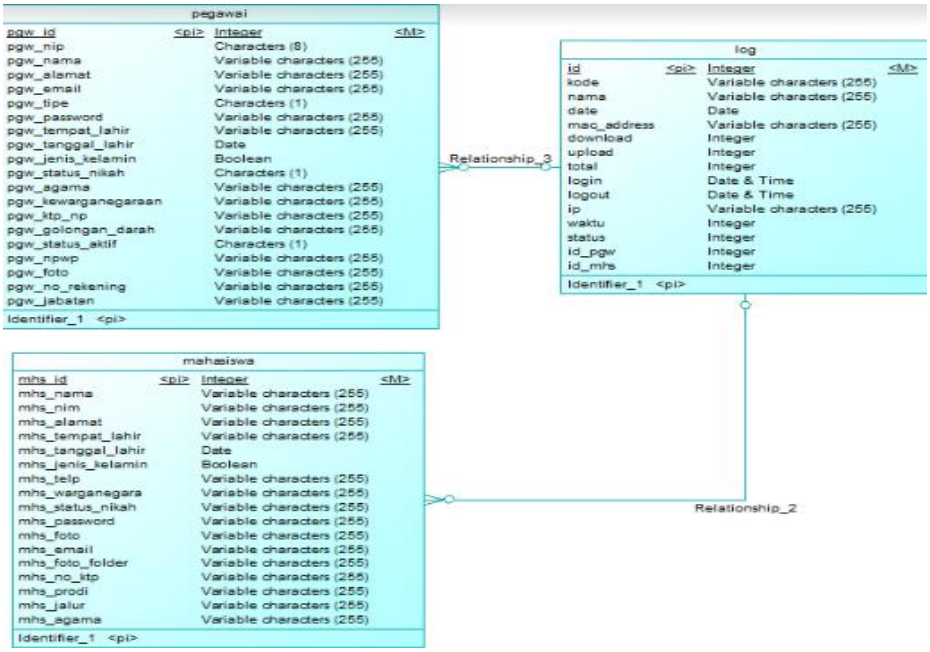

Fig. 4 CDM Leaderboard-Sisfo

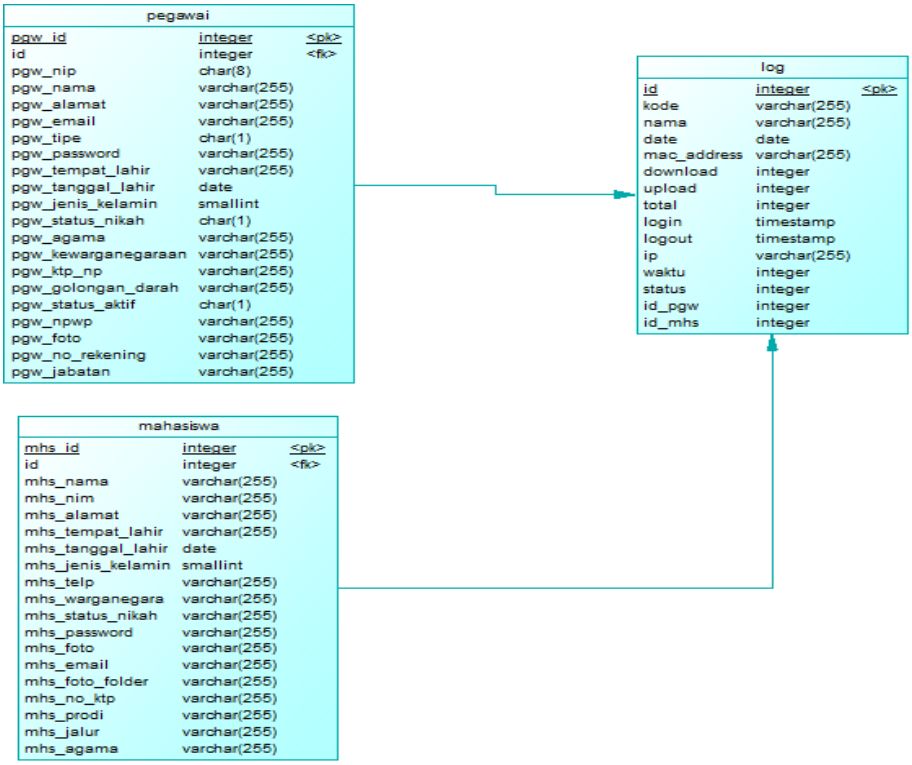

Fig. 5 PDM Leaderboard – Sisfo

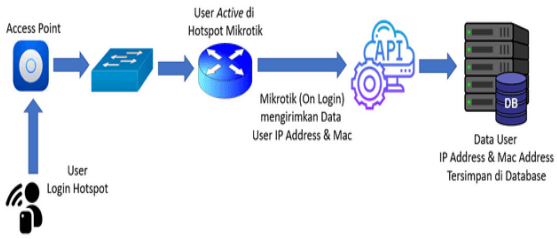

Fig. 6 User login

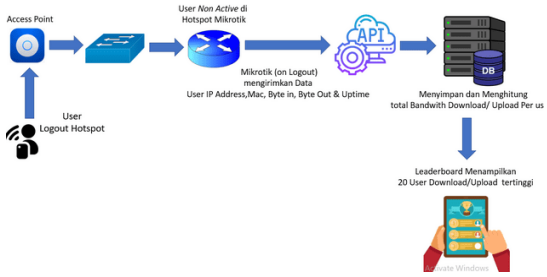

Fig. 7 User logout

On Login:

```
/tool fetch url="http://leaderboard.perbanas.ac.id/ws/index.php?kode=$user&nama=
$user&act=1&mac_address=$"mac-address"&ip=$address" mode=http
```

