Development of FonBi Application: A Phonetic Transcription Tool Assisted by Artificial Intelligence for Indonesian Language

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***Abstract*—This study discusses the development of FonBi (Fonologi Bahasa Indonesia or Phonology of Indonesian Language in English), a phonetic transcription tool designed to aid foreign speakers learning Indonesian. The research highlights the challenge of ineffective language learning for BIPA (Bahasa Indonesia bagi Penutur Asing or Indonesian Language for Foreign Speakers) learners due to the complex phonological system of Indonesian. To address this issue, the study followed a development cycle model and created FonBi, aimed at improving learning effectiveness and accelerating the language mastery process. The application provides accurate and precise phonetic transcription to help learners better understand and master the Indonesian language. The validation results from material and media experts indicate that FonBi is "very feasible," while limited testing by students suggests that it is also feasible. The study concludes that FonBi could provide an innovative solution for BIPA learners, bridging the gap between Indonesian speakers and foreign learners by enabling them to properly understand and pronounce the language. Overall, this study highlights the importance of phonetic transcription in language learning and the value of developing tools like FonBi to improve learning outcomes. By providing a user-friendly and accessible tool, FonBi has the potential to greatly enhance the learning experience of BIPA learners, and potentially serve as a model for developing similar tools for other languages and contexts.**

***Keywords*—FonBi, phonetic transcription, Indonesian language learning**

I. Introduction

Speaking skills are a fundamental ability that Indonesian language learners must master [1, 2]. The accuracy of a person's speaking skill level can be measured through verbal communication by paying attention to aspects such as sentence accuracy, pronunciation, and the selection of appropriate diction in the context and situation of communication activities [3]. However, learners often face difficulties in accurately pronouncing Indonesian words due to the various pronunciation versions of certain Indonesian vocabulary, which can cause confusion [4]. This is experienced by foreign learners who use Indonesian as their second language as well. To prevent errors in Indonesian language pronunciation, learners can use phonetic transcription as a guide to represent speech sounds on paper [5]. By providing guidance and correct pronunciation information through phonetic transcription, learners can master speaking skills better. Indonesian language usage is heavily influenced by the multiethnic society. Since Indonesian is not the mother tongue of most Indonesians, but rather a second language [6], regional languages acquired through language acquisition activities can result in errors when using Indonesian as a second language. These errors occur consistently because learners do not yet understand the system of the language being used, leading them to create their own pronunciations [7]. For instance, the pronunciation of the word /kembali/ differs among Javanese, Banjar, and Minangkabau people. Javanese pronounce it as [kəmbali], Banjar people as [kəmbaliʔ], and Minangkabau people as [kɛmbali]. The differences in pronunciation are influenced by the mother tongue of each ethnic group, and foreign learners using Indonesian as a second language also make similar errors.

Based on observations and interviews with students of Bahasa Indonesia bagi Penutur Asing (BIPA) or Indonesian Language for Foreign Speakers from Poland and Slovakia, it was found that they have difficulty with the velar nasal sound [ŋ] followed by vowels, such as in the word /sangat/, and the palatal nasal sound [ɲ] followed by vowels, such as in the word /punya/ [8]. The absence of these sound systems in the learners' first language can cause difficulties in pronouncing these sounds, leading them to map Indonesian language sounds they have learned onto the sound system of their first language.

Phonetic transcription can serve as a guide for correctly pronouncing Indonesian words with the right sounds. It represents speech sounds on paper using phonetic letters, which are created by modifying Latin letters. Phonetic letters are made with IPA (International Phonetic Association) symbols agreed upon by phonology experts to create standardized phonetic writing that can be used to record all languages [9–12]. However, phonetic transcription in the Indonesian language has not been fully developed. This can be seen from the absence of phonetic transcription in KBBI (Kamus Besar Bahasa Indonesia or Indonesian Dictionary in English). One reason for this is the lack of consistency in the pronunciation of sounds in the Indonesian language with written text.

Indonesian, an Austronesian language closely related to Malay, has been the lingua franca throughout the archipelago

for centuries. A variant of Malay was adopted as the official language when Indonesia declared independence in 1945, commonly known as Standard Indonesian or "Bahasa Indonesia". It is used as the language of government and instruction in schools, as well as in an increasingly wide range of social interactions, including interethnic, religious, and mass communication. The number of native speakers of Indonesian, particularly in the Jakarta area, is growing. Approximately 23 million people speak Indonesian as their first language, and an additional 140 million speak it as a second language [13]. For the latest discussion on its classification within Austronesian, see Adelaar [14]. Indonesian exhibits considerable regional variation. When used as a second language, it is strongly influenced by the regional language of the speaker. Studies of Indonesian phonology (at various levels of detail) [15–19] have been conducted. In addition, several Indonesian language learning guides discuss aspects of Indonesian phonology [20–24]. Generally, the Indonesian language has five vowels, namely [a], [e], [i], [o], and [u]. However, in oral language activities, an additional vowel, namely [ə], is used. Fig. 1 shows the human speech organs.

