The development of REST API-based android application for Micro, Small and Medium Enterprises (MSME) in Purbalingga Regency

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Abstract. Micro, small and medium enterprises (MSMEs) have an important and strategic role in national economic development. Purbalingga Regency has an area of 777.64 Km² consisting of 18 Subdistricts with contours of the region which mostly consist of mountains, access to communication and dissemination of information regarding the existence of job vacancies, Micro, Small and Medium Enterprises (MSME) products are absolutely necessary so that the existence of Micro, Small and Medium Enterprises (MSMEs) can improve the standard of living and the economy and equalize employment, especially in the Purbalingga region. The application made in this study is an android based application that can be used by entrepreneurs in the Purbalingga region to register their MSMEs and inform and process job vacancies. The application developed based on the REST (Representational State Transfer) architecture is proven to facilitate the process of data exchange between platforms and systems.

1. Introduction
Micro, Small and Medium Enterprises (MSMEs) have an important and strategic role in national economic development. In addition, to play a role in economic growth and employment, MSMEs also play a role in distributing development outcomes. MSMEs have also proven to be unaffected by the crisis. When the crisis hit in the period 1997 - 1998, only MSMEs were able to remain standing firm. Data from the Central Bureau of Statistics show that, after the 1997-1998 economic crisis, the number of MSMEs did not decrease, it increased steadily, even able to absorb 85 million to 107 million workers until 2012. In that year, the number of entrepreneurs in Indonesia was 56,539,560 units. Of these, there are 56,534,592 units of Micro, Small and Medium Enterprises (MSMEs) or 99.99%. The rest, around 0.01% or 4,968 units are large businesses [1].

The rapid development of MSMEs in Indonesia is not supported by the use of information technology in supporting its business processes. Tona Aurora Lubis in her research concluded that the limited utilization of information technology in MSME players both seen from the use of computers and the internet in managing their businesses was influenced by several key factors (inhibitors and potential supporters) namely a. Low understanding of the benefits of information technology in business development; b. Low Availability of Information Technology Investments; c. Still Low Support from Government Institutions [2].

Utilization of Information Technology in Micro, Small and Medium Enterprises is also influenced by the trend of utilization of communication technology. BPS in 2017 Indonesia Telecommunications Statistics states that the most rapid development is seen in the use of cellular telephones by the people
of Indonesia. The percentage of the population using cellular telephones continues to increase until 2017 reaching 59.59 percent as shown in figure 1.

The growth of mobile phone usage was also followed by the growth of internet usage in households which reached 57.33 percent, while computer ownership declined to 19.11 percent as the media accessed the internet through computers and laptops declined while using mobile phones increased [3].

Hafni Rosfita’s research shows that the role of MSMEs in accommodating labor is very large. Ahmad Rozali in his research suggested that further research be conducted on the role of MSMEs in employment absorption [4]. Latifah Rifan’s research in 2016 has succeeded in developing the application of accounting information systems in the Micro, Small and Medium Enterprises of Surabaya Cake Village by using PHP as a programming language and SQL as a database. Researchers suggest developing the system to be carried out gradually so that it is easier, more effective and efficient [5].

Based on previous studies, comprehensive system development is needed to get applications that can accommodate all existing business processes. Purbalingga with an area of 777.64 Km² consisting of 18 Subdistricts having business fields in Agriculture, Forestry, and Fisheries which contributed a contribution of 4,095,161 followed by Processing Industry, Large Trade and Retail, Car and Motorcycle Repair from the total value-added goods and [6] as well as having a contour of the area consisting mainly of mountains, access to communication and information dissemination regarding the existence of job vacancies, Micro, Small and Medium Enterprises (MSME) products is absolutely necessary so that the existence of Micro, Small and Medium Enterprises (MSMEs) can improve living standards and the economy and even job vacancies, especially in the Purbalingga region.

