Designing Hologram-based Virtual Assistant for Student Organization Activities

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Abstract— The purpose of this research is to develop a web-based virtual assistant chatbot using AIML (Artificial Intelligence Markup Language) as a media to share information of student organization activities. The Virtual assistant is developed with chatbot capabilities by applying AIML. Combining Chatbot with AIML enables virtual assistants to understand and respond the users more effectively and efficiently. Chatbot technology in a web-based virtual assistant system can help the student organization to get information of organizational activities. The AIML used in the chatbot system allows users to interact like humans talk. Designing the system is done firstly by creating a knowledge base using AIML. The voice API is used to convert the knowledge base into an audio stream, which involves a text to speech conversion process. Both processes were initiated using the O-master programming tool. The next process integrates the knowledge base and voice into the php code using JavaScript. The system involves designing a user interface and avatars for interaction with users. The system serves the results of knowledge base searching and plays the conversion of the voice using script-to-voice code. The last step is integrating the chatbot into the hologram system. The hologram system utilizes a four-sided prism. The result shows that the system can help students to obtain information in student organization activities interactively.

Keywords— virtual assistant, chatbot, AIML, hologram

I. INTRODUCTION

Student organizations usually use a traditional, individual-centered approach where they always try to follow and maintain information [1]. Student organizations also need to enjoy advances in information technology-based management systems, the use of mobile applications which are used as a means of communication and coordination to increase member participation.

Advances in information technology have made it easier for members to share information effectively and efficiently either via websites or mobile devices. Student organizations have communication problems between members caused by distance, time and network limitations. A real example is illustrated in the distribution of sudden schedule changes, announcements and activities. One technology that is able to overcome this problem in terms of ease of obtaining and sharing information in real-time is virtual assistant technology with chatbots. Chatbots provide support opportunities to students by asking if they need help [2].

Chatbot is a smart program or artificial intelligence software that is intended to communicate directly with humans, and can help and replace human roles by imitating how to communicate via text [3][4]. Chatbots are used as tools to interact with different levels of intelligence ranging from simple to complex [5]. With the increasing use of Chatbot technology, more and more chatbot platforms are being developed [6]. Currently, many of Chatbots use NLU (Natural Language Understanding), NLP (Natural Language Processing),

organizational knowledge, and representation knowledge to make maximum use of Chatbots [7], [8], [9], [10]. The implementation of chatbots can use AIML or NLP as an important role, so that user questions can be answered more dynamically. AIML is pattern-based language. AIML uses patterns to match user input to predefined templates. When user input matches a certain pattern, AIML provides a response that matches the associated template. This allows humans and computers to interact through pattern-based language.

This research uses a chatbot which functions as a tool to obtain and share information which can later be accessed via a website with the addition of a hologram feature for visualization of 3D avatar displays. Previous research conducted by [11] succeeded in building a chatbot application that can help with data training to find appropriate answers to user questions. Holograms are formed from a combination of two light rays on a microscopic scale. According to some researchers, using three-dimensional (H3D) hologram technology can help teaching, teaching assistants, and virtual teachers [12]. The advantage of holograms is their ability to display optical information of 3D objects. The optical information is then processed to form an image, view, or scene [13].

The problem formulation in this research is how to develop a web-based virtual assistant that makes it easier for student organization members to obtain and share information in real-time, and integrate it into a four-sided hologram to display information interactively and interestingly.

II. METHOD

This research aims to design and develop a web-based virtual assistant system that can interact with users via voice and text. The initial stage of system design involves creating a knowledge base using AIML. To convert the knowledge base into an audio stream, a voice API is used which includes a text to speech process. These two initial processes use the O-master programming tool. The next step is to integrate the knowledge base and voice API into the PHP code using JavaScript. This system also involves designing user interfaces and avatars for more engaging interactions. The system can display knowledge base search results and listen to voice conversion results using script to voice. The final step is to integrate this chatbot system into a four-sided prism hologram system. The flow of designing hologram-based virtual assistant is shown in Figure 1.