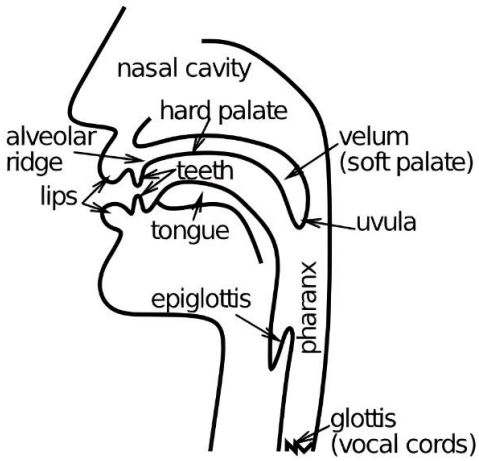

Fig. 1. Speech organs on human.

This research was conducted based on several reasons, one of which is the difficulty of BIPA learners in understanding and mastering Indonesian language due to the significant phonetic system differences between foreign languages and Indonesian language. In addition, not all BIPA learners have adequate linguistic education backgrounds, so there needs to be a tool that can help them to learn and master Indonesian language more easily. This is a serious concern because it will hinder the language learning process that they will undergo when coming to Indonesia [25]. In previous research, Setyowati has developed a phonetic transcription application based on Windows computers that is intended for BIPA learners [26]. However, the application has a drawback which is that it cannot be used on mobile devices, so users can only access it using a Windows computer which is not as practical as using a smartphone. This describes that there has not yet been a phonetic transcription application that has been successfully developed. Therefore, the author further developed the idea into the FonBi application that can be accessed anywhere and anytime.

FonBi (Fonologi Bahasa Indonesia or Phonology of Indonesian Language in English), is an application that helps Indonesian language learners who are non-native speakers (BIPA) to learn and master Indonesian language more easily through accurate and precise phonetic transcription. The uniqueness of this application is that it allows BIPA learners to accurately learn how to spell and pronounce each word in Indonesian language, so that they can see how the word should be pronounced correctly. In addition, FonBi also comes with a phonetic guide that explains the pronunciation of each consonant, vowel, and diphthong in Indonesian language, and provides examples of correct pronunciation. With this phonetic guide, BIPA learners can deepen their understanding of the phonetic system of Indonesian language, which can help them to master Indonesian language more effectively. FonBi is designed to be more practical and easy to use on smartphones, so BIPA learners can use this application to improve their Indonesian language skills more easily and effectively.

II. Literature Review

A. Phonetic Transcription

Phonetic transcription plays a crucial role in language learning and communication, providing a systematic representation of speech sounds. The literature on phonetic transcription provides insights into its importance and its potential relevance to the development of FonBi, a phonetic transcription tool for foreign speakers learning the Indonesian language. Geers et al., conducted a study on language delay in children with cochlear implants. Their research highlighted the importance of accurate phonetic transcription in assessing language development and identifying persistent language delay [27]. This study suggests that FonBi, by providing precise phonetic transcription, can assist in evaluating language proficiency and identifying areas of improvement for Indonesian language learners. Caumo et al., conducted a systematic review on the phonetic transcription of spontaneous children's speech with the aid of software. Their research emphasized the advantages of using software tools for phonetic transcription, including standardization, reliability, and efficiency [28]. This study provides insights into the potential benefits of incorporating software-based phonetic transcription tools, like FonBi, in language learning contexts. Riza & Kawakib conducted a study on utilizing the phonetic transcription of the International Phonetic Alphabet (IPA) to improve pronunciation in English as a Foreign Language (EFL) students. Their research highlighted the importance of accurate phonetic transcription in helping students avoid mispronunciations [29]. This study suggests that FonBi, by providing precise phonetic transcription for Indonesian language learners, can assist in improving their pronunciation skills. Furthermore, Brancalioni & Keske-Soares conducted a study on the treatment of phonological disorders using a software intervention for speech. Their research emphasized the importance of phonetic transcription and analysis in assessing and treating speech disorders [30]. FonBi can leverage phonetic transcription capabilities to assist in identifying and addressing pronunciation difficulties for Indonesian language learners.

