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Design of a Fire Monitoring System Using Web Fire Google Maps and Telegram

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ABSTRACT

Fire is a type of disaster caused by flames that pose significant threats to human life, infrastructure, vehicles, and the surrounding environment. In Tegal City, there were 40 reported fire incidents in 2017, which drastically increased to 120 incidents in 2018. This alarming rise highlights the urgent need for an effective and responsive fire monitoring system. This research aims to design a real-time fire monitoring system integrated with specifically developed hardware. The methodology involves observation, interviews, and literature studies to ensure the system's relevance and accuracy. The system developed in this study is capable of monitoring multiple registered locations simultaneously through a centralized website. It features real-time data updates, with information being received every second without the need for manual refreshing. Additionally, the system is equipped with a notification and alarm mechanism to provide early warnings when monitored areas are in a state of alert or danger. This innovation is expected to enhance fire disaster preparedness, enable rapid response, and minimize potential damage in vulnerable areas.
Kata kunci: Fire, Monitoring, NodeMcu ESP8266, Site

INTRODUCTION

Current technological developments in the telecommunications sector have had a significant impact on everyday life. This is evidenced by the increasing number of sophisticated and modern discoveries that greatly assist humans in their activities. Consequently, the need for technology continues to increase (Faisal et al., 2019). Monitoring sites are one form of technological development that can function as a security tool. Monitoring sites can be used easily and flexibly, one of which is in carrying out early prevention of indications of the cause of fire, with real-time monitoring and can detect if indications of the cause of fire occur so that fires can be prevented and losses can be minimized.

Fire is a disaster caused by uncontrolled ignition or combustion that can endanger human life, damage buildings, vehicles, and the surrounding

environment. Fires can occur intentionally or unintentionally. According to the Indonesian National Standard (SNI), a fire occurs when a material reaches a critical temperature and reacts chemically with oxygen, producing, for example, heat, flame, light, smoke, water vapor, carbon monoxide, carbon dioxide, or other products and effects.

Fires have various potential dangers for humans, therefore, intelligent equipment is needed that can notify us that a fire has occurred. In today's digital era, security systems are very important to provide early warnings to prevent danger, especially in taking early precautions against indications of smoke that could cause a fire (Dewi et al., 2017).

While the fire cases that occurred in the Tegal City area in 2017 were recorded as many as 40 fire incidents, in 2018 there was an increase in the number of 120 fire incidents that occurred in parts of Tegal Regency and Tegal City. Therefore, the design of a fire monitoring system using the Google Maps and Telegram web API was created to make it easier for firefighters to deal with fire incidents because they can monitor the condition of objects in real time and get more accurate information.

This research will combine website technology that will be used as the title of the Final Project, namely "Design of a Fire Monitoring System Using Google Maps and Telegram Web API". The website technology is a system that functions to monitor the level of smoke density in a room, and can display the location of a fire using the help of the Google Maps API, and the system will emit a warning sound if danger is detected on the object, in addition with the help of the Telegram API, users can send notification messages to customers if a fire occurs at their location.

Theoretical basis

Research conducted by Ahmad Faisal et al (2019) in a journal entitled "Web-Based Fire Monitoring and Early Warning System Simulator" states that the fire early warning simulator with SMS and web features is equipped with a manual call point fire detector (break glass), a simultaneous alarm (general alarm), a water flow detector on the sprinkler (flow switch), a fireman switch, an alarm reset, a flame sensor, a gas/smoke sensor and a temperature sensor. This simulator is equipped with an audible alarm, a visual alarm, a pressurized fan, and a fire damper. This simulator uses a SIM800L SMS module that functions to send fire data via SMS and an ESP8266 Wi-Fi module that functions to access fire data to a web server that will be displayed on the web and recorded in the database. The system can display maps using the navigation feature on Google Maps (Nugroho, 2010).

