PROGRAMMING LEARNING APP FOR KIDS: CUSTOMIZED KIDS ASSISTANCE SYSTEM

Fahmi M.F.A.

B.Sc. (Hons) in Information Technology Specializing in Software Engineering

Department of Computer Science and Software Engineering Faculty of Computing

Sri Lanka Institute of Information Technology

Sri Lanka

February 2024

PROGRAMMING LEARNING APP FOR KIDS: CUSTOMIZED KIDS ASSISTANCE SYSTEM

‘Project Proposal Report’

Fahmi M.F.A.

IT21037306

B.Sc. (Hons) in Information Technology Specializing in Software Engineering

Department of Computer Science and Software Engineering Faculty of Computing

Sri Lanka Institute of Information Technology

Sri Lanka

February 2024

1. Declaration

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
Fahmi M.F.A.	IT21037306	Fahmi

The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

29/02/2024

Signature of the supervisor: Date

2. Abstract

Sri Lanka is currently grappling with a significant economic challenge marked by a surge in USD prices. Traditionally reliant on exports like tea, fabric, and spices, the nation's export sectors have been severely impacted by the aftermath of the pandemic. Major garment factories and tea processing facilities faced closures, hindering the recovery process. With these sectors still in the recovery phase, generating sufficient USD through exports remains a challenge. However, a ray of hope lies in the thriving IT sector. Bigger companies were continuing to outsource employees from South Asian countries, offering a potential solution to Sri Lanka's economic woes. The dilemma, though, lies in the fact that highest percentage of such outsourced employees predominantly come from India, posing a significant threat to Sri Lanka's economic independence.

The predominant presence of Indian professionals in outsourced employment is not solely attributed to a higher population. Instead, it reflects a notable knowledge gap. Indians actively contribute to major open-source projects such as AOSP, Linux Kernel, Angular, and React, showcasing their proficiency in cutting-edge technologies. This trend is particularly evident among teenagers, where a 14-year-old Indian student might already be contributing to projects like AOSP, while a counterpart in Sri Lanka of the same age is just embarking on the basics of programming, like Scratch. The key factor distinguishing the outsourcing landscape is the significant variance in technological expertise, emphasizing the importance of addressing the knowledge gap to enhance Sri Lanka's competitiveness in the global IT outsourcing market.

The solution to bridging the knowledge gap lies in introducing programming education to children. To address this, we propose a mobile-based "Programming Learning App for Kids" designed for 8-10-year-olds. This interactive platform aims to reduce the gap significantly by offering engaging lessons and providing assistance through machine learning when children encounter difficulties or have questions.

Key Words: Machine Learning, Mobile Solution , e-learning

Table of Contents

3. List of figures

4. List of tables

5. Introduction

5.1. Background

These days, Sri Lanka is grappling with economic uncertainty, particularly due to the surge in USD prices. Most sectors currently available are not exhibiting the potential to alleviate the USD shortage in Sri Lanka. Many of these sectors are still in the process of recovering from the pandemic. Fortunately, the IT sector continues to play a significant role in maintaining economic stability in Sri Lanka, even amid the ongoing pandemic.

To enhance economic stability, it is imperative to collaborate with the IT sector. Larger corporations such as Google, Microsoft, Meta, and others are actively outsourcing employees from South Asian countries. One potential solution is to secure employment opportunities from these companies. However, a major challenge lies in the fact that India possesses the largest share of the global outsourcing market.