B. Artificial Intelligence

The literature on artificial intelligence (AI) provides valuable insights into its applications and potential relevance

to the development of FonBi, a phonetic transcription tool for foreign speakers learning the Indonesian language. Dhamija & Bag conducted a review and bibliometric analysis on the role of AI in the operations environment. Their research highlights the advantages of AI in enhancing operational excellence and improving business [31]. This study suggests that AI can be leveraged in the development of FonBi to enhance its functionality and effectiveness in supporting language learning.

In another study, Guo *et al*. reviewed the application of AI in smart homes. They discussed how AI technologies are utilized to improve the functionality and automation of smart home systems [32]. This research provides insights into the potential integration of AI in FonBi to enhance its capabilities and provide personalized learning experiences for Indonesian language learners. Furthermore, Sqalli and Al-Thani, conducted a literature review on the interaction between patients and AI systems in the management of chronic conditions. Their research highlights the importance of understanding the patient-AI interaction and designing effective AI-based health coaching systems [33]. This study can inform the development of FonBi to ensure its user-friendliness and effectiveness in supporting language learners with personalized feedback and guidance.

C. Phonetic Transcription Assisted by Artificial Intelligence

The literature on phonetic transcription and artificial intelligence (AI) provides valuable insights into their applications and potential relevance to the development of FonBi, a phonetic transcription tool for foreign speakers learning the Indonesian language. Shriberg & Lof conducted a study on the reliability of broad and narrow phonetic transcription. Their research highlighted the importance of transcription agreement and the challenges in achieving consistent results [34]. This study suggests that AI-assisted transcription, such as the one employed in FonBi, can enhance the reliability and accuracy of phonetic transcription. Bhaskar et al., discussed the design of futuristic telemedicine using AI and robotics. Their research emphasized the potential of AI-assisted frameworks in creating resilient health systems and improving access to quality healthcare [35]. This study suggests that FonBi, with AI assistance, can contribute to the advancement of language learning by providing accurate and efficient phonetic transcription. Zongqiang et al., developed an intelligent rebound hammer system based on the Internet of Things (IoT). Their research demonstrated the benefits of AI in improving measurement accuracy and data transmission stability [36]. This study suggests that AI-assisted systems, like FonBi, can enhance the efficiency and effectiveness of phonetic transcription in language learning. Furthermore, Yang discussed an AI-based piano performance and music automatic notation algorithm teaching system. Their research highlighted the role of AI in providing guidance and support in music education [37]. This study suggests that FonBi, with AI assistance, can provide guidance and feedback to Indonesian language learners, improving their pronunciation and language proficiency.

III. Research Method

The Borg and Gall development cycle is a well-known model for research and development, consisting of 10 stages [38]. However, this research simplifies the cycle into four key stages that are more relevant to the scope of the project: (1) preliminary studies, (2) planning, (3) development, and (4) validation, revision, and limited testing. Each stage is essential to the success of the project and requires careful attention to detail and thorough analysis. Fig. 2 below illustrates the stages of the research method used in this paper, which have been adjusted accordingly.

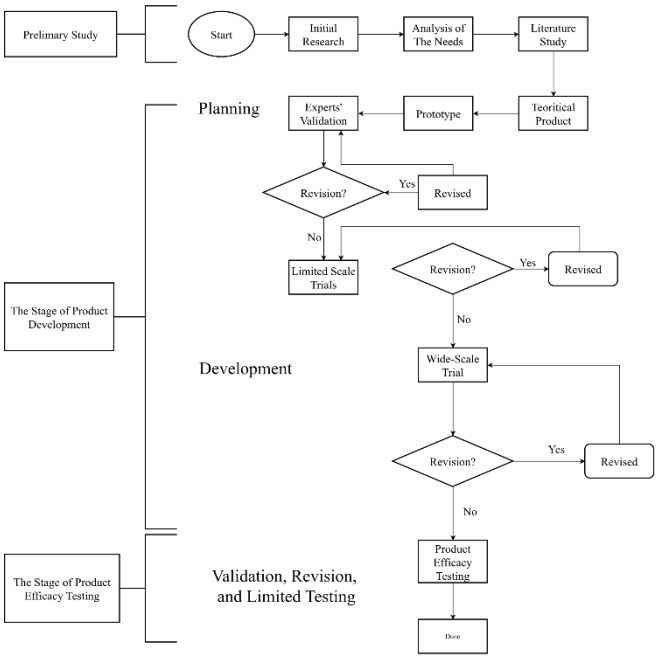

Fig. 2. Research method with adjustment.