Research conducted by Sri Safrina Dewi et al. (2017) in a journal entitled "Prototype of Building Fire Monitoring Information System Based on Google Maps and GSM Module" is the design of a prototype of a Google Map-based building fire information system using a GSM module communication line. The prototype was built using a DHT11 temperature sensor, MQ2 Smoke Sensor, Arduino Uno, GPS module and SIM9000 GSM modem. The research resulted in

a fire monitoring information system in two systems, namely a fire detection system and a fire location information system based on Google Maps. Both systems have run according to the experiments that have been carried out so that they produce information on the location of the fire along with data on the condition of smoke and temperature (Pressman, 2012).

METHOD

1) Researh Materials
   The main research material that will be used is data from the Tegal Fire Department.
2) Software Used
   Software is a computer program associated with software documentation such as requirements documentation, design models, and user manuals. The software required to create this monitoring system is:
   1. Windows 10 OS
   2. XAMPP
   3. Sublime
   4. Internet Browser

3) Research Procedures
   Conducting research requires a clear and measurable procedure. This research procedure uses the waterfall method, which consists of several stages, including:
   1. Plan
      The initial steps in conducting this fire monitoring system research include data collection and review of journals available online and in libraries. The collected data will then be developed into a research design for a fire detection monitoring system using the Google Maps and Telegram web APIs.
   2. Analysis
      The analysis contains the initial steps of data collection, as well as analysis of what data will later be used in designing this system.
   3. Design
      The site design includes the concept design that will be created as well as the creation of a database, system, and user interface that can be used easily so that it can be used by professionals and lay people so that Tegal City Fire Department officers can operate the website well and without any obstacles, it is hoped that the system that has been designed in such a way can be utilized to the maximum extent possible.
   4. Implementation
      The results of this research will be tested in real-world settings to determine and assess its effectiveness and to correct any errors in the design process. The results of these tests will then be implemented.

4) Data collection technique
The data collection method used in this study is;

1. Observation Method
   A data collection method conducted through direct observation, viewing, and collecting the required data on-site. The research was conducted. Observation can also be defined as a complex process. Data collection was conducted at the Tegal City Fire Department in Tegal Debong Tengah, South Tegal District, Tegal City, Central Java.
2. Interview Method
   Interviews were conducted to obtain data by asking questions and obtaining information directly from relevant sources. In this study, the interview was conducted with a member of staff from the Tegal City Fire Department.
3. Literature Study
   This method is intended to obtain and study related reference sources, both those that are contained in books, journals, and the internet.

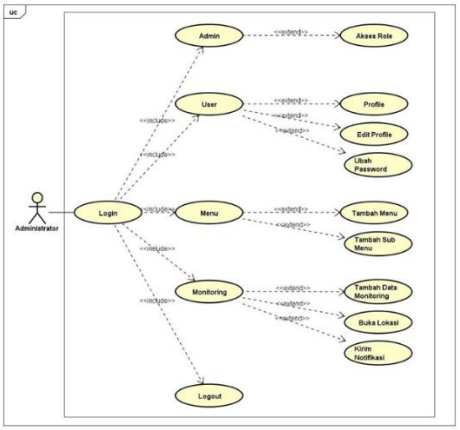
RESULT AND DISCUSSION

1) System Design

System design is a set of activities that describe in detail how a system will operate. The goal is to produce a software product that meets user needs. System design is depicted in diagrams, including use case diagrams, activity diagrams, sequence diagrams, and class diagrams.

