Innovative Teaching Through Voice-Activated Visual Multimedia: Supporting Student Practice at Politeknik Negeri Bali

I Ketut Gede Sudiartha[1], Putu Manik Prihatini[2], and Gde Brahupadhya Subiksa[3]

[1,2,3] Information Technology Engineering Department, Politeknik Negeri Bali, Bali, Indonesia
itutde@pnb.ac.id

Abstract. The application of computer technology is needed to help practicum assistants. Politeknik Negeri Bali, through research programs, has developed technology in assisting learning activities/ practicums. The application developed is VMPAs (Visual Multimedia Practice Assistant). At VMPAs, application development utilizes voice command technology for interaction with the application system, which then displays video pieces according to demand or practical needs. With the application, VMPAs can make it easier for lecturers/instructors to provide practical assistance. VMPAs emphasize multimedia-based services with usability testing to observe application functions. This research aims to design VMPAs service systems. The research method used in this study was adapted from the framework of the waterfall research methodology, which starts from the requirements analysis and definition stages, system and software design, implementation and testing unit, integration and system testing, and operational and maintenance. Based on the test results, it can be concluded that the level of VMPA's usability is good.

Keywords: Practicum, Usability, VMPAs

1 Introduction

The development of computer technology plays an important role in the development of multimedia computers. One of the technologies developed is the use of sound to interact with computer systems known as voice-assistants. The technology developed is a combination of voice recognition, language/speech processing, and artificial intelligence as voice synthesis (Abusharkh, S., & Mackey, R., 2021; Brown, P., & Smith, D., 2020; Hossain, M., & Rahman, T., 2022; Lee, C., 2022). The results of sound processing can be used as instructions for responding in the form of sounds, actions, or certain processing processes.

Improving educational services is very necessary in line with developments in computer technology. The role of digital and multimedia makes it easy to convey material and instructions in student practicums. The development of voice assistants in

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the field of education can be applied to delivering group material or personal practical assistance. Personal assistants involve natural language processing (Natural Language Processing) techniques, the development of which places more emphasis on voice commands (Bixby, A., & Carter, J., 2021; Dey, A., & Roy, S., 2021; Jain, R., & Patel, S., 2023; Kumar, A., 2023).

In practice, students often encounter obstacles and require individual explanations. This condition makes it difficult for instructors to handle it individually, while students cannot access information sources directly. For this reason, a system is needed that can be accessed using voice media to display instructions and impressions according to the practice being carried out.

The system is designed as a visual display that can interact with students through sound using voice command techniques. With a multimedia-based interactive visual display system that utilizes voice commands, it is hoped that the system can improve services in teaching in general and practice in particular.

2 Methodology

Fishbone research is conducted in the same way as multimedia research in general. However, more emphasis is placed on sound processing and search techniques for the Interactive Design of Multimedia-Based Visual Displays with the Application of Voice Command to Support Teaching Student Practice at the Politeknik Negeri Bali, as shown in Figure 1.

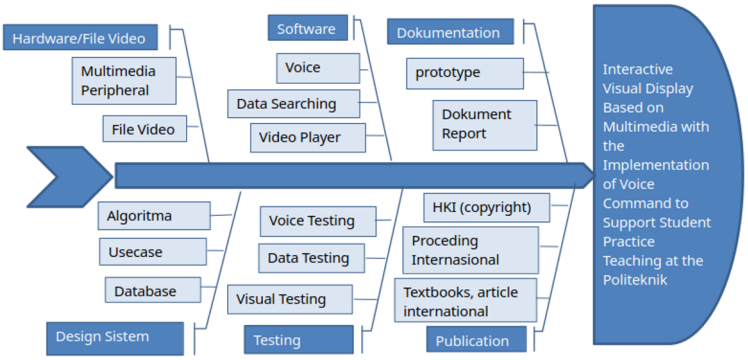

Figure 1. Research Fishbone

The system test flow is divided into two stages. The first step involves testing the design implementation in the laboratory, focusing on the functionality of key features through sound testing, data testing, and visual testing, all conducted using the black box method. The second test is a usability test to see the user's response to the system prototype (Kesuma, 2021; Kushendriawan et al., 2021; Joshi et al., 2022). It is hoped that this research, employing an inductive approach, can demonstrate the feasibility of applying

voice commands to develop interactive visual display systems that support students' practical learning at Politeknik Negeri Bali.