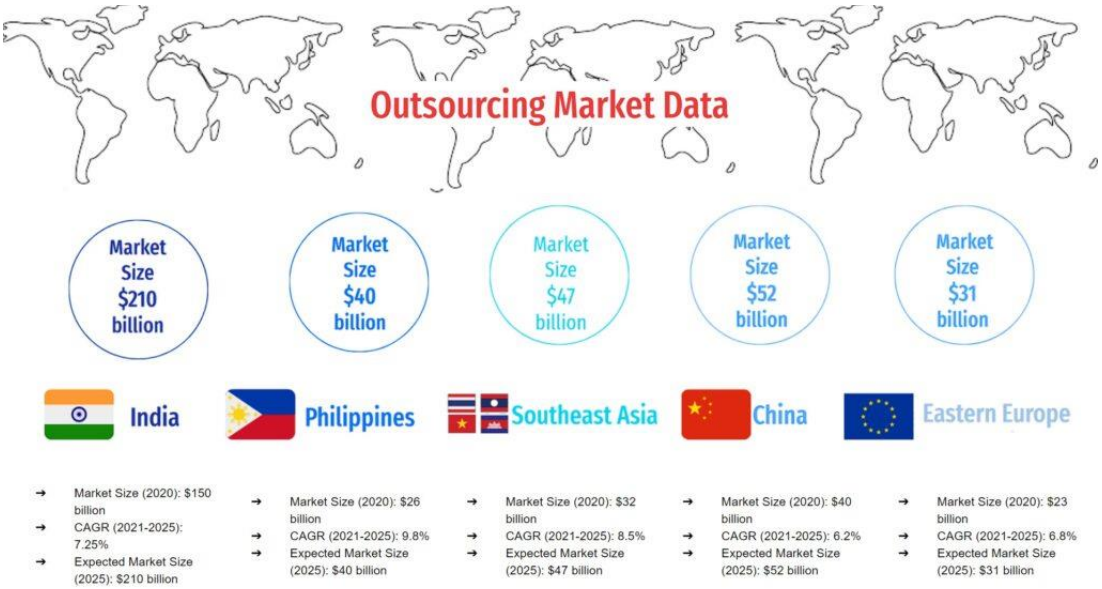

Figure 1 - Outsource Market Value all over the world [1].

India has attained the highest market value according to figure 1, not merely due to its large population, but primarily because it boasts the highest number of knowledgeable IT professionals. While Sri Lanka may also have skilled IT employees, the sheer abundance of talent in India surpasses it. The majority of Indian teenagers possess significant knowledge in the IT field, contributing to their dominance.

Moreover, India has made substantial contributions to the open-source community, playing a pivotal role in projects such as AOSP (Android Open Source Project), Linux kernel, Angular, React, and more. This active involvement in open-source initiatives has further solidified India's position as a key player in the IT industry.

In a more detailed comparison, if we consider teenagers of the same age group, for instance, 14-year-old students in both India and Sri Lanka, a notable disparity in their exposure to IT becomes evident. In India, some 14-year-olds are actively contributing to significant projects like the Android Open Source Project (AOSP). In contrast, in Sri Lanka, students at this age are just beginning their programming journey, starting with learning tools like Scratch as part of their syllabus. This highlights a significant knowledge gap between the two countries. While Indian students are already engaging in advanced IT projects at the age of 14, their Sri Lankan counterparts are still in the early stages of learning programming basics. As previously mentioned, this knowledge gap poses a challenge for Sri Lanka in competing with India, as the latter is not only ahead in terms of expertise but also likely to produce highly skilled IT professionals in the future. Closing this knowledge gap is crucial to enabling Sri Lankan students to compete on a more equal footing and eventually contribute as knowledgeable IT employees.

Our research has identified a significant gap, and we believe that imparting basic programming knowledge to children can help narrow this disparity. As a solution to address this knowledge gap, we have conceptualized a "Programming Learning App for Kids." This mobile application is specifically designed for students in grades 3-5. Through this app, students can acquire a foundational understanding of programming concepts. To further support their learning journey, we are implementing a "Customized Kids Assistance System" within the app. This system is designed to provide personalized assistance to students who may encounter doubts or difficulties while using the app.

5.2. Literature survey

According to the literature, some research authors have conducted studies on assisting children both with and without the use of AI.

5.2.1. Feedback-Augmented Learning

According to S. Ruan et al, the researchers conducted a study on enhancing children's learning of mathematics by incorporating an AI-based chatbot. The chatbot operates by providing hints to children as they learn math. Importantly, when children encounter doubts during their math learning process, they can pose their queries to the chatbot. The bot responds to the children in a highly interactive manner. Notably, the bot not only furnishes correct answers but also offers effective verification, a feature

the authors emphasize as fostering learning. The implementation of this chatbot utilized wizard-of-oz techniques, with the same person consistently assuming the role of the wizard to ensure uniformity in behavior and conversation style [2].

They implemented this system using Android Frameworks and TypeScript for Android tablets. The Wizard interface was developed using React and deployed on Netlify. Importantly, as mentioned in the paper, they did not utilize any AI or ML in building the chatbot. Furthermore, the backend employed the Hasura GraphQL Engine and was deployed on a Heroku server with a Postgres Database [2].

Finally, they evaluated their system in an in-lab study to test the children's assistance system using pre and post-tests. They selected 72 children as samples for their research. Participants (children) took an exam to assess the kids' assistance system. After one month of the study, authors asked the children to take the same test virtually via a website, with the answers changed to avoid recall. The children were then asked to answer the questions without seeking assistance, even from their parents [2].

In addition to that, according to their study, they finally arrived at results demonstrating how their assistance system is supportive to the students, making them more engaged and reducing confusion during the learning process According to figure 2 [2].