On Logout:

```
/tool fetch url="http://leaderboard.perbanas.ac.id/ws/index.php?kode=$user&nama=
$user&act=2&mac_address=$"mac-address"&ip=$address&up=$"bytes-in"&down=
$"bytes-out"&waktu=$"uptime-secs"" mode=http
```

Fig. 8 Scripts on login/logout

The PHP Rest API leaderboard script as listed in Fig. 9 serves to receive user activity data on the Mikrotik hotspot network sent through the mikrotik user profile on the Mikrotik login script on the leaderboard API link. The script contains user profile data, IP and Mac address which is then stored in the database.

The script sourced from the PHP Rest API is continued with the source code for the ranking process which consists of three parts, namely download, upload and length of time of internet use, each of which is recapitulated daily and monthly. Fig. 10 is an overview of the source code of daily downloads, while Fig. 11 is an overview of the source code of daily uploads.

The source code for recapitulating the time of internet use by users through hotspot networks is listed in Fig. 12. Then the last one in Fig. 13 is the source code to record the user's internet usage time on the Hotspot network. The leaderboard displaying the records of the top 20 user download categories is listed in Fig. 14, while the leaderboard display that records the top 20 uploads is listed in Fig. 15, while the top 20 internet usage is listed in Fig. 15. The last one in Fig. 16 is the menu for the Top Time 20.

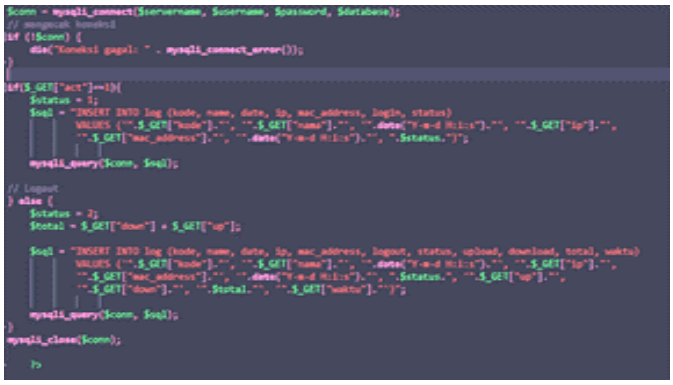

Fig. 9 Source code of the PHP Rest API leaderboard

```
public function download_harian()
{
    $date = date('Y-m-d');
    $downloadHarian = $this->MS_setup->download_harian($date)->result_array();

    $json = '[';
    $num=0;
    foreach($downloadHarian as $row)
    {
        $num++;
        $bd = $row['total'];

        $json .= '{
                "no": "'.$num.'",
                "name": "'.ucwords(strtolower($row['name'])).'",
                "total": "'.$this->konversiBytes($bd).'"},';
    }
    $json = substr($json,0,strlen($json)-1);
    $json .= ']';
    echo $json;
}
```

Fig. 10 Source code daily download

```php
public function download_harian ($date)
{
    $sql = "SELECT name, sum(download) as total
            FROM log
            where DATE_FORMAT(date, '%Y-%m-%d') = '".$date."'
            and status = 2
            group by name
            ORDER BY total desc
            limit 10 OFFSET 0";
    //echo $sql;
    return $this->db->query($sql);
}
```

Fig. 11 Source code daily upload

```php
public function upload_harian ($date)
{
    $sql = "SELECT name, sum(upload) as total
            FROM log
            where DATE_FORMAT(date, '%Y-%m-%d') = '".$date."'
            and status = 2
            group by name
            ORDER BY total desc
            limit 10 OFFSET 0";
    //echo $sql;
    return $this->db->query($sql);
}
```

Fig. 12 Source code daily activity time

```php
public function waktu_harian ($date)
{
    $sql = "SELECT name, sum(waktu) as total
            FROM log
            where DATE_FORMAT(date, '%Y-%m-%d') = '".$date."'
            and status = 2
            group by name
            ORDER BY total desc
            limit 10 OFFSET 0";
    //echo $sql;
    return $this->db->query($sql);
}
```

