APPLICATION OF THE HAVERSINE DISTANCE METHOD TO THE JOB AND VACANCIES SEARCH SYSTEM IN THE ENTERTAINMENT SECTOR IN INDONESIA

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Abstract

The International Monetary Fund (IMF) projects that the poverty rate in Indonesia will reach 5.2% by 2024, ranking 59th in the world, Indonesia is the country in Southeast Asia with the highest poverty rate. The second highest poverty rate is in 2023. The percentage is projected to reach 5.3% this year. According to the Central Statistics Agency (BPS), in August 2023 the number of open unemployment in Indonesia will reach 7.86 million people, equivalent to 5.32% of the total national workforce. The Philippines will face the highest poverty rate in the region, followed by Indonesia next with a poverty rate of 5.4%. By 2023. this high poverty rate reflects the urgent need to create jobs. Therefore, the author conducted this research with the aim of addressing the problem of high unemployment rates through a centralized platform that offers job search features and vacancies based on the nearest location for job seekers and providers in the entertainment field, which can be accessed anytime and anywhere. The result of this research is an android application that can facilitate and assist in finding or providing jobs. Through this research the author can contribute to the growth of the entertainment industry in Indonesia, creating new income opportunities for individuals with skills that are usually performed on-site such as singers, magicians, comedians, models, presenters, and other talents in the entertainment sector. This study adopts a qualitative approach, uses the prototype method in the development of the application and applies the Haversine method to calculate the distance between two coordinate points. Thus this study can make a positive contribution in addressing the unemployment problem and increasing job opportunities in the entertainment sector in Indonesia.

Keywords: *Android Platform, Haversine, Job and Vacancy Locator System.*

PENERAPAN METODE HAVERSINE DISTANCE PADA SISTEM PENCARIAN TENAGA KERJA DAN LOWONGAN PADA SEKTOR HIBURAN DI INDONESIA

Abstrak

The International Monetary Fund (IMF) memproyeksikan, tingkat kemiskinan di Indonesia akan mencapai 5,2% pada tahun 2024, menempati peringkat ke-59 di dunia, Indonesia adalah negara di Asia Tenggara yang memiliki tingkat kemiskinan tertinggi. Tingkat kemiskinan tertinggi kedua pada tahun 2023. Persentasenya diproyeksikan mencapai 5,3% tahun ini. Menurut Badan Pusat Statistik (BPS), pada Agustus 2023 jumlah pengangguran terbuka di Indonesia akan mencapai 7,86 juta orang, setara dengan 5,32% dari total tenaga kerja nasional. Filipina akan menghadapi tingkat kemiskinan tertinggi di kawasan tersebut, diikuti oleh Indonesia selanjutnya dengan tingkat kemiskinan 5,4%. Pada tahun 2023, tingkat kemiskinan yang tinggi ini mencerminkan kebutuhan mendesak untuk menciptakan lapangan kerja. Oleh karena itu, penulis melakukan penelitian ini dengan bertujuan untuk mengatasi masalah tingginya tingkat pengangguran tersebut melalui platform terpusat yang menawarkan fitur pencarian pekerjaan dan lowongan berdasarkan lokasi terdekat bagi pencari kerja dan penyedia di bidang hiburan, yang dapat diakses kapan saja dan di mana saja. Hasil dari penelitian ini yaitu sebuah aplikasi android yang dapat memfasilitasi dan membantu dalam pencarian atau menyediakan pekerjaan. Melalui penelitian ini penulis dapat berkontribusi pada pertumbuhan industri hiburan di Indonesia, menciptakan peluang pendapatan baru bagi individu dengan keterampilan yang biasanya dilakukan di tempat seperti penyanyi, pesulap, komedian, model, presenter, dan bakat lainnya di sektor hiburan. Penelitian ini mengadopsi pendekatan kualitatif, menggunakan metode prototipe dalam pengembangan aplikasi dan menerapkan metode Haversine untuk menghitung jarak antara dua titik koordinat. Dengan demikian studi ini dapat memberikan kontribusi positif dalam mengatasi masalah pengangguran dan meningkatkan peluang kerja di sektor hiburan di Indonesia.*