Android Mobile Application Development Based on REST API for Micro Enterprises in Purbalingga Regency is expected to be able to reach entrepreneurs in rural and remote areas in Purbalingga district by utilizing mobile technology that is growing rapidly at this time.

2. The architecture of MSME Information Systems

An information system is an integrated system that is able to provide useful information for its users. In other words, information systems are integrated systems or human-machine systems, to provide information to support operations, management within an organization. This system utilizes computer hardware and software, manual procedures, management models and databases. [7]

Android Application Development Based on REST API for Micro Enterprises in Purbalingga district is the initial stage in the utilization and integration of data on Micro, Small and Medium Enterprises in Purbalingga Regency in relation to the MSME Information System.

At this stage, a server application based on the REST API was developed which would later be able to accommodate and provide data that could be used in other application applications that are derivative.
applications. Figure 2 shows the architecture of the plan for developing the Information System for Micro, Small and Medium Enterprises in Purbalingga Regency.

**Figure 2.** The architecture of Purbalingga MSME Information System Development Plan

The stages of the stages/phases planned in the development of the Purbalingga MSME Information System can be explained as follows:

a. Android / IOS data App: at this stage an application system based on the Purbalingga MSME REST server was developed which was intended to obtain data from MSME entrepreneurs spread in purbalingga district, the output of this stage is a mobile-based application that can be used in the process of collecting information on business fields, products, and job vacancies that can be used in the data verification process.

b. Web Information System: At this stage developed an existing REST API-based Web application, this web application is used as an information system for general users who do not use mobile applications.

c. Online Multiplatform Registration: at this stage, an application system based on the Purbalingga MSME REST server was developed which was intended to facilitate entrepreneurs and entrepreneurs to register their business fields directly online. At this stage, it is expected that the Purbalingga UKM REST API system can be linked to the National System for MSME Registration to facilitate users in the process of processing MSME permits.

d. Product Marketing: at this stage, an application system based on the Purbalingga MSME REST server was developed which was intended to assist entrepreneurs in carrying out product marketing processes through applications made.

e. Community System: at this stage further integrated and verified data can be developed in the form of a Community System that provides a platform for the community of entrepreneurs in Purbalingga to utilize available data.

f. Data Interconnection: at this stage, the application system is based on Purbalingga's SME REST server that has sufficient data to connect and provide services for multiplatform applications.

g. Data Analysis System: at this stage, the adequacy of the data has met the requirements for the data analysis process to draw important information based on the existing scientific method.

h. Business Intelligent System: at this stage, the results of data analysis can be drawn to create an integrated system capable of providing suggestions and estimates of a condition based on existing data.
3. Analysis of System Requirements

As an initial stage in the development of an Information System for Micro, Small and Medium Enterprises (MSMEs) interviews and literature studies will be carried out on the parties who will be stakeholders of the system to be created. From the results of the system requirements analysis carried out obtained Software Requirements for the development of phase 1 of the Purbalingga MSME information system as shown in table 1.

| Kode | Requirements |
|------|--------------|
| SR-00 | The REST API system must be accessible by various programming language platforms that utilize REST APIs in their communication |
| SR-01 | The REST API system must be able to accommodate basic data from MSME Owners |
| SR-02 | The REST API system must be able to accommodate basic data from an MSME |
| SR-03 | The REST API system must be able to accommodate basic data from the products owned by an MSME |
| SR-04 | The REST API system must be able to verify the incoming MSME data |
| SR-05 | The REST API system must be able to accommodate job vacancies provided by MSMEs that have been registered and registered |
| SR-06 | The REST API system must be able to accommodate data on job applicants using mobile-based applications |
| SR-07 | The mobile application must be able to be used easily in the Login process in this case utilizing a user's Google account |
| SR-08 | Mobile applications must ensure the security of user sessions and data |
| SR-09 | Mobile applications must be able to implement the REST protocol API provided by UMKM servers (SR-01 - SR-06) |
| SR-10 | The mobile application must be able to generate Member Cards dynamically |

4. System Design

The system design process is done by following the Software Requirements document that has been made previously (SR-01 - SR-10). In general, the system design architecture that will be created is shown in Figure 3.

