



Implementation of Microservice Architecture in MSMEs Product Management System

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Abstract. Micro, small, and medium enterprises (MSMEs) are the backbone of the Indonesian economy, but they face challenges in accessing markets and promoting their products. Applications can help MSMEs showcase their products and make it easier for consumers to see information about MSMEs they want to visit or purchase from. Using microservices can make MSMEs applications easier and more efficient to access for users. This study examines the urgency and benefits of digital technology to support MSMEs, especially in the context of the national economy. The application was developed to simplify MSMEs business operations with features such as registration, login, data input, data editing, data deletion, and displaying lists and details of MSMEs. This study uses the System Development Life Cycle (SDLC), specifically the waterfall model, to achieve its objectives. The findings highlight the importance of digital transformation to support Indonesian MSMEs and the benefits of using microservices in developing applications that have a major impact on economic growth and competitiveness. The implementation of microservices using the waterfall method successfully produced a complete and well-performing MSMEs Application service. The service uses 7 APIs that also perform well.

Keywords: MSMEs, Technology, Applications, Microservice, Digital, APIs

1 Introduction

Digital technology supports small business owners or micro, small, and medium enterprises (MSMEs) to conduct transactions with unlimited markets and consumers. In the era of Covid-19, digital transformation is becoming increasingly important and needed to boost the marketing of MSMEs products in Indonesia [1]. Here we can see how much the development of technology in the era of Covid-19 has driven businesses around the world. The acceleration of digital transformation in the digital financial sector is estimated to reach an increase of between 21-26% in the relative daily download rate of mobile applications related to digital finance [2].

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2 Methodology

2.1 Problem Analysis

The development of applications has a very high urgency to support MSMEs businesses in Indonesia [3]. Application development can support the ease of business owners to showcase the types of MSMEs they have to consumers [4] [5]. The use of microservices in the development of MSMEs applications is due to the microservice architecture approach, which can divide applications into smaller, independent services that can be scaled independently [6]. This can improve the flexibility, scalability, and efficiency of applications as well as increase complexity and security risks [7].

2.2 Solution Design

System Development Life Cycle (SDLC) is a general methodology used to develop information systems. SDLC consists of several phases, starting from the planning, analysis, design, and implementation [8]. The waterfall method is one of the SDLC models used in the development of information systems or software. The waterfall model uses a systematic and sequential approach [9][10]. The stages of the waterfall model include requirement analysis, design, and implementation.

Requirement Analysis. Requirements analysis is the first stage in planning the development of an application using the waterfall method. It is a collaborative process between the developer and the client, to discuss the requirements and needs for the development of the MSMEs application service/system.

Table 1. Product requirement.

No.	User Story	Method	API Requirements
1.	As a user, I want to register so that I can access the MSMEs application service	soPOST	Username, Email, Password, Phone Number, Address, and Profile Picture
2.	As a user, I want to log in so that I can use all the features of the MSMEs application.	so POST	Email and Password
3.	As a user, I want to add MSMEs data.	soPOST	MSMEs Name, User Id, MSMEs Id, Profile URL, MSMEs Image, MSMEs Details, MSMEs Address, MSMEs Motto

4.	As a user, I want to update thePUT MSMEs list that I have uploaded	MSMEs Name, User Id, MSMEs Id, Profile URL, MSMEs Image, MSMEs Details, MSMEs Address, MSMEs Motto
5.	As a user, I want to delete theDELETE MSMEs list that I have uploaded	MSMEs Id
6.	As a user, I want to see the MSMEs list.	GET MSMEs Name and MSMEs Image
7.	As a user, I want to see the details of other MSMEs	GET MSMEs Name, Profile URL, MSMEs Image, MSMEs Details, MSMEs Address, and MSMEs Motto.

Table 1 presents the product requirements for the development of a system, which consist of user stories, methods, and data needs. User stories are a way to understand how users will interact with the system. User stories are used as a basis for further system development and help in identifying user needs.

Design. In this stage, the process of creating the structure, interactions, and visual appearance of the software that meets the needs of users and functional objectives.