1. Use Case Diagram

A Use Case Diagram is a depiction or representation of the interactions between a system and its environment. Here's a Use Case Diagram for the website being designed:

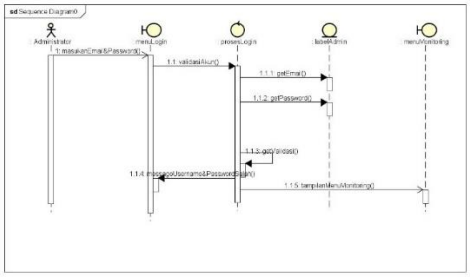


Picture1. Use Case Diagram

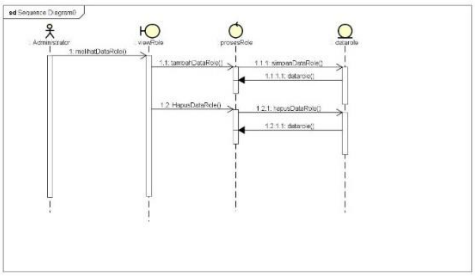
2. Sequence Diagram

A sequence diagram is a diagram that shows or displays the interactions between objects within a system, arranged in a sequence or timeline. These interactions, including users, displays, and so on, are

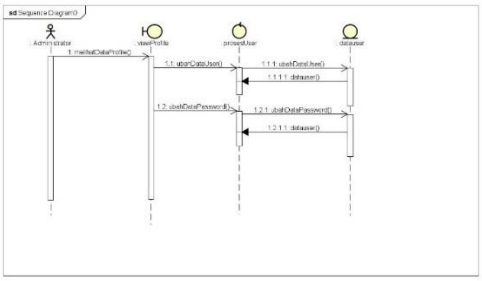
expressed in the form of messages. Here's a sequence from a fire monitoring site:



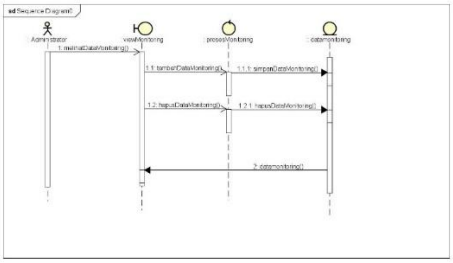
Picture2. Login Sequence Diagram



Picture3. Sequence Diagram Admin



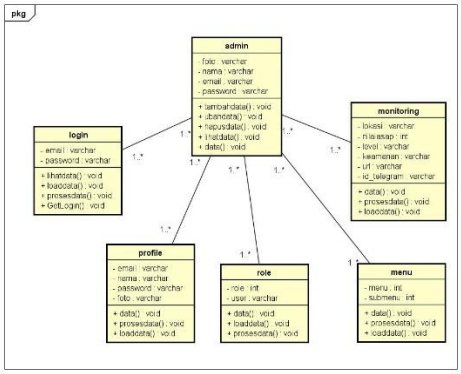
Picture4Sequence Diagram User



Picture5Sequence Diagram Monitoring

3. Class Diagram

Class Diagrams provide a broad view of a system by showing its classes and what relationships occur, not what happens if they are connected.

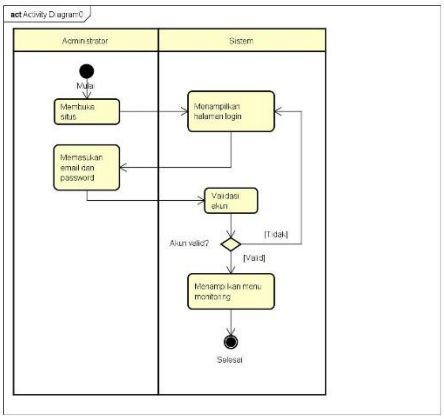


Picture6. Site Class Diagram

4. Activity Diagram

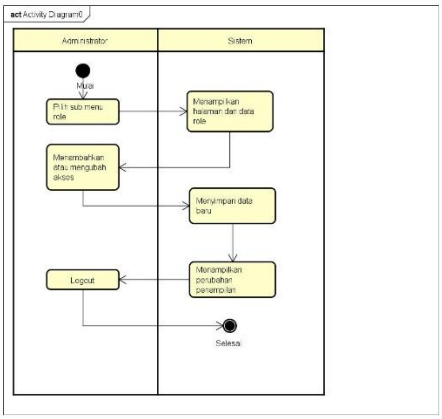
Activity diagrams are used to describe the activities within a system. To better understand the system being built, it's necessary to create an activity diagram of the current system, as follows:

a. Login Activity Diagram



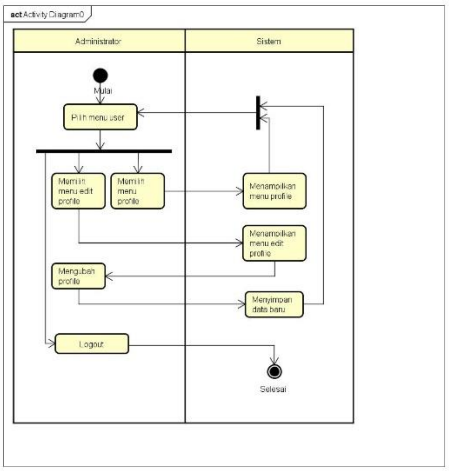
Picture7. Login Activity Diagram

b. Activity Diagram Role



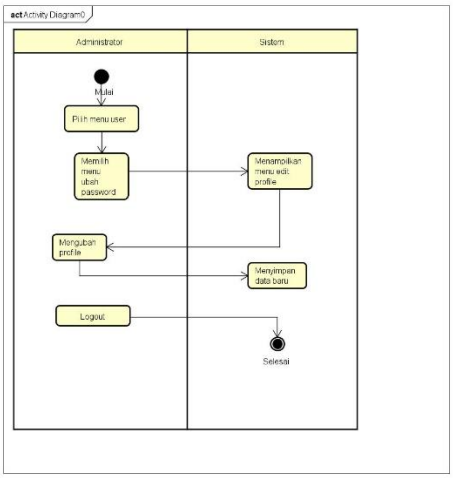
Picture8. Activity Diagram Role

c. User Activity Diagram



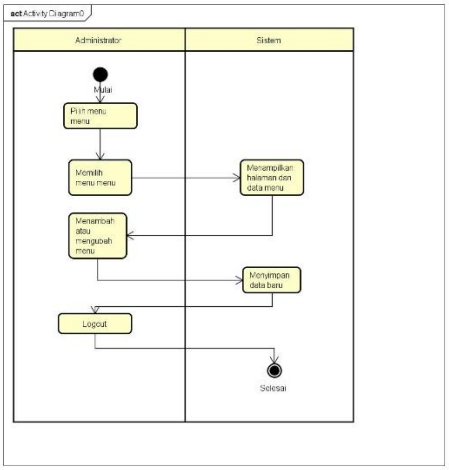
Picture9User Activity Diagram

d. Activity Diagram Change Password



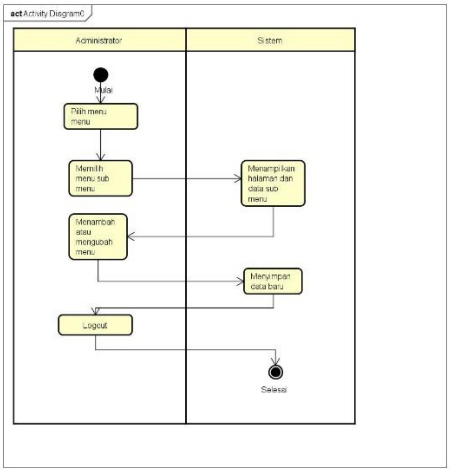
Picture10. Activity Diagram Change Password

