Expert System Development on Psychological Tests using a Mobile-Based 16 PF Measuring Instrument

Nyoman Ayu Gita Gayatri¹*, Dian Anggraini Kusumajati ²

¹Computer Science Department, School of Computer Science, 11480 Bina Nusantara University, Jakarta, Indonesia
²Character Building Development Center, Information Systems Department, School of Information Systems, 11480 Bina Nusantara University, Jakarta, Indonesia

Abstract. A personality or psychological test is a measurement or assessment activity through a systematic effort to reveal certain psychological aspects of an individual. This writing is structured to determine a mobile-based online personality test using the 16PF test tool in determining employee positions. The test also includes a comprehensive measure of normal personality which has been shown to be effective because it requires an in-depth needs assessment. The choice of this research is because the role of employees is significant in a company. Employee performance depends on the placement of the employee's position. The subjects used in this study were employees who would be placed in a job and used the 16 PF (The Sixteen Personality Factor Questionnaire) measurement method. Expert System is a system built to transfer the ability of one or several experts into a computer that is used to solve problems faced by users in a particular field. The author builds a mobile-based expert system application that is able to help recognize a person's personality. The process of making the application uses an object-oriented methodology with Unified Modeling Language (UML) visual modeling. The results of this study indicate that the 16 PF measuring instrument can be used to place employees in a position based on their personality.

1 INTRODUCTION

Previous research conducted to the use of an Expert System in the process of detecting a person's personality by using the Website-Based Personality Test application. The conclusion is based on the test results on the Personality Test application, namely the process of knowing a person's personality that is applied in a web-based expert system that can help users find out their personality, so that they can help develop it [1]. It can also help with the limited number of psychologists.

Psychological tests are instruments to measure a person's psychological capabilities such as their behavior and mentality. In practice, the psychological test is the process of understanding individuals about all their attitudes and behavior. Therefore, the psychological test is an important and useful tool for companies if they want to recruit employees and determine employees who deserve to be accepted to work in the company. Personality consists of patterns of thought, behavior, feelings that exist in a person where this is a characteristic that distinguishes that person from other people. Personality comes from the word "personality", in Latin "persona" means mask. It means showing the character or personality, and behavior of a person.

In determining the placement of employees, of course, companies often hold academic tests and also psychological tests. To test the psychological test, companies must work with psychologists to avoid mistakes. The problem that is often faced by companies is the length of time needed to carry out tests if a large number of employees are tested. If using the manual method, it will take a long time to correct employee test results. In addition, the risk of human error is also high if done manually. With the advancement of the current era, of course, technology is also developing rapidly. To reduce human errors that may occur when correcting employee tests, you can use an online-based 16 PF test tool to make it easier and more efficient. If it's done online, psychologists don't need to bring hard files for the test process.

Psychological tests are generally carried out using the old way, namely by giving individuals a pencil and test questions containing questionnaires in paper form. The test items were then collected, the scores from the tests were summed up and interpreted manually. The psychological test process using the old method will take a lot of time and make it difficult for companies to select employees. However, along with technological developments, many companies are adapting to providing psychological tests to facilitate the employee selection process.

The rapid development of technology has provided many benefits for companies in general in supporting their daily activities, including recruiting employees by
developing an online smartphone-based psychological test application. The test application as a support in providing efficiency, accuracy, speed in managing and storing test result data.

An expert system is one of the right software to solve this problem because it is an expert the system can present and use existing data in the knowledge base to temporarily replace the position of someone who has the ability to predict and analyze a person's personality.

For this reason, in carrying out placements that are in accordance with personality, it must be tested using the appropriate measuring instrument. In this study the 16 PF measuring instrument was used to find out what kind of placement suits the employee's personality. The 16 PF test is the most widely used personality inventory, which is based on Cattel's concept of personality factor analysis. 16 PF (The Sixteen Personality Factor Questionnaire) is a personality test created by Raymond B. Cattel which is used to identify the number and nature of human personality. Cattel created a hierarchical personality structure, which describes personality in a broad and detailed way to predict actual behavior. This research shows the difference between doing the 16 PF test kit manually and also doing the 16 PF test online.