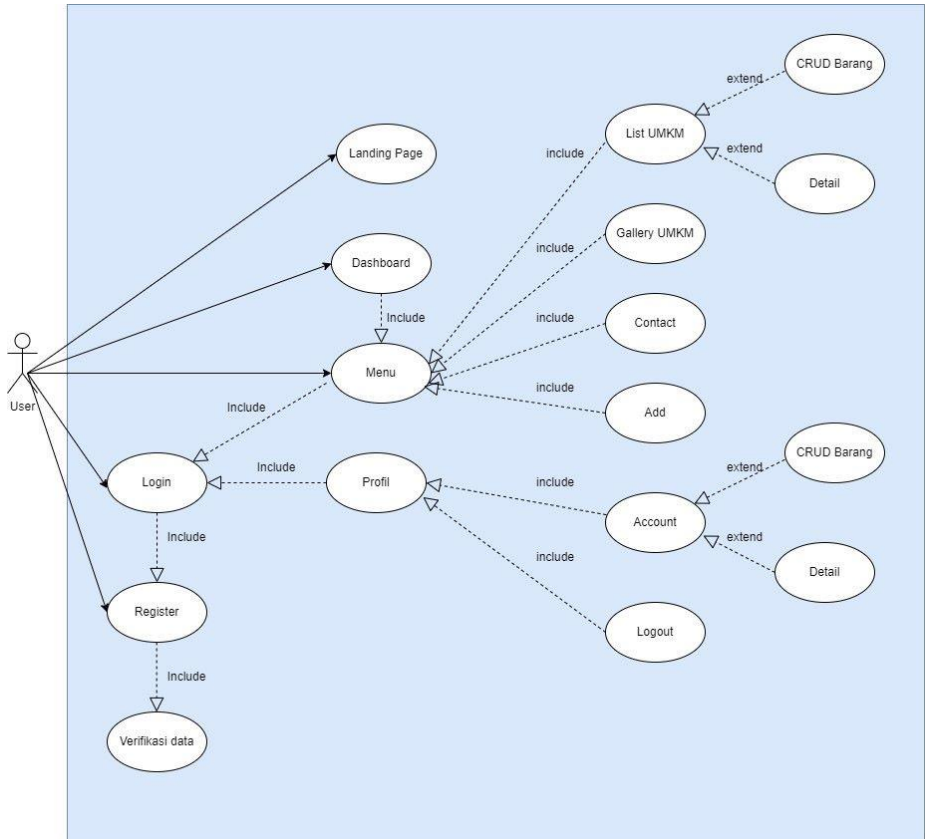


Fig. 1. Use case diagram.

Fig. 1. shows the use case diagram of the MSMEs application. The process starts with the user login in to the MSMEs application. If the user already has an account, the user can directly enter the application. However, if the user does not have an account, they must first register. After the user successfully logs in to the application, the user can access all application services, such as entering MSMEs data.

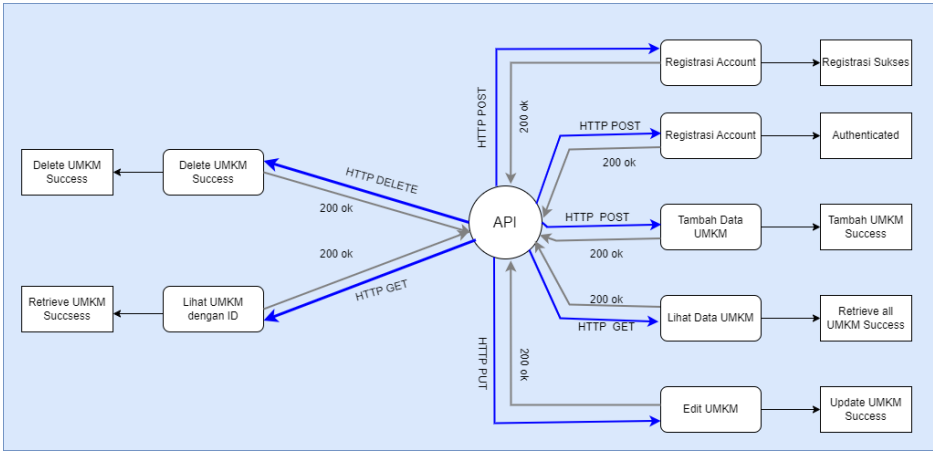


Fig. 2. Microservice design.