e. Activity Diagram Menu



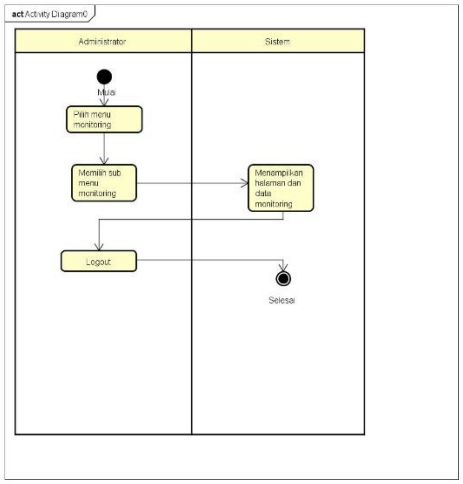
Picture11. Activity Diagram Menu

f. Activity Diagram Change Sub Menu



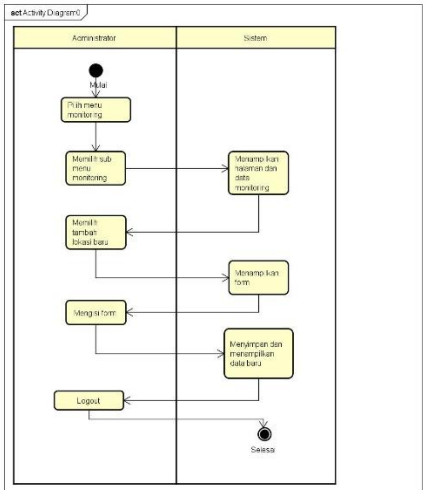
Picture12. Activity Diagram Sub Menu

g. Activity Diagram Monitoring



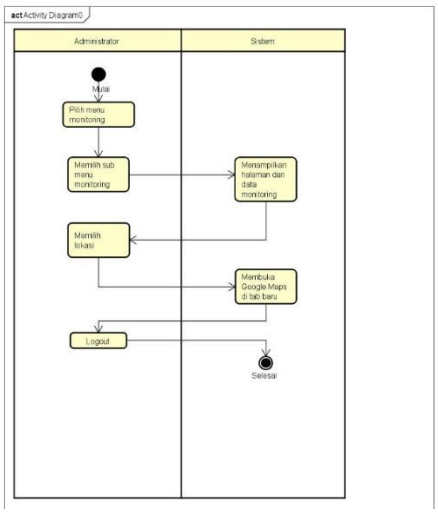
Picture13. Activity Diagram Monitoring

h. Activity Diagram Add Data



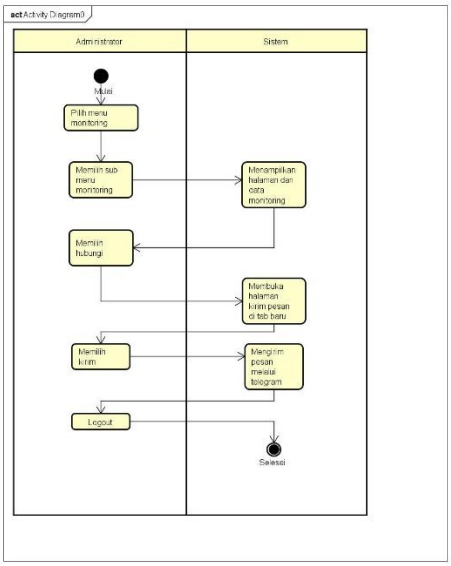
Picture14. Add Data Activity Diagram

i. Location Activity Diagram



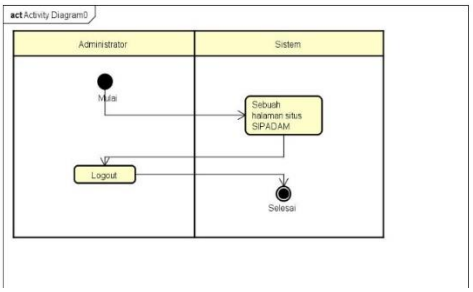
Picture15Location Activity Diagram

j. Activity Diagram Send Notification



Picture16. Activity Diagram Send Notification

k. Activity Diagram Logout



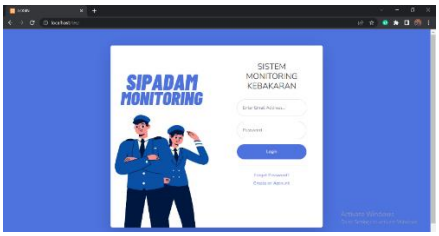
Picture17. Activity Diagram Logout

2. Implementation

System implementation is the implementation stage for the system based on the results of the analysis and design that have been carried out. The system implementation on the fire monitoring website was created to facilitate users in monitoring and obtaining accurate information about fires. In implementing the system, the site was assisted by Bootstrap version 4.6.0 as a CSS (Cascading Style Sheets) framework to beautify the appearance, PHP (Hypertext Preprocessor), and JavaScript as programming languages. The following are the results of the system implementation:

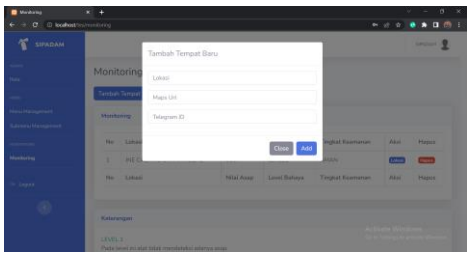
1. Login Page

   The login page is the main page displayed when the site is first accessed. The login page contains a form for entering user information, including an email address and password. After the user enters their email address and password, the system will validate the data to determine whether it has been previously registered. If the data is valid, the system will redirect the user to the monitoring page.