Table 1 shows usability test questions and scores of the Visual Multimedia Practice Assistant application (VMPAs).

Table 1. Usability Questions and Score

No.	Questions	Score
1	I think that I would like to use this product (VMPAs application) frequently.	1 - 5
2	I found the product (VMPAs application) unnecessarily complex.	1 - 5
3	I thought the product (VMPAs application) was easy to use.	1 - 5
4	I thought that I would like to use this product (VMPAs application) frequently. I think that I would need the support of a technical person to be able to use this product. (VMPAs application)	1 - 5
5	I found the various functions in this product (VMPAs application) were well integrated.	1 - 5
6	I thought that I would like to use this product (VMPAs application) frequently. I thought there was too much inconsistency in this product (VMPAs application).	1 - 5
7	I would imagine that most people would learn to use this product (VMPAs application) very quickly.	1 - 5
8	I found the product (VMPAs application) very awkward to use.	1 - 5
9	I felt very confident using the product (VMPAs application).	1 - 5
10	I thought that I would like to use this product (VMPAs application) frequently. I needed to learn a lot of things before I could get going with this product (VMPAs application).	1 - 5

The respondents assessed Table 2.

Table 2. Usability Score Index

Score	Answer
1	Strongly Disagree
2	Disagree
3	Neutral / Neither Agree nor Disagree
4	Agree
5	Strongly Agree

The average score for each respondent is calculated by adding up the scores of each question. For odd-numbered questions, the calculation is the score minus 1; for even-

numbered questions, it is 5 minus the score. The sum result of all questions multiplied by 2.5 can be formulated as follows:

$$X_i = (\Sigma(\text{Qo-1}) + \Sigma(\text{5-Qe})) \times 2.5 \quad (1)$$

$$Y = \sum_{i=1}^{n} X_i / n \quad (2)$$

Description of the formula:
X_i is the respondent's scores
Qo is an odd score
Qe is an even score
Y is the average of all respondents
n is the number of respondents

3 Result and Discussion

The following description will display the results of the system design, including structural design, application design, UI/UX display, and black box system test data from the laboratory. For usability testing, respondent data and respondent data analysis will be displayed.

3.1 Result

Visual Multimedia Practice Assistant (VMPAs) can be built by implementing voice commands and visual displays as media for user interaction with the application system. The general design of the system structure can be seen in Figure 2. Applications are designed for web-based applications, where the database is placed on the server. Users can interact with the system by opening the application via a browser and interacting via a visual display and microphone.

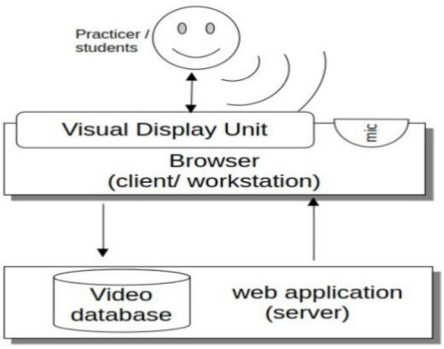

Figure 2. Design System Structure

In the practicum, this system is implemented by placing a visual display for each work group (3 - 5 practices) to facilitate interaction in one group. Figure 3 shows an illustration of the placement of the systems within each group.

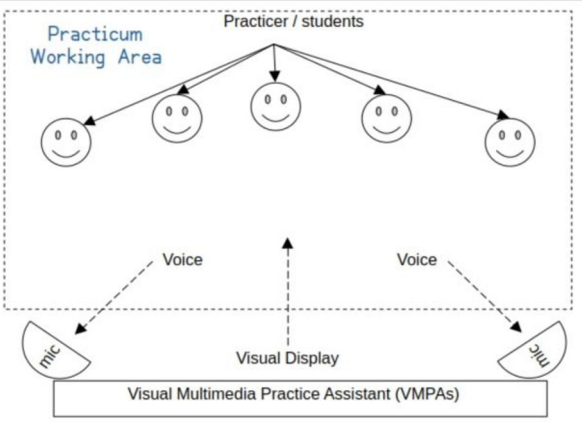

Figure 3. Design of Implementation System

This web-based computer application was created using the PHP and JavaScript programming languages, regarding the design results and functions expected from the Visual Multimedia Practice Assistant system. A UI/UX view of the system can be seen in Figure 4.