1) Preliminary studies: In this stage, initial studies are conducted to determine the feasibility of the project. This includes creating an application plan that outlines the project's objectives and identifying the key features that the application should have. By conducting a thorough analysis of the project requirements, the team can ensure that the project is on track and that all necessary elements are included.
2) Planning: Once the preliminary studies are complete, the team moves on to the planning stage. In this stage, the team creates a design for the application, analyzes the system, develops a user interface, and creates the application architecture. This stage is critical as it lays the foundation for the development stage that follows.
3) Development: The development stage is where the actual application is built. The team writes code, tests the application, fixes bugs, and creates the final product. This stage requires a significant amount of time and resources and is crucial to the success of the project.
4) Validation, revision, and limited testing: In the final stage, the team performs validation to ensure that the application meets the requirements and that it functions as intended. Based on user feedback, the team revises the application to address any issues that arise. The team then conducts limited testing to ensure that the application meets the necessary standards for release.

Product testing in this research was conducted to collect data used as a basis for determining the feasibility of the developed product. In this section, things to consider are: (1)

test design, (2) test subjects, (3) data types, (4) data collection instruments, and (5) data analysis techniques. Product testing design is divided into several stages which include: media expert and material expert validation. Media and material experts validate the feasibility of FonBi. Small group testing determines the application's effectiveness in learning and collects respondent opinions. Furthermore, large group testing is conducted to determine whether teaching materials in the FonBi application can be applied properly, as well as to get respondent opinions on the developed application on a large scale. The subjects in this study are lecturers as media and material experts, as well as students in the Department of Indonesian Language and Literature, Universitas Negeri Padang, who take the Indonesian Language for Foreign Speakers or Bahasa Indonesia untuk Penutur Asing (BIPA) course as test subjects.

The types of data obtained are qualitative and quantitative data, with quantitative data obtained from the assessment of the feasibility of the FonBi application by media experts and material experts in the form of questionnaires with scores ranging from 1 to 4, while qualitative data obtained from interviews conducted with informants and validators.

The data collection instruments used are interview guides, observation sheets, and questionnaires. Interviews and observations were conducted for needs analysis in developing the FonBi application. While questionnaires were conducted to measure the validity of the developed FonBi application. Responses on the questionnaire use a Likert measurement scale with answer scores ranging from 1 to 4.

The scale is as follows: 1 = not good/not feasible/not happy; 2 = fairly good/fairly feasible/fairly happy; 3 = good/feasible/happy; and 4 = very good/very feasible/very happy. The data analysis technique used is quantitative analysis to determine the feasibility of the developed application. Scores given by media and material experts in response to a questionnaire are used in a predetermined formula to determine the suitability of the developed media. The formula is based on the scores given by the experts and is analyzed quantitatively.

$$V = \frac{Tsa}{Ms} \times 100\%$$

where:

V: Validity by percentage

Tsa: Total score achieved

Ms: Maximum score

The score data obtained from the test results, the percentage is calculated using the percentage formula as above. After obtaining the percentage results from the calculation, the data is transformed into predicate statements and determined based on Table 1.

Table 1. Qualification criteria assessment measuring the validity level of eligibility

Indicator	Category	Information
1–50	Not feasible	Total revision
51–70	Less worthy	Major revision
71–85	Worthy	Minor revision
86–100	Very worthy	No revision

IV. Results and Discussion

FonBi is an application created as a phonetic transcription tool for Indonesian language learners for Speakers of Other Languages (BIPA). This application allows users to deepen their understanding of Indonesian pronunciation by displaying accurate phonetic transcriptions of words. The preparation for creating the FonBi application is done in the following steps.

A. Preliminary Study

In the initial stage of the research, the researcher conducted a preliminary study by interviewing several students who had taken the Indonesian Language for Foreign Speakers (BIPA) course. From the interviews, it was found that students had difficulty understanding how to write the phonetic transcription of a word. To understand the students' learning process, the researcher conducted more in-depth interviews and observed their learning activities. The learning that had been done was generally limited to group discussions and presentations, which did not provide enough time for individual learning. As a result, the students did not fully understand the concept of phonetic writing, especially in Indonesian phonetics. The researcher found that the related reference books used in BIPA teaching did not emphasize phonetic transcription writing enough. Therefore, the researcher conducted a literature review of books related to phonetic transcription and identified several best practices in teaching phonetic transcription writing. These best practices include providing more individual learning time, using visual aids such as diagrams and pictures, and providing exercises that focus on phonetic transcription writing.