Affective State	A	B	C	D
engagement	76.1 (19.9)	83.1 (12.5)	85.4 (13.7)	**90.0 (7.3)**
boredom	**4.8 (8.2)**	4.6 (6.2)	3.4 (4.8)	1.0 (2.1)
confusion	**13.7 (12.5)**	8.8 (6.2)	9.2 (8.7)	5.0 (5.2)
curiosity	0.3 (1.1)	0.3 (0.5)	0.58 (1.1)	**1.1 (2.1)**
happiness	1.3 (3.4)	1.2 (1.9)	0.7 (1.5)	**2.7 (2.9)**
frustration	**3.0 (4.9)**	1.9 (3.2)	0.7 (1.4)	0.2 (0.6)
neutral	**0.9 (2.5)**	0.2 (0.7)	0.0 (0.0)	0.0 (0.0)

Figure 2 - Percentage (%) of time participants spent in each affective state. Largest percent for each state in bold [2].

Overall, an assistance system for kids helps to address doubts that arise during their learning process. The study assessed math improvement by comparing pre-study quiz scores with post-study quiz scores across different conditions of the e-learning platform. Significant effects were observed in the improvement of volume concepts, indicating that the assistance system, particularly in the narrative with chatbot condition, led to enhanced learning outcomes in specific math areas [2].

5.2.2. AI Based Kids Assisting System

According to S. Pawar et al, the authors express their willingness to incorporate Artificial Intelligence (AI) into their mobile solution. They believe that integrating AI into a kids' learning app increases the grasp of concepts for children. Thus, they propose a solution for when kids encounter doubts about what they are learning.

They are providing assistance to kids by using a voice recognition system, which means kids can ask questions using their voice. They have built a system to extract the text from that voice. After extracting the text, it is input into their neural network system, which processes the input and provides output in the form of images to kids [3]. They explained their voice assistance system in the system diagram mentioned below in Figure 3.

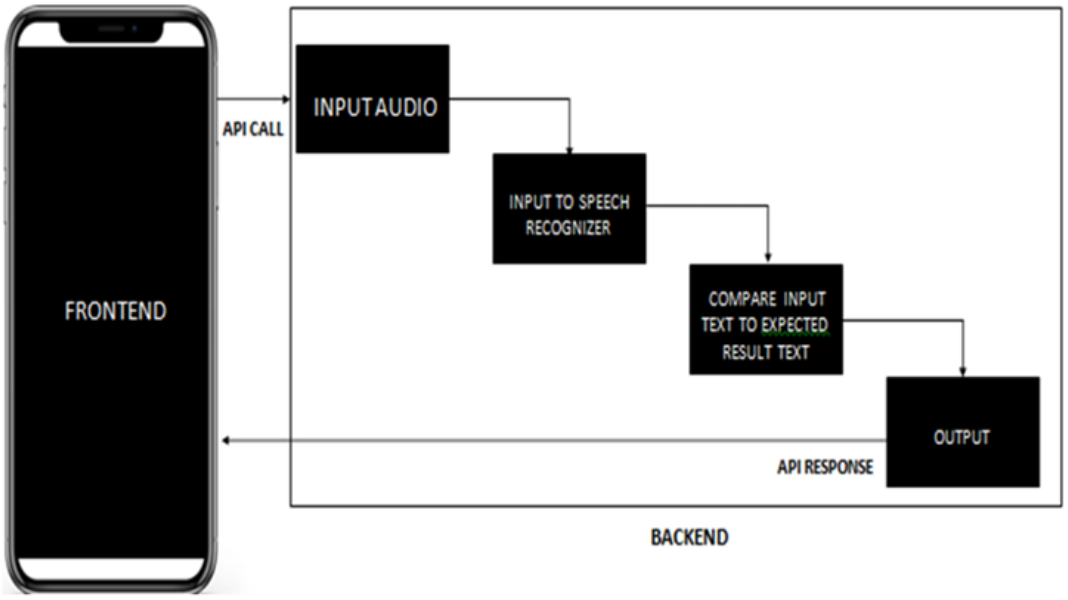

Figure 3 - Speech Recognition System (SRS) [3]

This research has been conducted for kids aged 3 to 7 years old. The main motive of the authors is to bring AI to kids' learning apps so that children can grasp concepts quickly and effectively. Moreover, implementing a voice-based assistant is considered the best way to gather input from kids and clear their doubts by showing images.