Fig. 2. shows the microservice architecture flow, which illustrates the relationship between methods, responses, and page views that will be built in the MSMEs application service. The microservice is implemented in 7 APIs. For example, the registration page will use the endpoint `http://34.101.119.196/api/register` (POST) with the expectation that the system will return a 200ok response as a sign that the system has received the input data correctly.

Development. Development aims to realize the application concept in a form that can be run and used by users.

```

public function register(Request $request){
    $registrationData = $request->all();
    $validate = Validator::make($registrationData, [
        'username' => 'required|max:60','email' => 're-
        quired|email:rfc,dns|unique:users',
        'password' => 'required', 'number_phone' => 're-
        quired', 'alamat' => 'required',]);
    if($validate->fails()){return response ([ 'message' =>
    $validate->errors()], 400);}
    $registrationData['password'] = bcrypt($request-
    >password);
    $user = User::create($registrationData);
    return response ([
    'message' => 'Register Sukses','user' => $user],200)
}

```

The listing code above shows the register() function that receives a request parameter containing user registration data. The user data is then validated using the validator class. If the validation fails, this function will return a response with a status code of 400. If the validation is successful, this function will store the user registration data in the database using the user class. After the registration data is successfully stored, the function will return a response with a status code of 200. Next, the API generated in the process above will be implemented in the creation of MSMEs application services. This can be seen in **Fig. 3**.

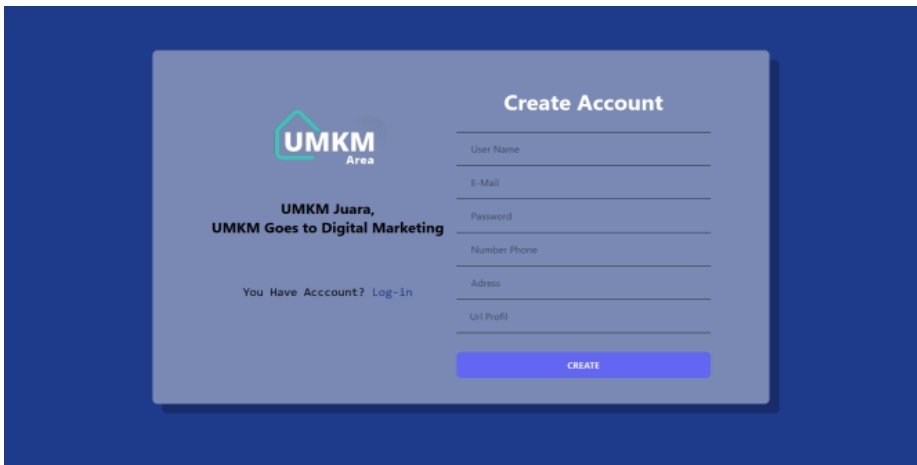
The image shows a registration form titled "Create Account" for "UMKM Area". The form is set against a dark blue background. On the left side, there is a logo for "UMKM Area" featuring a house icon, followed by the text "UMKM Juara, UMKM Goes to Digital Marketing". Below this, there is a link: "You Have Account? Log-In". On the right side, the form has a title "Create Account" and six input fields: "User Name", "E-Mail", "Password", "Number Phone", "Address", and "Url Profil". At the bottom of the form is a blue button labeled "CREATE".

Fig. 3. Registration interface

On this page, users can enter their personal information, such as their username, email address, password, phone number, address, and profile URL. This information is used to identify and verify the user's identity before they can access the full features and functionality of the MSMEs application.

```

const handleRegister = async (e) => {e.preventDefault();
const response await

fetch('http://34.101.119.196/api/register', {method:
'POST',
headers: {
'Content-Type': 'application/json'
},
body: JSON.stringify({
username, email, password, number_phone, Alamat,

gambar_profil
})
});

```

The code above shows the Register() function, which uses the useNavigate hook to navigate pages, and useState to store user input data such as username, email, password, number_phone, address, and profile_image. The function uses fetch to send a registration request to the API with the URL http://34.101.119.196/api/register, with the POST method and the header 'Content-Type': 'application/json'.

Table 2. API implementation on system interface.