From the survey conducted among ten students about their difficulties in writing phonetic transcription, eight students reported difficulty in writing phonetic transcription. The reasons for their difficulties include lack of practice, lack of understanding of phonetics, difficulty in distinguishing between similar sounds, difficulty in identifying syllables, limited exposure to Indonesian language, difficulty in recognizing tone and intonation, confusion with spelling conventions, difficulty in identifying stress in words, lack of familiarity with IPA symbols, difficulty in distinguishing between voiced and voiceless sounds, difficulty in transcribing complex words, difficulty in transcribing everyday phrases, difficulty in transcribing proper names, and difficulty in transcribing borrowed words. One student did not experience difficulties in writing phonetic transcription. The survey details can also be seen in the following Table 2.

Overall, the researcher suggests focusing on teaching phonetic transcription writing in BIPA courses using standardized methods and best practices to better prepare students for future language learning.

Table 2. Difficulty in writing phonetic transcription

Student	Difficulty	Cause of Difficulty
1	Yes	Lack of practice
2	Yes	Lack of understanding of phonetics
3	No	-
4	Yes	Difficulty in distinguishing between similar sounds
5	Yes	Difficulty in identifying syllables
6	Yes	Limited exposure to Indonesian language
7	Yes	Difficulty in recognizing tone and intonation
8	Yes	Confusion with spelling conventions
9	Yes	Difficulty in identifying stress in words
10	Yes	Lack of familiarity with IPA symbols

B. Planning

Product specifications of the developed innovation in the

form of the FonBi mobile application that can be used as a phonetic transcription tool for Indonesian language learners. This application can be accessed anytime and anywhere independently through the website (www.fonbi.my.id) so that it can adjust to the learning speed of each user. There is a feature to record voice and directly transcribe it into Latin letters and IPA phonetic symbols, which can help Indonesian language learners improve their pronunciation. This application also has a phonetic dictionary of the Indonesian language that can help users understand and deepen their knowledge of the phonetics of the Indonesian language. The storyboard preparation consists of several steps, namely giving the application a name, outlining the content of the application, designing the application features, and preparing research instruments.

The following are the results of the storyboard preparation. The first step is to give a name to the application. The name of the application is crucial as it serves as the identity of the application. At this stage, the name FonBi was chosen. FonBi is an abbreviation of "Fonologi Bahasa Indonesia" (Indonesian Phonology). FonBi is a mobile application that can be accessed through Android and iOS devices. The second step is to outline the content of the application. This stage designs what will be displayed in FonBi and how the menu order will be presented. At this stage, an overview of the menu or content contained in FonBi was obtained. There are four main menus in FonBi that are organized sequentially, namely: (1) phonetic transcription tool, (2) Indonesian phonetic dictionary, (3) application testimonials, and (4) about the application. The first page is the phonetic transcription tool that allows users to write words and directly transcribe them into Latin letters and IPA phonetic symbols. The second page of the FonBi application is a phonetic dictionary of the Indonesian language. This dictionary contains a list of words in the Indonesian language along with their transcriptions in the International Phonetic Alphabet (IPA), which can help users understand and correctly pronounce words. In addition, researchers have also collected some books on the phonetics of the Indonesian language that can be used as references for users who want to learn more about this topic. With the phonetic dictionary and these additional references, it is hoped that the FonBi application can help users improve their Indonesian language skills, especially in terms of pronunciation and intonation. On the next page, there is a testimonial page to get feedback from FonBi application users. The third step is designing the application features. The main feature of the FonBi application is the Indonesian phonetic transcription tool, which allows users to write words and directly transcribe them into Latin letters and IPA phonetic symbols. The application also comes with a guide to Indonesian phonetics. The fourth step is to develop research instruments. The research instrument developed is the FonBi assessment instrument for media, language, and material experts. Meanwhile, to test the effectiveness of FonBi, a user response questionnaire is used. The main design and transcription menu of the FonBi application can be seen in Figs. 3 and 4 below.

C. Development

The key element in developing the FonBi application is the API created by researchers (https://api.fonbi.my.id) through the integration of the Google Bard API and the API from Indonesian Grapheme-to-Phoneme. This API offers advanced machine learning capabilities that are critical to the application's functionality. Additionally, NodeJS is utilized as the backend to provide a stable and reliable foundation for the application. All of these APIs are combined to deliver sophisticated machine learning capabilities that are essential to the application's functionality. To complement this, NodeJS is used as the backend, providing a stable and reliable foundation for the application. Below is Algorithm 1, an API and the results of the FonBi application.