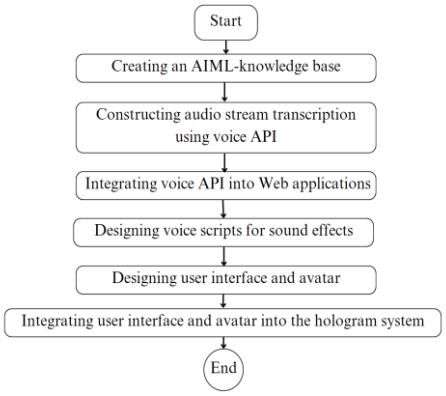

Fig 1. The flow of designing hologram-based virtual assistant

III. DESIGNING AND DEVELOPING A HOLOGRAM-BASED VIRTUAL ASSISTANT

This section discusses designing, developing, and testing a hologram-based virtual assistant. Discussion of designing and developing steps follow the flow as shown in Figure 1.

A. AIML-knowledge base

Today's chatbots often use AIML knowledge bases to better understand and respond to user questions. From 1995 to 2000, Artificial Intelligence Markup Language (AIML) was created based on the

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concepts of Pattern Recognition or Pattern Matching techniques [14]. AIML is a programming language specifically designed for chatbots that can process natural language. AIML contains a collection of patterns and responses that can be used by chatbots to find answers to each sentence given [15]. With AIML, chatbots can use predefined rules and patterns to recognize keywords in user input and provide appropriate responses. A key advantage of AIML is its ability to be customized to suit specific application needs, with developers able to add categories and templates to a chatbot's knowledge base to address a variety of topics and situations. AIML also allows integration with other AI technologies such as NLP and machine learning, to improve the chatbot's ability to understand the context of the conversation.

B. *Audio Stream Transcription using Voice API*

Constructing audio transcription using Voice API was done by four steps including client installation, introduction configuration, create a recognition audio object, and carrying out transcription

- *Client Installation*
  The first step is to initialize the Google Cloud Speech client that will be used to send transcript requests.

```
$client = new SpeechClient();
```

- *Introduction Configuration*
  The second step is setting recognition configuration for Google Cloud Speech, including audio encoding, sample rate, and language code.

```
$config = new RecognitionConfig([
    'encoding' =>
RecognitionConfig\AudioEncoding::LINEAR16,
    'sample_rate_hertz' => 16000,
    'language_code' => 'id-ID'
]);
```

- *Create a Recognition Audio Object*
  The third step is converting audio content into objects that can be recognized by the Google Cloud Speech API.

```
$audio = new RecognitionAudio([
    'content' => $audioContent
]);
```

- *Carrying out Transcription*
  The last step of audio stream transcription using voice API is sending a request to the Google Cloud Speech API to recognize and transcribe the provided audio.

```
$response = $client->recognize ($config,
$audio);
```

C. *Voice API integration into Web Applications*

Constructing Voice API integration into Web Applications was done by two steps including sending and processing audio data and displaying transcription step, and audio transcription using google cloud speech API and returning results as JSON step.

- *Sending and Processing Audio Data and Displaying Transcription*
  The first step is sending a POST request to the server with the recorded audio data. The results from the server in the form of transcription are then taken from the JSON response and displayed in an HTML element.

```
fetch('process_audio.php', {
    method: 'POST',
    body: formData
})
.then(response => response.json())
.then(data => {
    transcriptionText.textContent = 'Transkripsi: ' +
data.transcription;
});
```


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- *Audio Transcription Using Google Cloud Speech API and Returning Results as JSON*

  After receiving the uploaded audio file, the Google Cloud Speech API was used to perform audio transcription. Furthermore, the transcription results are retrieved, processed, and returned as a JSON response to the web application.

```
$response = $client->recognize($config, $audio);
$transcription = '';
foreach ($response->getResults() as $result) {
    foreach ($result->getAlternatives() as $alternative) {
        $transcription .= $alternative->getTranscript() . ' ';
    }
}

echo json_encode(['transcription' => $transcription]);
```

D. *Voice-script for Sound Effects*

Constructing the Voice-Script for sound effects was done by three steps including the javascript section in <head> and <body>, the javascript section for initialization and sound settings, and the javascript checkloading() function steps.