![Figure 3. System Architecture](image)

Figure 3 shows the general architecture of the system that will be created. The database will be a data repository while resources for connected application applications will be provided by the REST Server.
4.1. REST API Server

REST (Representational State Transfer) is an architecture of a communication method that generally uses the HTTP protocol to create and manage data communications so that the system can have the good and easy performance to develop [8]. REST itself was made by Roy Fielding from the University of California. Rest is a simplified and lighter web service compared to SOAP. REST separates client and server, client and server have different and separate duties and responsibilities. Each request (request) that comes from the client will have all the information needed to service the request. The response that the client will receive will be based on the request [9].

REST is a web service that applies the concept of switching between states wherein navigating REST via HTTP links to perform certain activities Response from a web service REST can be XML or JSON [10]. In the development of the Purbalingga MSME System, REST (Representational State Transfer) was based on PHP programming with the Code Igniter framework. This server application functions as a provider of information resources on multiplatform clients. REST uses several common methods in web communication, namely POST, GET, PUT and DELETE in the transaction process. The message sent by the server is an HTTP code in the header. Table 2 shows the HTTP code that is often used in using the REST API [11]

| HTTP Code   | Description                                                                 |
|-------------|-----------------------------------------------------------------------------|
| 200 OK      | The command sent to the server is correct and successfully executed.         |
| 400 Bad Request. | The command sent to the server contains an incorrect entry            |
| 401 Unauthorized. | The sender of the command sends the wrong keycode                       |
| 403 Forbidden | The sender of the command does not have access rights to the intended resource|
| 404 Not Found Resource | The destination is not found on the server                             |
| 429 Too Many Requests | The sender of the order accesses to reach/exceed the limit that has been determined from a certain time limit. |
| 500 Internal Server Error | The server or program snippet in the resource has an error.             |

4.1.1. Database Structure, the database is a data set that describes activity from one or several related entities [12]. Database design carried out on Micro, Small and Medium Business Information Systems (MSMEs) refers to the needs defined in table 2. Figure 4 shows the relation table from the database created.
4.1.2. API / Web Service, the REST method has the advantage of being faster and more efficient than the SOAP method, besides that, in its implementation, the REST method has more efficient resource consumption [13]. REST which is developed based on the CodeIgniter framework has a function as a resource provider in the form of data/information originating from the database. The API address provided by the REST server that was created and its function is shown in table 3.

**Table 3. WEB API and Its Functions**

| No. | URL Address       | Method | Description                                                                 |
|-----|-------------------|--------|-----------------------------------------------------------------------------|
| 1.  | /API/Ukm          | Get    | Display a list of all MSMEs that have been verified                         |
| 2.  | /API/UkmUser      | Get    | Displays a list of MSMEs from the intended user                            |
|     |                   | Put    | Updating UMKM data that is available on the database and has been verified |
|     |                   | Post   | Enter new MSME data                                                        |
|     |                   | Delete | Delete selected MSME data                                                  |
| 3.  | /API/Produk       | Get    | Display a list of products available from verified MSMEs                  |
| 4.  | /API/ProdukUser   | Get    | Displays a list of products available from a user from a particular MSME   |
|     |                   | Put    | Updating Product data                                                      |
|     |                   | Post   | Enter data on new products from MSMEs                                     |
|     |                   | Delete | Delete selected Product data                                               |
| 5.  | /API/Lowongan     | Get    | Display a list of available vacancies from verified MSMEs                 |
| No. | URL Address  | Method | Description |
|-----|-------------|--------|-------------|
| 6.  | /API/LowonganUser | Get | Displays a list of vacancies available from a user from a particular MSME |
|     |             | Put   | Updating Job Data |
|     |             | Post  | Enter new job data from MSMEs |
|     |             | Delete| Delete selected Job data |
| 7.  | /API/User   | Get   | Displays a list of Users available in the MSME system |
|     |             | Put   | Updating User Data |
|     |             | Post  | Enter new data New users |
|     |             | Delete| Delete selected User |