1.1 The scope of application of psychological tests

A. This mobile-based application was created using the 16 PF (The Sixteen Personality Factor Questionnaire) method.

B. Software prototyping and implementation simulation.

The psychological test process is used in the recruitment and placement of employees. Therefore, this program aims to provide an android-based psychological test application design that can be done via a smartphone. This Android-based Psychological Test application can simplify the recruitment and placement of employees and simplify all processes.

2 FOUNDATION OF THEORY

2.1 Theories Related to Software Engineering

2.1.1 Object Oriented Programming

Object-oriented systems are systems that focus on Object Oriented Programming, which is an object-oriented programming paradigm. Object oriented (OO) is the right combination of encapsulation, inheritance, and polymorphism or at least an object oriented based language must have support for these three concepts. There are several pillars of Object Oriented, as follows [2]:

- **Encapsulation**. Encapsulation is a mechanism for merging processes and data into an object.

- **Inheritance**. Inheritance is the concept of re-declaring multiple attributes and methods within a closed scope.

- **Polymorphism**. Polymorphism means the ability to accept various forms. With the support of polymorphism, object oriented can send the same message, but interpreted differently by different classes.

2.1.2 Software Development Life Cycle

The Software Development Life Cycle or SDLC is used to design, develop and produce quality, reliable, cost-effective and timely software. The waterfall model is a non-overlapping sequential process model, which means that until the first stage has not been completed, the next stage cannot be started. This model tends to be simple and easy to understand [3].

2.1.3 Unified Modeling Language (UML)

The Unified Modeling Language (UML) is a standard set of diagramming techniques created by Grady Booch, Ivar Jacobson, and James Rumbaugh. The purpose of UML is to provide terms for object oriented and technical diagrams that can describe project system development from analysis to implementation.

2.1.4 Testing (Black Box Testing)

Black-box testing is a testing method that is carried out by viewing the software you want to try out as a black box with inputs and outputs, so that the testers do not need to know how the system works or the internal components contained in the system in carrying out the testing process [4].

2.2 Theories Related to Research Themes

2.2.1 Expert System

An expert system is a computer-based system that utilizes knowledge, facts and reasoning techniques to solve problems that generally can only be solved by an expert in that field. In designing an appropriate expert system, the designed application is required to be able to solve various problems by imitating the performance and thinking of experts or experts [5]. Expert systems can help other people who are not experts in the expert or field to overcome certain problems in accordance with the knowledge base contained in the expert system.
- **User Interface (User Interface).** Is the mechanism used by the user and the expert system to communicate.
- **Knowledge Base.** The knowledge base contains knowledge for understanding, formulating, and solving problems.
- **Knowledge Acquisition.** Is the accumulation, transfer, and transformation of problem-solving skills from knowledge sources into computer programs.
- **Inference Engine/Motor (Inference Engine).** This component contains the mechanisms of mindset and reasoning used by experts in solving a problem.
- **Workplace/Whiteboard.** The workplace is an area of working memory, which is used to record ongoing events including temporary decisions.
- **Facility Explanation.** The explanation facility is an additional component that will increase the ability of the expert system, used to track responses and provide explanations about the behavior of the expert system interactively through questions.
- **Knowledge Improvement.** Experts have the ability to analyze and improve their performance and the ability to learn from their performance.

2.2.2 Mobile Apps

A mobile application is a type of software application developed to run on a mobile device such as a smartphone with the expectation that it can be easily carried, held and used by hand.

2.2.3 Androids

Android is an operating system for mobile devices that is open and based on the Linux operating system. Android can be used by everyone who wants to use it on the device. Android provides an open platform for developers to create their own applications to be used for various software [6].

3 RESEARCH METHODS

In this study using the waterfall method. The waterfall model is a non-overlapping sequential process model, which means that until the first stage has not been completed, the next stage cannot be started. This model tends to be simple and easy to understand.