1. INTRODUCTION

The International Monetary Fund (IMF) projects that the poverty rate in Indonesia will reach 5.2% by 2024, ranking 59th in the world, [1] Indonesia is the country in Southeast Asia with the highest poverty rate. The second highest poverty rate will be in 2023. [2] The percentage is projected to reach 5.3% this year. According to the Central Bureau of Statistics (BPS), in August 2023 the number of open unemployment in Indonesia will reach 7.86 million people, equivalent to 5.32% of the total national labor force. [3] The Philippines will face the highest poverty rate in the region, followed by Indonesia next with a poverty rate of 5.4%. By 2023. [4].

Meanwhile, the media and entertainment industry has witnessed tremendous growth and continues to set new trends with significant global impact. [5] According to data quoted by Katadata from PricewaterhouseCoopers (PWC), global revenue in the media and entertainment industry has been steadily increasing since 2014. In 2021, global entertainment industry revenue reached $2.4 trillion USD, marking an increase of $0.1 trillion USD from the previous year. [6] Katadata data also predicts this revenue growth will continue until 2023.

However, job seekers in the entertainment sector face challenges in finding job opportunities and reaching a wide market share.[7] The lack of a centralized platform to connect freelancers with employers in the entertainment industry is one of the hurdles faced. Advances in Information and Communication Technology (ICT) present a significant opportunity[8] to address the issue of unemployment and facilitate access to employment for freelancers in the entertainment industry. In recent years, there has been a significant increase in the use of smartphones in Indonesia, [9] with millions of people having access to such devices. This creates a strong foundation for the development of mobile applications as a solution to connect freelancers with employers in the entertainment sector.

This study aims to design and develop a centralized platform based on the Android system, using the haversine method, that serves as a hub for freelancers in the entertainment sector in Indonesia. This application is designed to assist individuals with various talents that can be displayed on the spot such as singers, [10] magicians, [11] comedians, [12] models, [13] and others, in finding suitable job opportunities.

With this system in place, freelancers in the entertainment sector can more easily find job opportunities that match their skills, increase their income, and reduce unemployment.[14].

2. RESEARCH METHOD

2.1. Method of Collecting Data

2.1.1. Literature Review

Data collection is conducted by studying, researching, and reviewing various literature sources from libraries, including books, scientific journals, websites, and other relevant readings related to the research being conducted.

2.2. Field Study

Field study is a data collection technique by conducting research and direct review of the problems taken[15] In this research, field studies are conducted directly within the community, which includes:

2.2.1. Surveys

The author uses the Google Form platform as the main tool. To ensure the validity and relevance of the data, the author selectively distributed this questionnaire to freelancers, focusing on forums on social media that specifically target freelancers in the entertainment sector.

2.3. System Design Methods

The author uses the prototyping method as an approach to application development which involves creating an initial model or prototype to test, demonstrate and get feedback. The aim of using this method is to identify user needs, validate the design, and minimize the risk of inefficient development.[16] In developing applications using the prototyping method there are also stages in the process, namely:
1.   Requirement Analysis And Definition
This phase involves identifying user needs, objectives, and requirements that the application aims to fulfill. These requirements are gathered through questionnaires [17] distributed to entertainment industry workers, which are then analyzed and used as a reference for feature development within the application
2.   Planning
During this stage, the prototype planning[18] process takes place. This includes translating user requirements into application features, selecting an appropriate prototyping approach, and identifying the resources necessary for the application development.
3.   Design
The design phase involves creating an initial prototype based on the identified needs and requirements. The prototype design includes the visual layout, user interface, and functional features

to be tested. in this study the authors designed the application using figma. [19]

4. Development

This stage entails turning the initial prototype design into a testable and evaluable form. The application is developed using suitable tools and technologies [20] ording to the planning, and the initial prototype design is implemented into code that can be compiled into an application.

5. Testing

Following the completion of application development, testing and evaluation phases are conducted. The method employed during this stage is black box testing, [21] which aims to assess the effectiveness of application features and identify any potential issues.