Access to the address of the API can be done with a variety of programming languages. Figure 5 shows an API call in the Python language:

```python
import requests
url = 'localhost/ukmrest/apix/ukm?key=99'
headers = {}
response = requests.request('GET', url, headers = headers, data = payload, files = files, allow_redirects=False, timeout=undefined, allow_redirects=false)
print(response.text)
```

**Figure 5.** Example of calling API in Python language

Figure 6. Shows the server response in the form of JSON:

```json
{
  "status": true,
  "data": [
    {
      "id_ukm": "2",
      "id_user": "1",
      "idstatus": "2",
      "nama_ukm": "Sumbe Makmur",
      "alamat": "Jl. Makmur no.14",
      "jam_buka": "08:00:00",
      "jam_tutup": "15:00:00",
      "noijin": "0912093021930"
    }
  ]
}
```

**Figure 6.** JSON output

### 4.3. Android Mobile Application

The REST API can be called and applied to various programming languages. Implementation carried out in this study in accordance with the architecture in Figure 3 is applied to Android mobile applications using the Java programming language and the Android Studio IDE (Integrated Development Environment)

#### 4.3.1. Authentication Process

Authentication is the process of filtering users (users) who will access the application. In accordance with the needs of the software made in this case SR-07, the system applies Google authentication as part of User authentication.
Figure 7 shows the order of authorization, starting when the application calls the Google URL. The URL includes a query parameter indicating the type of access requested. Google handles user authentication, session selection, and user approval. The result is an authorization code, which can be exchanged for applications with access tokens and refresh tokens [14]. The token that has been obtained from Google will then be stored in the MSME database which will be used as the user's key when accessing the service from the API provided by the REST server. Figure 8 shows the implementation of using Google sign on the application developed.

Figure 8. Use of a Google Account in the user authentication process

4.3.2. The MSME membership card, the MSME membership card uses QR Code technology. QR codes (abbreviated as Quick Response Code) are trademarks for a type of barcode matrix (or two-dimensional
barcode) that was first designed in 1994 for the automotive industry in Japan. QR codes use four standard coding modes (numeric, alphanumeric, byte/binary, and starch) to store data efficiently. In the mobile application developed, the QR Code is generated from tokens which are encrypted with the MD5 algorithm. Changing Token values and dynamically guarantee the security of the use of the QR Code in future transactions. Figure 9 shows the implementation of using the QR Code in the application that has been made.

![Figure 9. MSME cards with dynamic QR Code](image1)

![Figure 10. Application Menu](image2)

4.3.3. Management of MSMEs, Software Requirements SR-09 writes that mobile applications must be able to implement the REST API protocol provided by MSME servers (SR-01 - SR-06). The implementation of SR01-SR06 is created in the application menu shown in figure 10. Figure 11 shows the implementation of the menu in Figure 10.

![Figure 11. Menu Implementation](image3)
Android applications created have been able to implement all APIs provided by the REST server that has been created. So that it has met all the software requirements that have been determined.

5. Conclusion
The results of the research can be concluded as follows
a. The development of an Android application for Micro, Small and Medium Enterprises (MSMEs) based on REST API for Micro Enterprises in Purbalingga Regency has been successfully implemented and fulfills the specified software requirements (User Requirements)
b. The REST server created based on the CodeIgniter framework can apply all existing header requests (POST, GET, PUT, DELETE)
c. As the initial phase of the 8 stages of the development of the Micro, Small and Medium Business Information System (MSME), the development of Android-based applications is able to prove that the REST server created can serve requests for resources from various programming language platforms.
d. It is necessary to test the performance of the REST server with regard to the number of incoming requests.

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