Fig. 3. FonBi App design.

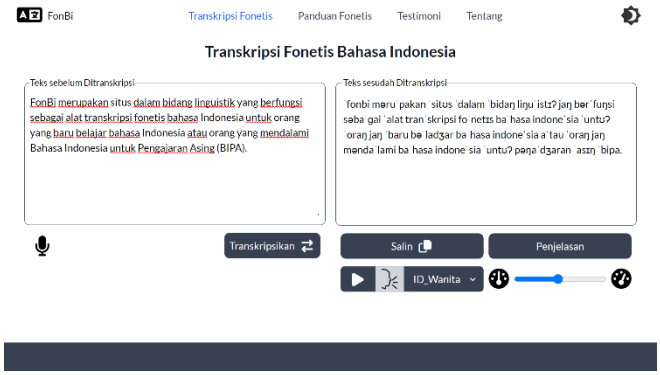

Fig. 4. FonBi application transcription menu design.

Algorithm 1: FonBI API

```
curl --location
'https://api.fonbi.my.id/transcript' \
--header 'Content-Type: application/json' \
--data '{
    "text": " FonBi merupakan situs dalam bidang
linguistik yang berfungsi sebagai alat
transkripsi fonetis bahasa Indonesia untuk orang
yang baru belajar bahasa Indonesia atau orang
yang mendalami Bahasa Indonesia untuk Pengajaran
Asing (BIPA)."
}'
```

The Results:

```
{
    "status": 200,
    "message": "success",
    "result": " ˈfonbi məruˈpakan ˈsitʊs ˈdalam
ˈbidaŋ liŋuˈistɪʔ jaŋ bərˈfuŋsi səbaˈgai ˈalat
tranˈskripsi foˈnetɪs baˈhasa indoneˈsia ˈuntʊʔ
```

```
ˈoraŋ jaŋ ˈbaru bəˈladʒar baˈhasa indoneˈsia
aˈtau ˈoraŋ jaŋ mənda ˈlami baˈhasa indoneˈsia
ˈuntʊʔ pəŋaˈdʒaran ˈasɪŋ ˈbipa."}
```

In the explanation section, the researchers also developed an algorithm to evaluate language pronunciation. The algorithm is based on the SAMPA (Speech Assessment Methods Phonetic Alphabet) concept, which is a phonetic notation system used to represent sounds. The explanation feature using SAMPA can be seen in Fig. 5 below.

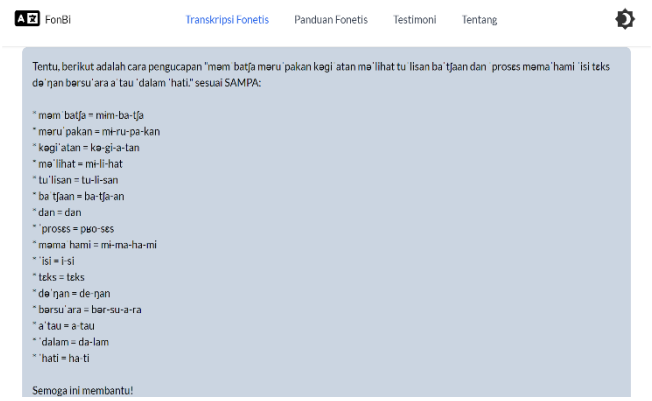

Fig. 5. SAMPA.

Python is also used in the development of FonBi to create Edge-tts (https://github.com/rany2/edge-tts), a text-to-speech synthesis system that is crucial for the application's functionality. This feature allows users to convert text to speech, making communication easier in various languages. The algorithm creates and deletes audio files every 10 minutes. In addition to this feature, users can also customize the speed of the generated audio output. This enables personalized experiences that meet the specific needs of users. By adjusting the speed of the audio output, users can better understand and retain the presented information. This feature is very useful for individuals who have difficulty processing information at normal speed or for those who prefer to learn at a slower or faster pace. With the addition of this functionality, users can take control of their learning experience and optimize their ability to absorb information. The use of Edge-tts and Text-to-Speech Synthesis System in FonBi application can be seen in Algorithm 2 and Fig. 6 below.