The sequence and steps in the research method can be seen in the flowchart below

Figure 2.1: Research flow

2.4. Haversine Method

In this research, the haversine method is used as a tool to measure the distance or similarity between existing data in the worker locator system and job vacancy finder for the entertainment industry in Indonesia.[22] Haversine distance is a commonly used method to measure the distance between two points on a spherical surface, such as the Earth.[23] This method assumes that the Earth is a perfect sphere and calculates the distance between two points using the Haversine formula, which takes into account the latitude and longitude of the points. In the context of a worker and vacancy search system, each data (both worker data and vacancy data) is represented as a coordinate point that has a longitude and latitude.

The author uses the Haversine formula as the basis for calculating the distance between two geographic coordinate points (longitude and latitude) in meters. The use of the haversine method as a tool to measure distance in this study can be seen in Figure 2.2 below:
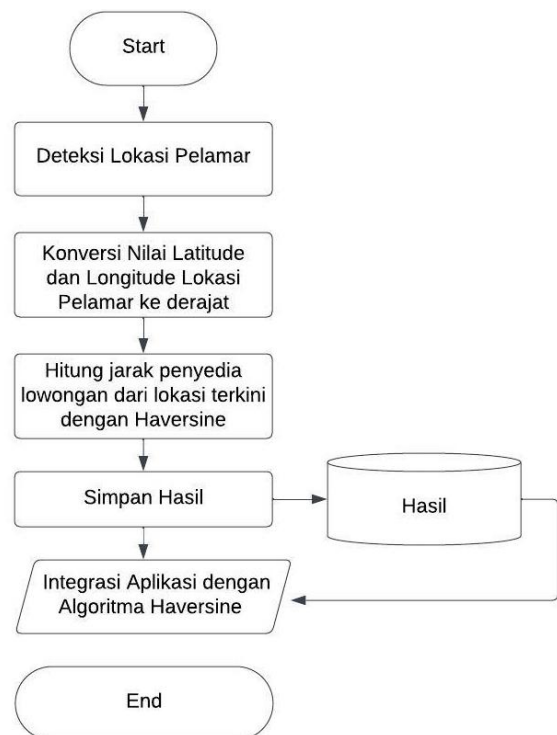

Figure 2.2: Flowchart of Haversine Calculation

3. RESULTS

3.1. Requirements Data Analysis

3.1.1. Age and Profession

Through the participation of 19 respondents, the data shows that various professions are involved, such as singers, painters, models, magicians, etc. With an average age of 21 years, which is a productive age, the analysis results show that the Singer profession tops the list in terms of popularity, reaching 10.5% of the total 19 population data results can be seen in figure 3.1 and 3.2 below.
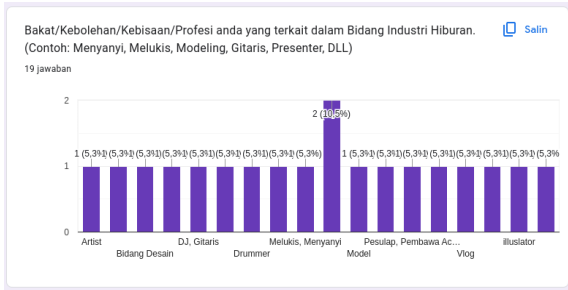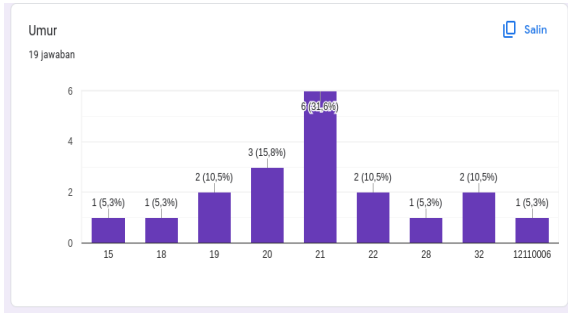
Figure 3.1: Profession Diagram