- *The JavaScript section in <head> and <body>*

  The first step is loading the ResponsiveVoice.js library from an external source. This library is used to provide text-based speech synthesis in the browser.

```
<script type="text/javascript" src="js/jquery-
2.js"></script>
<script
src="https://code.responsivevoice.org/responsivev
?key=3XSc6fPC"></script>
```

- *The JavaScript section for initialization and sound settings*

  The code, *responsiveVoice.speak('<?php echo $answer; ?>', $('#voiceselection').val());* is used to start voice synthesis with existing text as a response from the php server. The next coed, *responsiveVoice.OnVoiceReady* is used to handle when the voice is ready to use after loading.

```
$(window).load( function() {
    // Pengaturan awal setelah window load
    responsiveVoice.speak('<?php echo $answer; ?>',
$('#voiceselection').val());
    // Event listener untuk menangani saat
ResponsiveVoice.js selesai dimuat
    responsiveVoice.OnVoiceReady = function() {
        voiceReady = true;
        CheckLoading();
    };
});
```

- *The JavaScript CheckLoading() function*

  This step is done to ensure that both the ResponsiveVoice.js library and *the* web page are ready to use sound effects. When these two components are ready (*voiceReady* and *windowReady*), the voice options are displayed, and the user can select the desired voice.

```
function CheckLoading() {
    if (voiceReady && windowReady) {
        // Menampilkan pilihan suara setelah semua siap
        $('#voicetestdiv').fadeIn(0.5);
        $('#waitingdiv').fadeOut(0.5);
        var voicelist = responsiveVoice.getVoices();
        var vselect = $("#voiceselection");
        vselect.html("");
        $.each(voicelist, function() {
            vselect.append($("<option
/>").val(this.name).text(this.name));
        });
        $('#voiceselection').val(getUrlParameter('voice') ||
defaultparams.voice);
    }
}
```

E. *Userinterface and Avatar*

Constructing user interface and avatar was done by four steps including inquiry form and submit button; TTS and avatar input options; container for avatar images and animations; and javascript script for speech recognition and UI manipulation.

- *Inquiry Form and Submit Button*

  This step allows users to enter their questions and submit them by pressing the "Submit" button. A "Voice" button is also provided to start speech recognition using the webkitSpeechRecognition API.

```
<label>Tuliskan pertanyaan Anda:</label>
<form name="ask" onsubmit="return false">
   <input type='text' name='say' autofocus /><br>
   <input type='button' value='Kirim' name='submit'
class='button' onclick='animasi(this.form)'/>
   <input id="bStart" type="button" value="Suara"
onclick="start(this.form);" />
</form>
```

- *TTS (Text-to-Speech) and Avatar Input options*
  This step displays options for selecting a voice (Voice) and entering text that will be converted into sound. Avatar (gif) input is also provided in this step.

```
<div id="ttsoptions">
   <div style="visibility:hidden;">
      <label>Voice:</label>
      <select id="voiceSelecter"
class="guioption"></select>
   </div>
   <div>
      <input type="hidden" id="texttospeakinput"
value="<?php echo $answer; ?>" class="guioption"
onClick="this.setSelectionRange(0, this.value.length)" >
      <div id="texterrormessage"
class="guierrormessage"></div>
   </div>
   <div>
      <input type="hidden" id="gifurlinput"
value="https://i.imgur.com/ork8hoP.gif"
class="guioption" onClick="this.setSelectionRange(0,
this.value.length)">
      <div id="giferrormessage"
class="guierrormessage"></div>
   </div>
</div>
```

- *Container for Avatar Images and Animations*
  This step shows the container in which an avatar image or animation (in this case, a GIF) is displayed to the user.

```
<div>
   <div id="imagecontainer">
      <img id="exampleimg"
src="https://i.imgur.com/ork8hoP.gif"
rel:animated_src="https://i.imgur.com/ork8hoP.gif"
rel:auto_play="0" />
   </div>
</div>
```

- *JavaScript Script for Speech Recognition and UI Manipulation*

```
function start(form){
   recognition.onstart = function(event) {
      form.say.value = "";

document.getElementById("loadingstat").innerHTML="
<span style=\"font-family: Tahoma; font-size:12;
background-color: #FF0000; color: #FFFFFF; align:
right\"><blink> Listening your
voice... </blink></span>";
   }
   recognition.onresult = function(event) {
      console.log(event);
      form.say.value = "";
            for(var i=0; i<event.results.length; i++){
         form.say.value = form.say.value +
event.results[i][0].transcript;


}
   }
   recognition.onend = function() {
      recognizing = false;
      if(form.say.value!=="") answer(form.say.value);

document.getElementById("loadingstat").innerHTML="
";
   };
   recognition.start();
}
```

The last step is done to initializes speech recognition using webkitSpeechRecognition and handles events that occur when the user interacts with the UI and enable speech recognition.