No	API	Implementation
1	http://34.101.119.196/api/register (POST)	Registration
2	http://34.101.119.196/api/login (POST)	Login
3	http://34.101.119.196/api/umkm (GET)	List MSMEs and Profile
4	http://34.101.119.196/api/umkm (POST)	Add MSMEs Data
5	http://34.101.119.196/api/umkm/{id} (PUT)	Edit MSMEs Data
6	http://34.101.119.196/api/umkm/{id} (DELETE)	Profil

7 http://34.101.119.196/api/umkm/List_MSMEsandProfile/{id} (GET by Id)

3 Result and Conclusion

3.1 Result

Testing was performed using black-box testing, referring to the results of the MSMEs application frontend system. Blackbox testing is a functional testing that focuses on the behavior of the software on input given by the user to obtain/generate the desired output without looking at the internal processes or code executed by the software [11] [12]. At this stage, the tester will document what has been tested and any obstacles faced. This process verifies the implementation of the system with the initial requirements of the MSMEs application.

Table 3. Application performance testing.

No.	Test Case	Result
1.	Verification of personal data to ensure the functionality and reliability of the user registration process in the system	success
2.	Access verification can only be accessed by registered users.	success
3.	Verification of add or adding MSMEs data.	success
4.	Verification of editing or updating MSMEs data.	success
5.	Verification of delete or removal of MSMEs data.	success
6.	Verification of user logout activity in the MSMEs application frontend system	success

In addition to testing the results of the MSMEs application frontend system, testing was also carried out on the API used to ensure that the API functions properly. The testing was carried out using Postman. Postman is a web-based REST client tool. This tool is useful for testing web services that are under development [13]. One example of API testing on Postman can be seen in Fig. 4.

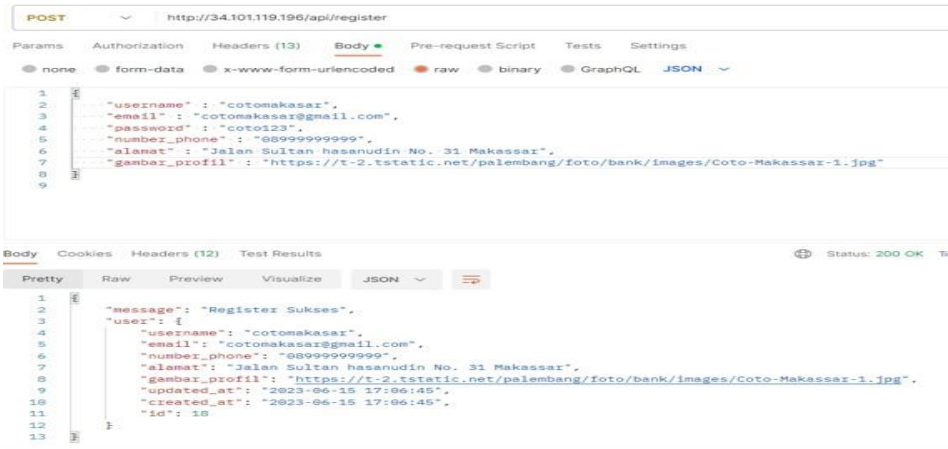


Fig. 4. POST API registration.

Fig. 4. is an example of an API that is used to process user registration, using the endpoint `http://34.101.119.196/api/register` (POST). In this API, users are required to enter data such as name, email, password, phone number, address, and profile picture. After the user successfully completes the registration process, the system will provide a response in the form of a message as shown in the figure above, with a response status of "200 OK". This response indicates that the registration process has been successfully completed.

Table 4. API responses.

No.	Endpoint	Response
1	<code>http://34.101.119.196/api/register</code>	200 Ok
2	<code>http://34.101.119.196/api/login</code>	200 Ok
3	<code>http://34.101.119.196/api/umkm</code>	200 Ok
4	<code>http://34.101.119.196/api/umkm</code>	200 Ok
5	<code>http://34.101.119.196/api/umkm/{id}</code>	200 Ok
6	<code>http://34.101.119.196/api/umkm/{id}</code>	200 Ok
7	<code>http://34.101.119.196/api/umkm/{id}</code>	200 Ok

3.2 Conclusion

The implementation of microservice using the waterfall method resulted in the MSMEs Application service with features that include landing page, dashboard, login, registration, MSMEs list, MSMEs gallery, add MSMEs data, edit MSMEs data, delete MSMEs data, detail, account, and logout. This application has good performance, as

evidenced by the application performance testing which reached a success rate of 100%. The development of the MSMEs application service uses 7 APIs. All APIs used in the application development show good performance, as evidenced by the APIs performance testing with a success rate of 100%. In the future, the development of this system is expected to use more APIs to provide a better user experience with the ability to manage data directly through the user interface.