Figure 3.2: Ages Diagram

3.1.2. Interest and Income

Based on the data obtained through the questionnaire, the majority of participants have shown interest in earning income through their talents. In addition, most of the participants already have experience in their respective fields, which indicates that they have earned income from their talents before. This data shows that there is significant potential for freelancers in the entertainment industry to earn income through their talents, and there are already some participants who have successfully done so. these results can be seen in figures 3.3 and 3.4 below

Figure 3.3: Interest Diagram

Figure 3.4: Income Diagram

3.1.3. Age and Profession

The questionnaire data revealed significant challenges for freelancers in accessing their target audience, particularly the lack of government support and effective promotional platforms. In addition, all respondents highlighted the need for a centralized platform to promote their services and connect with clients. These findings underscore the urgent demand among entertainment freelancers for a unified platform that simplifies interaction with clients, overcomes barriers, and expands market outreach opportunities. The results can be seen in Figures 3.5 and 3.6 below.

Figure 3.5: Challenges Diagram

Figure 3.5: Needs Diagram

3.1.4. Specific Needs in Application Features

Based on the questionnaire data, the participants highlighted several features needed in the app: job search, talent search, in-app messaging, image uploads for professional support, and in-app payments. The data shows that the four most important features are job search, in-app messaging, image uploads for professional support, and talent search. the results can be seen in the following figure
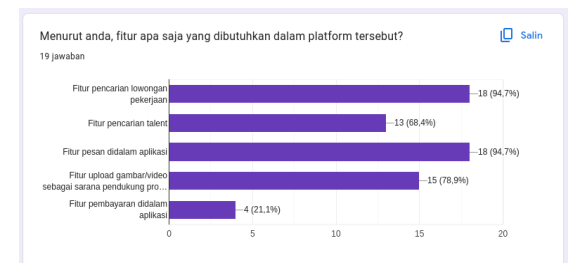

Figure 3.6: Specific Needs in Application Features Diagram

3.2. Flowchart

At the initial system design stage, the author uses flowcharts to design the flow and algorithm of the system to be developed. Flowchart serves as a visual tool to provide a rough overview of how the

system will operate, illustrating the sequence of steps and the decision-making process in system operations in a simple and understandable way.[10] By using flowchart, the author can identify important components in the system and gain initial insight into the design and functionality needed to achieve system goals. the flowchart can be seen in the figure below.

3.2.1. Authentication

Gambar 3.7: Authentication Flowchart

3.2.2. Edit Profile

Figure 3.8: Edit Profile Flowchart

3.2.3. Apply for Job Vacancies

Image 3.9: Apply for Job Vacancies Flowchart

3.3. Activity Diagram

The author utilizes an Activity Diagram to depict the workflow scenarios and interactions within the system. The Activity Diagram aids in visualizing the workflow and processes within the system in a more structured manner. [11] With this approach, system development can be carried out more efficiently according to user needs and expectations.
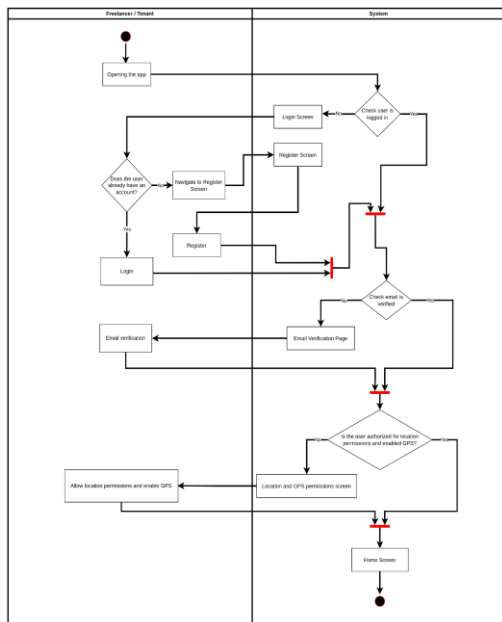
3.3.1. Authentication

Figure 3.10: Authentication Diagram Activity

When the user opens the application, the system will check if the user is logged in. If not, the system will prompt the user to log in using an existing account or register if they do not have an account. After logging in, the user is directed to verify their email as a security measure before using the app fully. Next, the system will ask for permission to access the user's location and enable GPS on their device. After completing all verification and permission steps, users can finally access the Homepage. as for these stages can be seen in the image below.