F. *User interface and Avatar Design*

Constructing user interface and avatar was done in one step that is sending audio for transcription and controlling avatar with transcription results. The avatar and the user interface and Avatar integration used in the virtual assistant is shown in Figure 2 and 3.

Fig 2. Avatar Design

- *Sending Audio for Transcription and Controlling Avatar with Transcription Results*

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This step integrates the entire workflow from recording to the talking avatar, connecting the various key components of the application.

```
fetch('process_audio.php', {
   method: 'POST',
   body: formData
})
.then(response => response.json())
.then(data => {
   transcriptionText.textContent = 'Transkripsi: ' +
data.transcription;
   responsiveVoice.speak(data.transcription, "Indonesian Femal
   animateAvatar();
});
```

Fig 3. User interface and Avatar integration

G. Rectangular Prism Hologram

The virtual assistant developed in this study is an interactive device that uses a hologram projector to display a rectangular prism-shaped 3D interface in space. This device consists of a hologram projector, a transparent hologram screen, a processing unit that manages user commands, input sensors to capture commands, and speakers to provide feedback. The user gives command which is then processed by the processing unit to produce a response. The response is displayed in the hologram form and voiced through the speaker, while the external data can be accessed to update information or answer questions. The construction of hologram-based virtual assistant is shown in Figure 4.

Fig 4. Hologram-based Virtual Assistant

H. Testing

An important part of building a system is testing. Testing steps are carried out to find out whether the process in the system is correct or not. Black box testing is created to verify and validate the system. Testing begins by providing input to the system to verify and validate its response from the system output.

TABEL I
BLACKBOX TESTING

ID	Scenario	Input	Expected Output	Actual Output	Status
H-1	Benefits of joining a student organization	“What are the benefits of joining a student organization?”	"Taking on roles within the organization can help you learn how to lead and manage a team effectively" or "You'll meet many new	"Taking on roles within the organization can help you learn how to lead and manage a team effectively" or "You'll meet many new	Pass

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ID	Scenario	Input	Expected Output	Actual Output	Status
			people from different backgrounds, which can lead to lasting friendships and professional connections"	people from different backgrounds, which can lead to lasting friendships and professional connections"	
H-2	Types of Student Organizations	"What types of student organizations are there on campus?"	"These focus on enhancing knowledge and skills in specific academic fields or scientific research." or "These cater to various hobbies and talents such as music, sports, arts, and more."	"These focus on enhancing knowledge and skills in specific academic fields or scientific research." or "These cater to various hobbies and talents such as music, sports, arts, and more."	Pass
H-3	Joining a Student Organization	"How do you join a student organization?"	"Attend recruitment events and sign up during the designated period." or "Reach out to current members or leaders to express your interest and learn how to get involved."	"Attend recruitment events and sign up during the designated period." or "Reach out to current members or leaders to express your interest and learn how to get involved."	Pass
H-4	Role of a Chairperson	"what is the role of a chairperson in a student organization?"	"The chairperson sets agendas, guides discussions, and ensures activities run smoothly." or "They delegate tasks, motivate members, and oversee the progress of projects." or "Acting as the spokesperson and main representative at various functions and meetings."	"The chairperson sets agendas, guides discussions, and ensures activities run smoothly." or "They delegate tasks, motivate members, and oversee the progress of projects." or "Acting as the spokesperson and main representative at various functions and meetings."	Pass
H-5	Increasing Member Participation	"How to increase member participation in organization activities?".	"Plan events that interest and excite members to encourage their involvement." or "Recognize and reward contributions to motivate continued participation."	"Plan events that interest and excite members to encourage their involvement." or "Recognize and reward contributions to motivate continued participation."	Pass

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IV. CONCLUSION

This hologram-based virtual assistant system designed using AIML can improve effective communication and facilitate coordination within student organizations. This system interacts in real-time using voice and text and provides 3D avatar visualization, making the display even more attractive. The use of AIML-based chatbots and the integration of technology such as voice API for voice transcription has succeeded in creating a responsive and interactive user interface. The implementation of this system can help overcome communication obstacles that are often faced by student organizations, such as time and distance limitations, and can help increase member participation in various organizational activities.

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