References

1. J. I. Manajemen et al., "Penerapan Transformasi Digital pada UKM Selama Pandemi COVID-19 di Kota Denpasar," vol. 6, no. 1, 2021, [Online]. Available: <http://journal.undiknas.ac.id/index.php/manajemen>
2. J. Fu and M. Mishra, "Fintech in the time of COVID-19: Technological adoption during crises," *Journal of Financial Intermediation*, vol. 50, Apr. 2022, doi: 10.1016/j.jfi.2021.100945.
3. S. Borah, C. Kama, S. Rakshit, and N. R. Vajjhala, "Applications of Artificial Intelligence in Small- and Medium-Sized Enterprises (SMEs)," in *Lecture Notes in Networks and Systems*, Springer Science and Business Media Deutschland GmbH, 2022, pp. 717–726. doi: 10.1007/978-981-16-8763-1_59.
4. N. H. Vu and N. M. Nguyen, "Development of small-and medium-sized enterprises through information technology adoption persistence in Vietnam," *Inf Technol Dev*, vol. 28, no. 3, pp. 585–616, 2022, doi: 10.1080/02681102.2021.1935201.
5. S. Z. Zamani, "Small and Medium Enterprises (SMEs) facing an evolving technological era: a systematic literature review on the adoption of technologies in SMEs," *European Journal of Innovation Management*, vol. 25, no. 6, pp. 735–757, 2022, doi: 10.1108/EJIM-07-2021-0360.
6. A. Sinambela and F. Farady Coastera, "Implementasi Arsitektur Microservice pada Rancang Bangun Aplikasi Marketplace Berbasis Web," 2021. [Online]. Available: <http://ejournal.unib.ac.id/index.php/rekursif/1>
7. L. M. Alchuluq and F. Nurzaman, "Analisis pada Arsitektur Microservice untuk Layanan Bisnis Toko Online," 2021.
8. F. Heriyanti and A. Ishak, "Design of logistics information system in the finished product warehouse with the waterfall method: Review literature," in *IOP Conference Series: Materials Science and Engineering*, Institute of Physics Publishing, Jun. 2020. doi: 10.1088/1757-899X/801/1/012100.
9. A. Nurseptaji, "Implementasi Metode Waterfall pada Perancangan Sistem Informasi Perpustakaan," *Jurnal Dialektika Informatika (Detika)*, vol. 1, no. 2, pp. 49–57, May 2021, doi: 10.24176/detika.v1i2.6101.
10. C. K. H. C. K. Yahaya, M. H. H. Rosly, M. M. A. M. Hamzah, and M. Kassim, "Automated Waterfall Water Level Monitoring for Warning Phenomena," in *2021 IEEE 11th International Conference on System Engineering and Technology, ICSET 2021 - Proceedings*, Institute of Electrical and Electronics Engineers Inc., 2021, pp. 206–211. doi: 10.1109/ICSET53708.2021.9612564.
11. S. Vilkomir, J. Baptista, and G. Das, "Using MC/DC as a Black-Box Testing Technique," 2017.

12. D. Corradini, A. Zampieri, M. Pasqua, and M. Ceccato, "RestTestGen: An Extensible Framework for Automated Black-box Testing of RESTful APIs," in Proceedings - 2022 IEEE International Conference on Software Maintenance and Evolution, ICSME 2022, Institute of Electrical and Electronics Engineers Inc., 2022, pp. 504–508. doi: 10.1109/ICSME55016.2022.00068.
13. G. Arsyia and P. Zaman, "Perancangan dan Implementasi Web Service sebagai Media Pertukaran Data pada Aplikasi Permainan," 2017

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