3.3.2. Edit Profile

To access profile information, users need to navigate to the Account page from the Home page and select the "My Profile" menu. If the user has previously completed profile information, they will be able to view and edit that information directly. However, if the profile information is incomplete, the user will be prompted to complete it before being able to access the profile page. This process is necessary because when completing the profile information, the user can also activate the "Open for bidding" feature so that the user's profile can appear on the Freelancer Dashboard page. as for these stages can be seen in the image below.
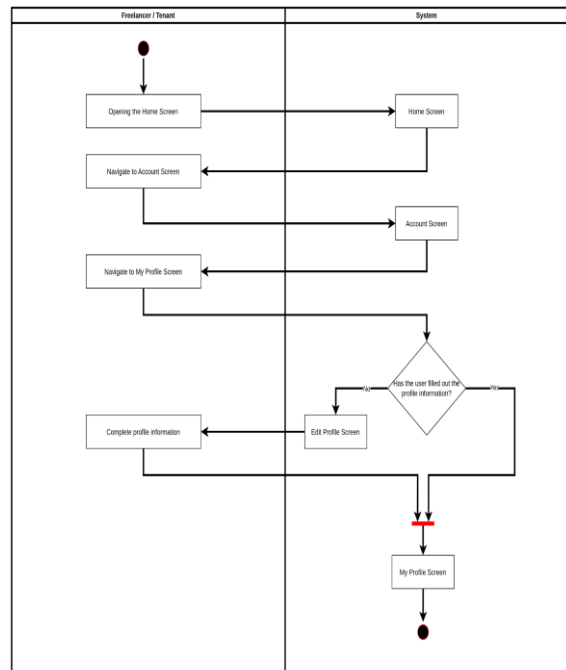

Figure 3.11: Authentication Diagram Activity

3.3.3. Applying for a Job Vacancy

To help freelancers find suitable vacancies, users can navigate to the "Job Vacancies" page and select jobs that match their skills. Once selected, the system will display the job vacancy detail page. Next, the system performs a check to determine whether the "Contact" button will be displayed or not. If the user is the owner of the post, then the "Contact" button will

not appear. However, if the post belongs to another user, then the "Contact" button will be displayed. With the "Contact" button, users can contact the vacancy provider through the message feature in the application. as for these stages can be seen in the image below
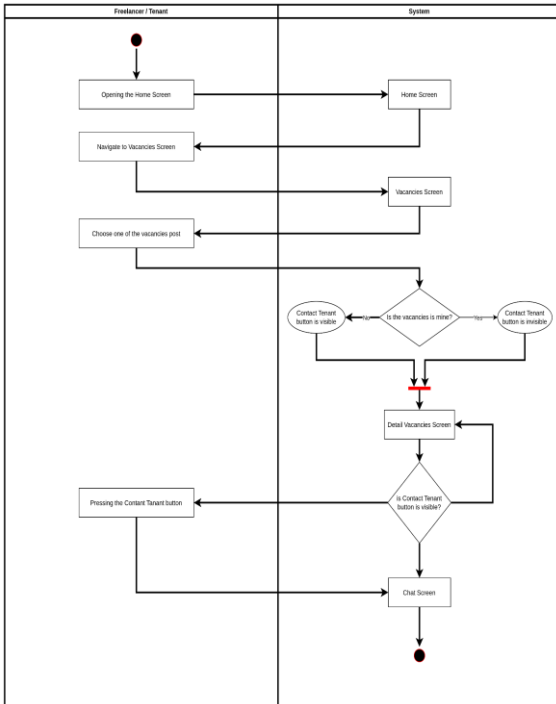