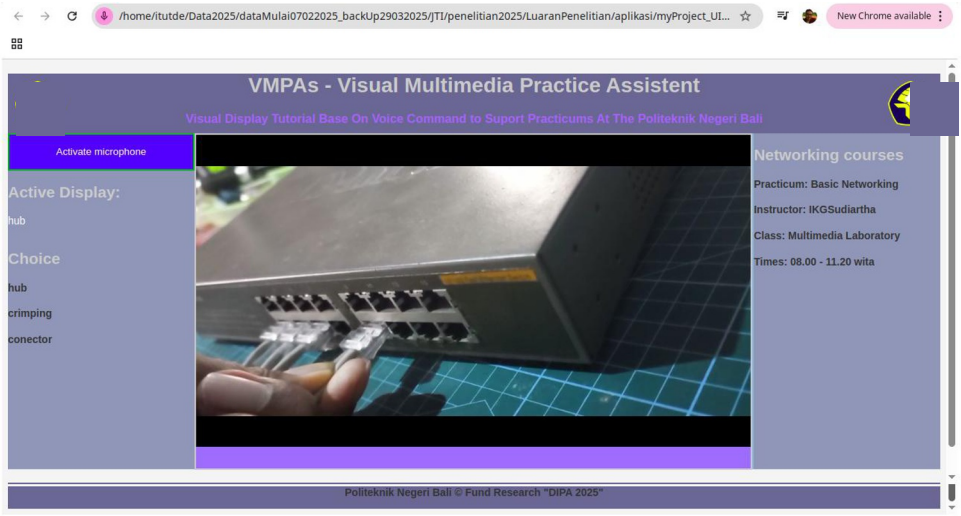

Figure 4. User Interface Application

The results of system testing using the black box method can be seen in Table 3. Voice command testing demonstrates that the system can convert sound into text effectively.

This is proven by the appearance of the text according to the voice commands given. Followed by searching the video file data in the database for text. The next test involves observing the sound and visual appearance of the video displayed by the system, based on the video data from the search results in the database.

Overall testing using the black box system method shows that the application can run well according to the expected design and function. Usability testing is also carried out to see user responses to products that have been built. Table 4 shows the user response data and the results of the calculation of the average respondent according to Equations 1 and 2.

3.2 Discussion

According to the test results using the black box method in Table 3, the system performs well according to design. Voice commands can be applied to build web-based applications to display videos on multimedia visual practice assistants. Voice commands can be translated into text form and then used to search for video data in the database. Videos are displayed according to data obtained from the database. This interaction can make it easier for practitioners to obtain guidance during the practicum. Adjustments to existing theories (Jeff Sauro, 2011) indicate that the average score for all users is 76.2, as shown in Table 4. This score suggests the application is acceptable, earning a good adjective or grade 'B' as illustrated in Figure 5. A similar implementation is also carried out in several journals (Kesuma, 2021).