Based on Figure 2, the following is an explanation of each stage of the waterfall model:

In its development the waterfall method has several stages, namely:

a. **Requirements Analysis**
   In this phase, all software product requirements will be collected and documented in the software requirements specification document.

b. **System Design**
   In this phase, the structure of the entire software will be designed based on the previous phase, namely requirement analysis.

c. **Implementation**
   In this phase, software development will begin. The development will be divided into small programs called units. These units will be tested depending on functionality and integration in the next phase.

d. **Testing**
   In this phase, all units developed in the implementation phase will be integrated. After all units have been integrated, they will then be tested in this phase to check whether they are fit for purpose. Software bugs will be reported, fixed and retested.

4 DESIGN ANALYSIS

Analysis and design of applications using UML diagrams which is a standard language for modeling applications built with object-oriented methodology. The process flow is described using a Use Case Diagram which is intended to form an explanation of the main functions and application behavior in an outline with the hope that the processes that occur in it can be understood easily. The activity on the system is described in the Activity Diagram shown in Figure 4. The following is an explanation of these functions as shown in Figure 3 and Figure 4:

![Use Case Diagram of Expert System Application](https://example.com/use_case_diagram.png)

**Fig. 3. Use Case Diagram of Expert System Application**

Personality test

![Waterfall Model](https://example.com/waterfall_model.png)

**Fig. 2. Waterfall Development Life Cycle**
5 RESULTS AND DISCUSSION

The application screen design is a display design that will later be applied in the application as an interface display. The following is the display design of the Psychology Test application:

5.1 System Implementation

Personality design is a display of data from users who will do a psychological test.

Fig. 4. Activity Diagram Test Page

Fig. 5. Display of the Sign Up and Login Screens

The welcome screen is the first screen the user sees when logging into the application if the user has not logged in using the device or has. All application users can perform the login function by filling in email data and passwords that have been registered in the database. If the credentials are declared valid, the application user will be directed to the application's main page.

Fig. 6. Display Personality Information

Fig. 7. Display of Psychology Test and Test Results

The Psychology test display is the display used by the user in working on the psychological questions displayed by the system.

5.2 System Function Testing

The testing process uses the concept of black-box testing. For black-box testing, application developers carry out testing by trying to run several scenarios in the application. The results of functionality testing using the black box method show that all functions and features in the application for the community from the first time it is run to completion can run well according to what has been planned. There are 5 features that have been tested, Table 1 shows the results of testing the game application.

Table 1. Test Results for the Psychology Test Application

<table>
<thead>
<tr>
<th>No</th>
<th>Testing Information</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sign Up Menu</td>
<td>Passed</td>
</tr>
<tr>
<td>2</td>
<td>Displaying the Login menu can run well</td>
<td>Passed</td>
</tr>
<tr>
<td>3</td>
<td>Displays the Personality Information Menu</td>
<td>Passed</td>
</tr>
<tr>
<td>4</td>
<td>Displaying the Test menu can be used properly</td>
<td>Passed</td>
</tr>
<tr>
<td>5</td>
<td>Displays information on test results that have been carried out along with the history of tests that have been carried out</td>
<td>Passed</td>
</tr>
</tbody>
</table>

5.3 Deployments

When the requirements and non-functionality have been tested and validated, the software will be deployed so that it can be used by users.

5.4 Maintenance

If there are some problems when used by the user, they will be resolved in this phase. And there can be additions
or improvements to the software if the user is not satisfied with the results.

6 CONCLUSION

Psychological test results can be used to optimally improve self-perception and develop exploration in certain areas as well as to determine the position to be assigned to employees. Based on the results of the research conducted, the researchers can draw the following conclusions:

a. With an expert system program to determine employee personality using a mobile-based 16 PF Measuring Tool.

b. The mobile-based employee personality determination expert system program can display personality results and can find out the strengths and weaknesses of each personality and can find out the appropriate positioning for each employee.

c. This expert system is designed interactively which aims to make it easier for users when personality tests and make the system more informative which can be done anytime, anywhere regardless of place and time.

d. This application is not made for entertainment as is widely circulated on the internet, but this application is built really based on knowledge (knowledge base).

e. With the application that researchers have made, companies do not need to use manual methods in determining employee personalities so that it speeds up time in coaching and placing work positions.

References