Fig. 13 Source code daily activity time

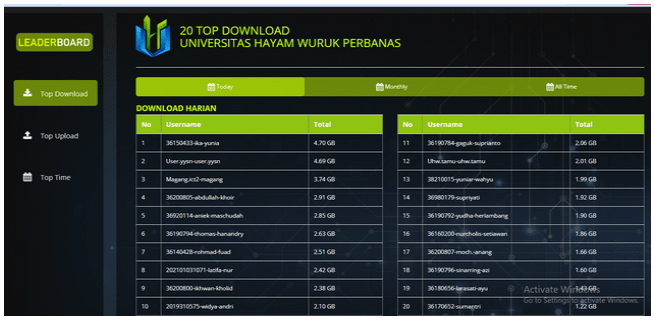

Fig. 14 Top 14 downloads

Fig. 15 Top 15 uploaded images

Fig. 16 Top time

The leaderboard application is further tested non-functionally. The goal is to ensure that the process of user activity data through the hotspot sent to the leaderboard is successfully recorded (recording) as well as turning off that the ranking or ranking function can operate. Another goal is to minimize the occurrence of deviations by users as well as deviations caused by the system [11] [22]. The black box test in this study consists of testing the fit of users login, users logout and the test results of the entire leaderboard system, as Table I, while the results of the black box test on the overall function of the leaderboard are listed in Table II.

TABLE I
THE RESULTS OF THE BLACK BOX USER LOGIN AND LOGOUT TEST ARE LISTED.

ID	Description	Expected Results
A01	*User* connects with WiFi and *login* on *captive portal*	The system is able to send data when *the user logs* in to the *captive user* accordingto the Mikrotik *hotspot* profile
A02	*Leaderboard* API	The system is able to run and send *the script on login* " **/tool fetch url="http://leaderboard.perbanas.ac.id/ws/index.php?kode=$user&nama=$user&act=1&mac_address=$"mac-address"&ip=$address" mode=http"**
A03	Mysql Database	The system stores *login* activity data
B02	*Leaderboard* API	The system was able to send and run *the script on logout* "**/tool fetch url="http://leaderboard.perbanas.ac.id/ws/index.php?kode=$user&nama=$user&act=2&mac_address=$"mac-address"&ip=$address&up=$"bytes-in"&down=$"bytes-out"&time=$"uptime-secs"" mode=http"**
B03	*Leaderboard database*	System stores *log out* activity data
B04	*Leaderboard*	The system calculates the total activity and displays the ranking of the highest 20 *users*

TABLE II
OVERALL BLACK BOX USER LEADERBOARD TEST RESULTS

ID	Description	Expected Result	Test-Results	Conclusion
C01	User connected wifi and logged in on captive portal	The system is able to send data when the user logs in to the active user according to the configuration in the Mikrotik Hotspot Profile	The system sends user values including login time, user name, mac addrees, IP Address script On Login sent and saved to the Database via API Leaderboard	Succeed
C02	Database Leaderboard	System Store Login Activity Data	The system stores user values including login time, user name, mac addrees, IP Address to the Database	Succeed
C03	User Logout or inactive on Hotspot network	The system sends an Outgoing Script when the user logs out or is not connected to the wifi network for >2 hours according to the configuration in Mikrotik	The system sends user values including logout time, user name, mac address, IP address byte in, byte out and uptime secs. Through the script On Logout is submitted and saved to the Database via the API Leaderboard	Succeed
C04	Database Leaderboard	System stores Logout event data	The system stores logout time, User name, mac address, IP Address byte in, byte out and uptime secs. Database	Succeed
C05	Leaderboard	The system calculates the total activity and displays the ranking of the 20 highest users	The system displays the highest 20 User Rankings i.e. Download, Upload and Time	Succeed

The results of the analysis of the Black Box testing in Table II, namely the integration of the leaderboard system has been running according to the expected design and development, where each user logs in to the hotspot system via the captive portal will send data (Fig. 8 on the login script) to the leaderboard via the Rest API (Fig. 9 Rest API) to be stored in the Database. Furthermore, when the user logs out (Fig. 8 On scrip logout) or the user is not connected to the wifi network, it will automatically send data to the leaderboard via the leaderboard Rest API (Fig. 9 Rest API) to process all its activities and rank 20 users, both download, upload as well as the highest usage time (Fig. 10-13) will then be displayed on the leaderboard system (Fig. 14-16).

IV. CONCLUSION

The leaderboard application in its implementation can not only be used in e-learning as a value ranking, but can also be applied to the use of internet technology via WiFi or the use of captive portals. The development of a leaderboard on the use of internet technology via WiFi provides some important information as a basis for decision making by the management specifically at higher education institutions. This information includes the amount of bandwidth needed for each download and upload activity by each user who is at UHW Perbanas every day or every month. Other information that is also important is how long each user uses or connects to the

internet network through a captive portal on a daily and monthly basis. The implication of both information is that management can determine how much capacity or bandwidth is needed for each UHW Perbanas operational activity. The determination of the amount of bandwidth has an impact on determining the size of the budget in the Information and Communication Technology work unit of UHW Perbanas. The amount of the budget is also related to cost efficiency and the effectiveness of the institution's operational activities that take place during the working day. Based on the test results with a black box, the leaderboard application can be applied to the internal environment of UHW Perbanas. The leaderboard application is also related to good university governance, specifically in the information technology and financial governance of UHW Perbanas. The implementation of good university management is also related to the achievement of UHW Perbanas' vision as a leading, superior and globally minded university. The achievement of this vision must be supported by all work units includingthe Information and Communication Technology faculty and financial functions.

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