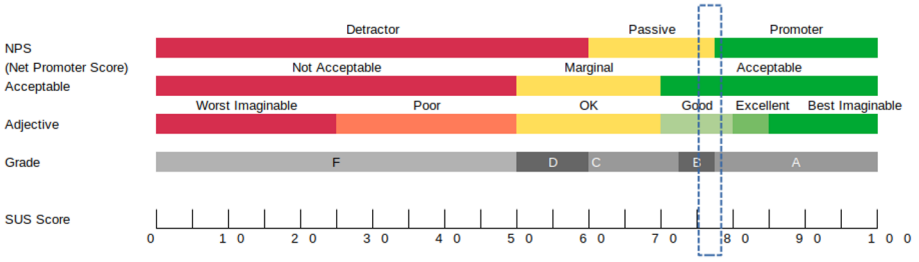

Figure 5. Usability Score

Table 3. Black Box System Testing Result

Item	Method	Result	Description
Voice Command	The user chooses a video tutorial with voice instructions	One video tutorial chose and displayed text on the display board	The application can convert voice to text. Text displayed on the visual display as a user command request
Data selection	The user chooses a video tutorial with voice instructions	One video tutorial to choose from the Database	The application can search for Data Video tutorials from the database, as text displayed on a visual board
Visual Display	The user chooses a video tutorial with voice instructions	Video tutorial displayed on the visual display	The application can play a video tutorial on the visual display automatically as the data video is retrieved from the database
Sound	The user chooses a video tutorial with voice instructions	Video tutorial played with sound automatically	An application can play sound on a visual display unit automatically as data video is retrieved from the database
Data Administration	Admin maintenance database (Create, Insert, Delete, and Update Data)	A change was made in the database as maintenance by the administrator	The application can be used for maintenance the database system

Table 4. User Scoring Respons

Respondent	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Score
R1	4	3	4	1	4	2	5	2	4	1	80
R2	4	1	5	2	4	1	4	1	4	1	87.5
R3	5	2	4	1	5	2	5	1	4	2	87.5
R4	5	5	5	1	5	1	5	1	5	1	90
R5	5	2	4	2	4	1	5	1	4	2	85
R6	4	3	5	2	5	2	4	1	4	2	80
R7	5	2	4	1	4	2	5	1	4	1	87.5
R8	3	2	4	2	4	2	5	1	4	3	75
R9	4	1	4	1	4	1	4	1	4	2	85
R10	5	1	5	1	5	1	5	2	5	2	95

R11	4	5	4	1	4	2	5	1	4	1	77.5
R12	4	2	4	3	4	2	4	2	3	5	62.5
R13	5	1	4	1	5	2	4	2	5	1	90
R14	3	4	4	3	3	3	2	3	3	4	45
R15	4	3	4	2	4	2	5	2	4	2	75
R16	4	2	4	3	4	2	4	4	4	3	65
R17	3	3	4	2	4	2	4	2	4	4	65
R18	4	4	4	2	4	3	5	2	4	5	62.5
R19	4	2	5	2	4	3	4	1	3	2	75
R20	4	2	3	3	4	2	5	2	5	2	75
R21	5	5	5	5	5	5	5	5	5	5	50
R22	3	2	5	1	4	1	5	1	5	1	90
R23	5	2	4	2	4	2	4	2	4	4	72,5
R24	4	2	4	3	3	4	3	2	3	3	57.5
R25	4	2	5	2	5	2	5	2	5	2	85
R26	4	3	4	1	4	2	5	2	4	1	80
R27	4	2	5	2	5	2	5	2	5	2	85
R28	4	1	5	2	4	1	4	1	5	1	90
R29	4	2	4	3	3	4	3	2	3	3	57.5
R30	5	2	4	1	5	2	5	1	4	2	87.5
R31	3	2	5	1	5	1	5	1	4	1	90
R32	5	5	5	1	5	1	5	1	5	1	90
R33	5	5	5	5	5	5	5	5	5	5	50
R34	4	5	4	1	4	2	5	1	4	1	77.5
R35	5	1	5	1	4	1	4	2	5	2	90
R36	4	2	3	3	4	2	5	2	5	2	75
R37	5	2	4	2	4	1	5	1	4	2	85
R38	4	2	4	3	4	2	4	2	3	5	62.5
R39	4	1	4	1	4	1	4	1	4	2	85
R40	3	2	4	2	4	2	5	1	4	3	75
R41	4	1	5	1	4	2	4	2	5	1	87.5
R42	4	3	5	2	4	2	4	1	4	2	77.5
R43	3	2	5	2	4	3	4	1	3	2	72.5
R44	3	4	4	2	4	3	5	2	4	5	60
R45	5	2	4	1	4	2	5	1	4	1	87.5
R46	3	4	4	3	3	3	2	3	3	4	45
R47	4	3	4	2	4	2	5	2	4	2	75
R48	3	2	4	2	4	2	5	1	4	3	75
R49	4	2	4	3	4	2	4	4	4	3	65
R50	4	2	5	2	5	2	5	2	5	2	85
SUS score Average											76.2

4 Conclusion

From the hypothesis and research carried out, voice command technology can be applied to web-based multimedia applications to support student practicums and be acceptable to users. The application of voice command technology provides options for multimedia development in the world of education. More optimal video database management is needed for the development of this system, making the provision of video tutorial data easier.

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