Figure 3.12: Applying for a Job Vacancy Diagram Activity

3.4. Interface Design

At this stage the author designs the User Interface design.
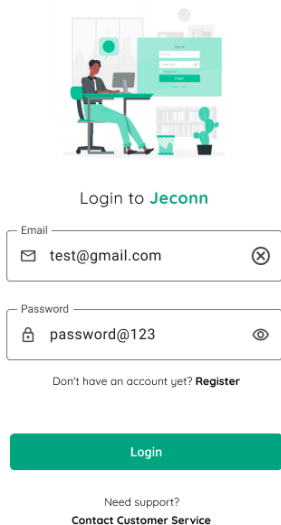
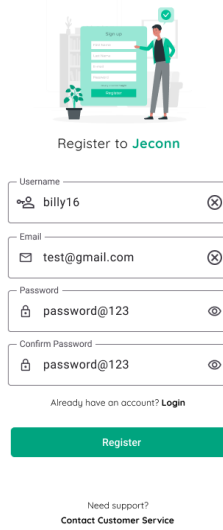### 3.4.1. Login Screen

Figure 3.12: Login Screen Design

3.4.2. Register Screen

Figure 3.14: Register Screen Design
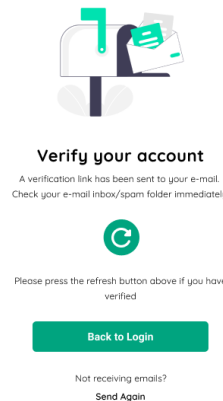
3.4.3. Email Verification Screen

Figure 3.15: Email Verification Screen Design

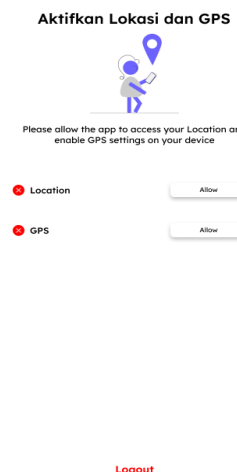### 3.4.4. Location and GPS Permissions Screen

Figure 3.16: Location and GPS Permissions Screen Design

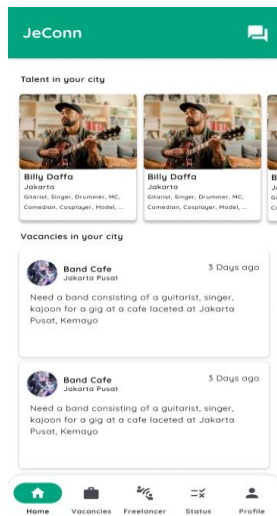### 3.4.5. Home Screen

Figure 3.17: Home Screen Design
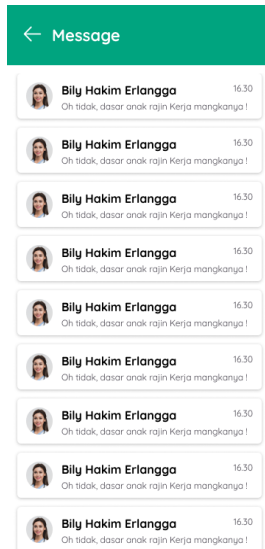
3.4.6. Message List Screen

Figure 3.18: Message List Screen Design

Detail Message Screen

Figure 3.19: Detail Message Screen Design
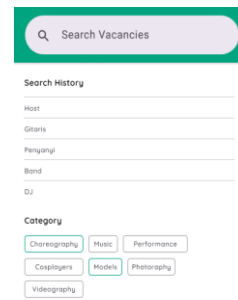
3.4.7. Search Vacancies Screen

Figure 3.20: Search Vacancies Screen Design
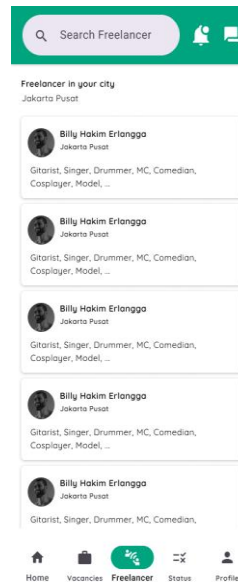
3.4.8. Freelancer Screen