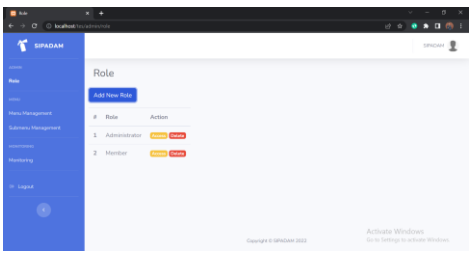


Picture18. Login Page Implementation

2. Monitoring Page
   A form will appear when the user clicks the "Add New Location" button. This form requires three pieces of information: location information, a URL that will then connect to Google Maps, and a Telegram ID used to notify customers of fires. The monitoring table contains values for displaying smoke density and security status, designed using Ajax technology, allowing the system to change values every second without having to refresh the browser software.

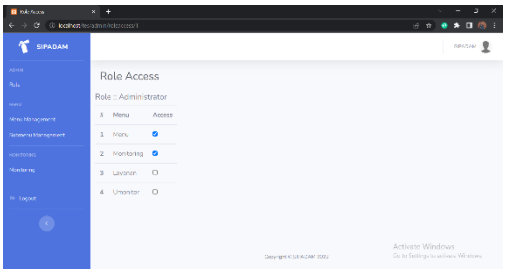

Picture19. Implementation of the Add Monitoring Data Form

3. Role Page
   On the role page there is a table containing role data that has previously been entered into the database, in addition there is an access button that functions to direct users to the role access page which contains menu data.



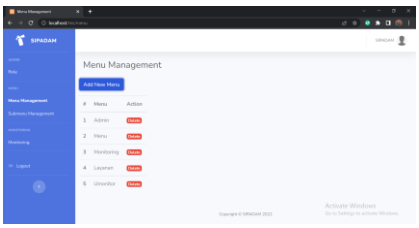
Picture20. Role Page Implementation

4. Role Access Page
   On this page there is a table containing menu data that has previously been entered into the database and there is a checkbox that functions to activate and deactivate menu access for a role.



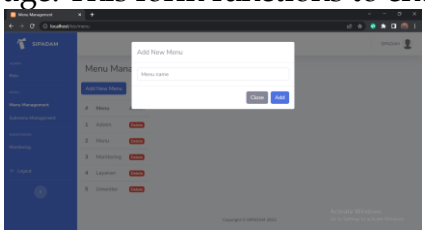
Picture21. Role Access Page Implementation

5. Management Menu Page
   On the menu management page there is a table containing menu data that has previously been entered into the database, in addition there is an add new menu button that functions to open the add new menu form, then the new menu that can be added will appear on the navigation bar on the left and the menu button can be used according to what page will be created.