Algorithm 2: Edge-tts

```
app.post("/tts", async(req, res)=>{
  const { text, lang } = req.body;
  if(!text) return res.status(400).json({message:
"Bad request"})
  const langs = {
    ""id-1": "id-ID-ArdiNeural",
    "id-2": "id-ID-GadisNeural",
    "su-id-1": "su-ID-JajangNeural",
    "su-id-2": "su-ID-TutiNeural",
    "jw-id-1": "jv-ID-DimasNeural",
    "jw-id-2": "jv-ID-SitiNeural"
  }
  const timestamp = Date.now();
  const fileName = random()+"|"+timestamp+".mp3"
  const py = child.spawn("edge-tts", ["--voice",
langs[lang] || langs["id-1"], "--text",
text.substring(0, 1000), "--write-media",
"./.tmp/" + fileName])
  py.stderr.on("data", (r)=> {
    console.log(r.toString())
    if(fs.existsSync("./.tmp/" + fileName)){
      res.send({path: "/voices/"+fileName,
timestamp})
    }else{
     res.status(500).end()
    }
  })
  py.stdout.on("data", ()=>{
   res.send({path: "/voices/"+fileName,
timestamp})
  })
})
cron.schedule("*/10 * * * *", ()=>{
      fs.readdirSync("./.tmp").filter(v =>
v.endsWith(".mp3") &&
v.split("|")[1].split(".mp3")[0] < (Date.now() -
600000)).forEach((file)=>{
v.endsWith(".mp3") &&
v.split("|")[1].split(".mp3")[0] < (Date.now() -
600000)).forEach((file)=>{
       console.log("deleting voice", file)
        fs.unlinkSync("./.tmp/"+file)
      })
})
```

Fig. 6. Text-to-speech synthesis system.

D. Application Validation, Revision, and Limited Trial

Validation is an effort to obtain academic recognition [39]. Validation is done by testing the validity of the material and learning media. To obtain validation data, experts in the field of material and learning media are involved. The instrument used is a questionnaire that contains assessment sheets and comments. The assessment sheet contains descriptions of aspects that need to be assessed by validators, which are appropriate for the type of validation. In this study, validation was carried out by two experts, namely a professor in the field of Indonesian Language and Literature Education, Faculty of Language and Arts, Universitas Negeri Padang for material and learning media. Validators give scores between 1 and 4 for assessment. A score of 1 for the category of very poor, a score of 2 for poor, a score of 3 for the category of good, and a score of 4 for the category of very good. The total score is calculated by dividing the obtained score by the maximum score and multiplying by one hundred percent (result score/maximum score × 100%). The results of the material and media expert assessment survey can be seen in the following Table 3.

Table 3. Material and media expert assessment

Validator	Percentage	Category
Material expert validator	88%	Very worthy
Expert validator	89%	Very worthy
Average	88.5%	Very worthy

Material expert validators state that the material is good and can be used with minor revisions according to suggestions and feedback. Specifically, the validators emphasize that there are still some words that are missing or not in accordance with the latest Indonesian Dictionary. Therefore, users can see the vocabulary or latest words commonly used by society in Indonesia. Detailed information on material revisions can be seen in the following Table 4.

Table 4. Material revision

No.	Material before Revision	Material after Revision
1	Some materials or words are not in accordance with the IPA standard.	All materials and words have been corrected according to the previously established standards.
2	The arrangement of some words in the material, such as "almarhumah" becomes "almAarhumAɦ," is disorganized	The word arrangement has been updated according to the transcription column in Google Sheets.
3	There are still some words that are not present or in accordance with the latest Indonesian Dictionary.	Some words have been adjusted to the latest dictionary and are continuously updated over time.

Media expert validators stated that FonBi is good, attractive, and efficient. So FonBi can be used with some revisions. Limited testing was conducted on 30 students who have taken the Indonesian Language for Foreign Speakers (BIPA) course. Questionnaires were used to determine students' responses to FonBi. The opinions or responses of students to FonBi can be seen in the following Table 5.