Figure 3.21: Freelancer Screen Design

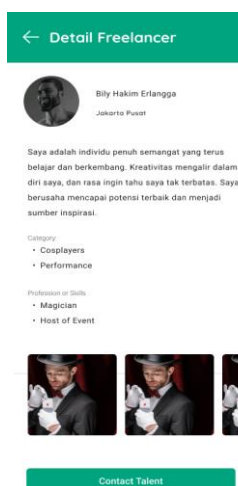### 3.4.9. Detail Freelancer Screen

Figure 3.22: Detail Freelancer Screen Design
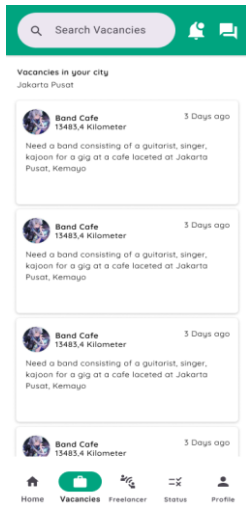
3.4.10. Vacancies Screen

Figure 3.23: Vacancies Screen Design

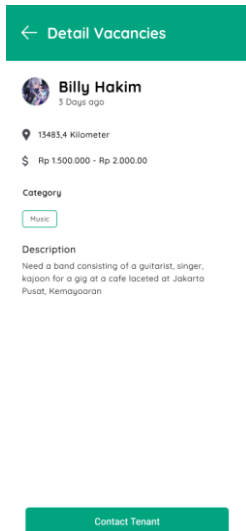### 3.4.11. Detail Vacancies Screen

Figure 3.24: Detail Vacancies Screen Design
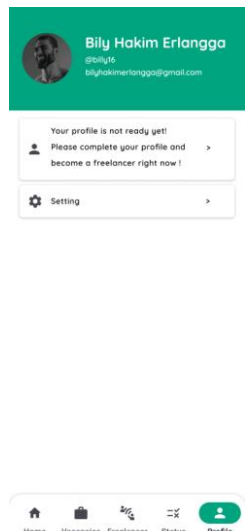
3.4.12. Profile Screen

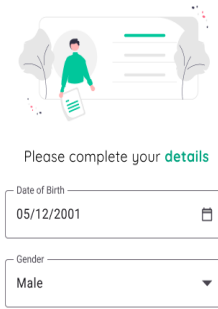Figure 3.25: Profile Screen Design

3.4.13. Edit Profile Screen

Figure 3.26: Edit Profile Screen Design

3.4.14. Setting Screen
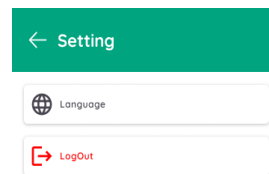
Figure 3.27: Setting Screen Design

3.5. Implementation

3.5.1. Application of haversine

Using the Haversine formula as the basis for calculating the distance between two geographic coordinate points (longitude and latitude) in meters.

$$a = sin^2 \left(\frac{\Delta lat}{2}\right) + cos(lat_1) \cdot cos(lat_1)$$

$$b = cos(lat_2) \cdot sin^2 \left(\frac{\Delta lon}{2}\right)$$

$$c = a \cdot b$$

$$d = 2 \cdot atan \left(\sqrt{(c)}, \sqrt{1-c}\right)$$

$$distance = earthRadius \cdot c$$

a. *lat1* and *lon1* are the latitude and longitude of the first point in radians.
b. *Δlat* is the latitude difference between the second point and the first point.
c. *Δlon* is the difference in longitude between the second point and the first point.
d. *c* is the part of the Haversine formula that calculates the angle between two points on the Earth's surface.
e. *d* is the angle between two points calculated using inverse trigonometry.
f. *earthRadius* is the radius of the earth in meters.
g. *distance* is the distance between two points in meters.