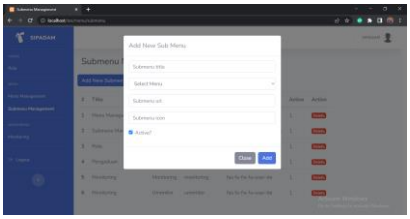
Picture22. Implementation of the Menu Management Page

6. Add New Menu Form Page
   In the add new menu form there is an add new menu form which can be accessed if the user presses the add new menu form button on the management menu page. This form functions to enter a new menu.



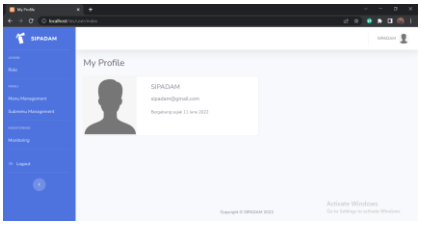
Picture23. Add New Sub Menu Form

7. Management Sub Menu Page
   On the sub menu management page there is a table containing sub menu data that has previously been entered into the database, apart from that there is an add new sub menu button which functions to open the add new sub menu form.



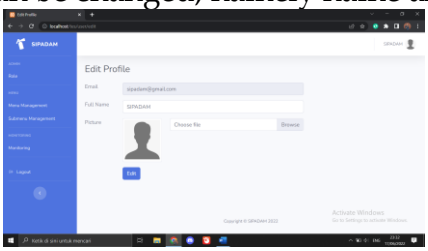
Picture24. Management Sub Menu Page

8. My Profile Page
   On the my profile page there is a card that contains data on the account currently in use, this card contains data on the name, email, and date the account was created.



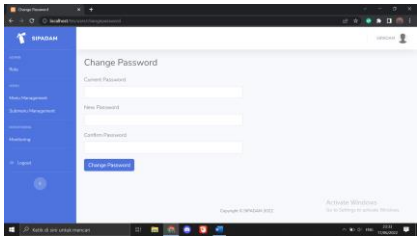
Picture25. My Profile Page

9. Edit Profile Page
   On the edit profile page there is a function to fill in the account data that will be changed, on this page there is 1 form that cannot be changed, namely email, and 2 forms that can be changed, namely name and profile photo.



Picture26. Edit Profile Page

10. Change Password Page
    On the change password page, there are 3 forms that can be filled in, namely the old password form, new password form, and confirmation of the new password form.



Picture27. Change Password Page

11. Test Results

The testing stage is a stage that must be carried out to assess whether the system that has been created can run well and is in accordance with the design or not.

Table1. Research result

Data Input	Expected results	Test Results
Login	Can enter the main display if the password and username match those registered, if not, return to the login display.	In accordance
Monitoring Page	Displays a menu according to its features, and can monitor in real time.	In accordance
Page Role	Displays a menu according to its features	In accordance
Page Menu Management	Displays a menu according to its features	In accordance
Page Sub Menu Management	Displays a menu according to its features	In accordance
Page Edit Profile	Displays a menu according to its features	In accordance
Page Change Password	Displays a menu according to its features	In accordance
Page Report	Displays a menu according to its features	In accordance

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CONCLUSION

Based on the research conducted, it can be concluded that the SIPADAM monitoring site is capable of reading smoke levels, danger levels, and safety levels sent by specially designed devices in real time without requiring a page refresh. This feature enables efficient and accurate monitoring of potential fire hazards. In addition, the site is equipped with a multi-level alarm system, where level 2 and level 3 are differentiated by distinct alarm sounds. This design ensures that users receive accurate

information corresponding to the severity of the threat. As a result, timely and appropriate responses can be taken to mitigate risks. However, access to the SIPADAM monitoring site is currently limited to administrators of the Tegal City Fire Department, and is not yet available to the general public or other institutions outside this authority.

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