Table 5. Student's responses to FonBi

Student sample	Appropriateness Percentage	Appropriateness Information	Information
01	80	Worthy	Very easy to use. Very accurate transcription
02	85	Worthy	Easy to use, but sometimes there are errors in the transcription
03	50	Not feasible	Difficult to use and inaccurate transcription
04	90	Worthy	Very easy to use and accurate transcription
05	70	Worthy	Easy to use, but sometimes difficult to find certain characters
06	95	Worthy	Transcription is very accurate and the app is easy to use
07	60	Less worthy	The app is easy to use, but the transcription isn't always accurate
08	40	Not feasible	It's hard to use and the transcriptions are often wrong
09	90	Worthy	Very helpful in learning the pronunciation of difficult words
10	75	Worthy	The transcription is fairly accurate, but has some errors
11	95	Worthy	The application is easy to use and the transcription is very accurate
12	65	Less worthy	Easy to use, but transcription is not always accurate
13	30	Not feasible	It's hard to use and the transcriptions are often wrong
14	80	Worthy	Very helpful in learning Indonesian
15	70	Worthy	The application is easy to use, but there are some errors in the transcription
16	95	Worthy	Transcription is very accurate and the app is easy to use
17	60	Less worthy	Easy to use, but transcription is not always accurate
18	40	Not feasible	It's hard to use and the transcriptions are often wrong
19	85	Worthy	Application helps in learning the pronunciation of difficult words
20	75	Worthy	The transcription is fairly accurate, but has some errors
21	95	Worthy	The application is easy to use and the transcription is very accurate
22	65	Less worthy	Easy to use, but transcription is not always accurate
23	35	Not feasible	It's hard to use and the transcriptions are often wrong
24	85	Worthy	Very helpful in learning Indonesian
25	70	Worthy	The application is easy to use, but there are some errors in the transcription
26	95	Worthy	Transcription is very accurate and the app is easy to use
27	60	Less worthy	Easy to use, but transcription is not always accurate
28	40	Not feasible	It's hard to use and the transcriptions are often wrong
29	85	Worthy	Application helps in learning the pronunciation of difficult words
30	75	Worthy	The transcription is fairly accurate, but has some errors
Average	84	Worthy	

Based on the table above, most students rated that the FonBi application is worth using and helps in learning difficult word pronunciations, thus facilitating the process of learning the Indonesian language. The average percentage of application suitability is 84%. Although the majority of students feel comfortable with the use of the application, some experienced difficulties in navigating the application features. In addition, there are reports of transcription errors resulting in some students not getting the grades they deserve. Therefore, training and technical support are needed for students who need it to use the application more effectively and minimize errors. Researchers have also made improvements to the transcription system, especially in the algorithm section, to ensure the accuracy and consistency of transcription results.

V. Discussion

Based on the results of limited trial analysis, it can be inferred that the student response to the FonBi application is positive and FonBi is highly possible to use. Previous research on phonetic transcription has been done extensively and the same goes for other phonetic transcription applications [28–30, 34, 40–42]. However, although many phonetic transcription applications have been developed, there is no phonetic transcription application for the Indonesian language that has been fully developed, especially for BIPA learners who want to learn and come to Indonesia. Therefore, this research was conducted. Another reason for this research is the lack of Indonesian phonetic transcription applications as a guide for conducting research practices in the Indonesian Language course for Foreign Speakers (BIPA) at the Department of Indonesian Language and Literature, Faculty of Language and Arts, Universitas Negeri Padang. FonBi is an application created as a phonetic transcription tool for the Indonesian language for BIPA learners. This application allows users to deepen their understanding of Indonesian pronunciation by accurately displaying phonetic transcription in words.

In addition, FonBi presented in digital format makes it easy for students to access its features. FonBi, which has been successfully developed, is classified as an interactive learning medium. Interactive learning media is the best alternative that can contribute to increasing reading interest and motivation [43]. Student responses to the FonBi application are that the FonBi application is easy to access and does not burden their device performance. It is hoped that this application can respond to various challenges when responding to digital era developments, as various problems that arise in the digital era have entered all aspects of human life.

VI. Conclusion

This development research concludes that the results of FonBi development are proven feasible by referring to assessments from material experts, media experts, and limited trials in the form of responses from students. The average score of material expert validation is with the category of "very feasible", while the result of media expert validation reaches with the category of "very feasible", and the average result of student trials is with the category of "feasible". Therefore, FonBi is declared feasible to use in the learning process. This can help improve the effectiveness of learning and accelerate the process of mastering the Indonesian language. Thus, the FonBi application can be an innovative solution in the process of Indonesian language learning for BIPA learners. In addition, the results of this research can be the basis for the development of similar applications that are more advanced and can help Indonesian language learners from various backgrounds. The prospects of the development of these research results can be a reference for further research on technology applications for Indonesian language learning for BIPA learners.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Nursaid, Bima Mhd Ghaluh, and Ella Wulandari developed the research concept by identifying the problem, designing the study, analyzing the data, and writing the article. Yenni Hayati and Muhammad Ismail Nasution carried out the data analysis process and article writing. Meanwhile, Ayu Gustia Ningsih and Anggi Trinanda Harahap played a role in collecting data and interpreting research findings. All authors had approved the final version.

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