3.5.2. Application of haversine in code

The haversine distance formula is implemented into the Kotlin programming language.

```
fun calculateDistance(point1: LocationEntity, point2: LocationEntity): String {
    val earthRadius = 6371 // radius of the earth in kilometers

    val lat1 = Math.toRadians(point1.latitude!!)
    val lon1 = Math.toRadians(point1.longitude!!)
    val lat2 = Math.toRadians(point2.latitude!!)
    val lon2 = Math.toRadians(point2.longitude!!)

    val dLat = lat2 - lat1
    val dLon = lon2 - lon1

    val a = kotlin.math.sin(x dLat / 2)
        .pow( n 2) + kotlin.math.cos(lat1) * kotlin.math.cos(lat2) * kotlin.math.sin(
        x dLon / 2
    ).pow( n 2)
    val c = 2 * kotlin.math.atan2(kotlin.math.sqrt(a), kotlin.math.sqrt( x 1 - a))

    val distance = earthRadius * c

    val formattedDistance = String.format("%.1f", distance)

    return "$formattedDistance Kilometer"
}
```

Figure 3.28: Calculate Haversine Distance Function

3.6. Testing

This stage involves testing each feature in the application using the black box testing method with the aim of analyzing the effectiveness of these features and identifying potential problems.[12] In black box testing, the main attention is focused on the inputs and outputs of the application, without requiring a deep understanding of its internal structure.[13] With this approach, testing will identify errors or differences between expected and actual results. Using this method, each feature of the application will be tested comprehensively to ensure that the application performs as expected and provides a good experience to the user.

Table 1 Table Blackbox Testing

No	Feature	Test Case	Result	Conclusion
1	Login	When not logged into the app	System will navigate into the Login Screen	Valid
2	Register	When a user registers	System will navigate into the Register Screen	Valid
3	Account verification	When the user has not verified	System will navigate into the Verification Screen	Valid
4	Location and GPS Permissions	When the user has not authorized the app to access location and GPS	System will navigate into the Permission Screen	Valid
5	Home	When the user opens into the application	System will navigate into the Home Screen and display the latest 5 data with workers and job vacancies with the haversine distance.	Valid
6	Vacancies	When a user opens the Vacancies Screen	System will navigate into the Vacancies Screen and display all job vacancy data sorted by the latest posting date with the haversine distance.	Valid
7	Freelancer	When a user opens the Freelancer Screen	System will navigate into the Freelancer Screen and display all freelancer data sorted by the latest posting date with the haversine distance.	Valid
8	Chat	When a user contacts another user	System will navigate into the Chat Screen	Valid

4. DISCUSSION

This research concludes that the term "job seeker" refers to someone who is actively looking for employment. A job seeker engages in routine activities to search for job vacancies and information about employment opportunities. In the context of Indonesia, the number of available job openings is relatively small compared to the existing unemployed population. This leads to intense competition among job seekers to apply and strive to be the best. Therefore, to address this challenge, job seeker websites are used as a source of employment information, making it easier for job seekers to find jobs that match their desires.

This study concludes that in 2021, the global entertainment industry's revenue reached USD 2.4 trillion, marking an increase of USD 0.1 trillion compared to the previous year. Data presented by Katadata also predicts that this revenue growth will continue through 2023.

This research concludes that there is a difference in the TPT (Total Productivity of Labor) value in Indonesia between the period before and during the Covid-19 pandemic. Factors that influenced the TPT during the 2010-2021 period include the growth rate of the Gross Regional Domestic Product (GRDP), the Human Development Index (HDI), and the occurrence of the Covid-19 pandemic. However, the values of the Minimum Wage Level (UMP) and inflation did not have a significant impact on the TPT.

This research has found that unemployment has a significant impact. The higher the unemployment rate, the higher the poverty level. This study requires further refinement, especially in the context of policies that can be implemented to address the issues of unemployment and poverty.

This research concludes that the feature of receiving and sending messages within an application is an effective means of communication. This feature allows users to interact and communicate efficiently through messaging.

5.   CONCLUSIONS

Based on the discussion that has been described, the following conclusions can be drawn:
1. The application of the haversine method in measuring the distance between workers and vacancy providers can help increase opportunities for workers, especially in the entertainment industry in Indonesia, to reach a wider market share.
2. The features contained in this application have been designed according to user needs obtained through questionnaires.
3. This centralized platform has the ability to be an effective platform in connecting workers and clients, as well as facilitating the meeting process between the two. Thus, this application can provide benefits for freelancers in the entertainment field.

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