5.2.3. Artificial Intelligence based Education: Chatbot Assistance System

According to K. Kutubuddin et al, the authors have discussed the use of AI (Artificial Intelligence) in education or e-learning platforms. Primarily, they conducted this study to explore the impact of AI on the learning process, specifically in early childhood education. The aim is to identify new AI technologies that provide a personalized and effective learning experience for kids [4].

So, the authors covered the provision of assistance when kids encounter doubts while learning, utilizing an AI-based solution. They conducted a review of existing research papers about AI in education, child-centric learning, and personalized tutoring. As a methodology, this paper includes instances of qualitative research. For example, the Narrative Dialogue Technique has been used to investigate the impact of the digital feedback system on learning to study benefits and challenges in implementing AI in child-centric education. Finally, they have come up with the diagram below that indicates the features when AI is used in child-centric education [4].

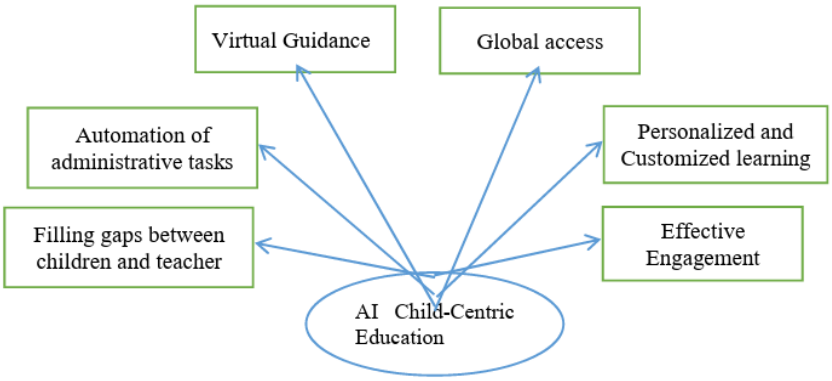

Figure 4 - Features that AI provides for child centric education. [4]

According to Figure 4, the authors have introduced a feature called Personalized and Customized learning, under which the assistance system is categorized. They describe personalized and customized learning as follows: they gather 50 participants as samples for each session and conduct multiple sessions. In this context, they propose a robot as a solution. This implies that a robot can scan a child's expression, and based on that expression, the robot will assist the kids [4].

But specifically for the kids' assistance system, they provide a chatbot assistance system. Because it assists kids through a conversation form, which is easy for them to understand. These kinds of chatbots are called Conversational Agents. In simple terms, they argue that assistance through a chatbot is very effective. They provide an example: at Georgia State University, they have a chatbot for their students called "Pounce." It helps students at the university by providing assistance for financial matters, admissions and registration processes, and other administrative activities [4].

5.3. Research Gap

Currently, various e-learning apps are available with different features and varying pros and cons [2-4]. However, many of these apps are a bit outdated and do not offer proper assistance for kids.

For example, consider the solution in [2]. They are currently providing a chatbot-like assistance system. However, when a child asks a question, the answers provided by the system may not always be useful, leading the child to ask the same question repeatedly. This repetition could potentially make learning boring and, in some cases, create anxiety. It is crucial to bear in mind that we are developing an assistance system for kids, and they expect to receive answers promptly.

Then there's the solution presented in [3]. They offer an assistance system for kids that relies on voice input. The system extracts information from the voice and feeds it into their customized neural network, providing solutions in the form of images. However, in such situations, it is not feasible to convey all answers through images alone. Sometimes, the use of words or phrases is necessary to communicate the correct response. While this approach may be attractive to kids, there is no guarantee that it will consistently provide accurate answers and address the doubts of the kids. If a child inputs a question, the system may display an image that is not relevant to the inquiry. Therefore, this approach may not be a suitable solution for assisting kids effectively.

The solution presented by [4] closely resembles the one offered by [2]. Therefore, certain aspects need attention. There is a limited understanding of the system, as chatbots may not fully comprehend the questions or doubts expressed by kids. This limitation can result in the generation of inaccurate or irrelevant responses, potentially frustrating the children and impeding their learning process. Another significant concern with these systems is that kids might become overly reliant on chatbots for answers. This dependence could hinder the development of critical thinking and problem-solving skills. Addressing this issue is better suited for solutions such as the one proposed by [3].

More importantly, the proposed solutions in [2] and [4] involve chatbots. These chatbots are trained on datasets that may contain biases. Consequently, these biases could be reflected in the chatbot responses, potentially influencing the kids' understanding of topics. This might lead to a change in the kids' comprehension of specific concepts or chapters they are learning.

Finally, we have identified gaps in some other e-learning apps for kids that have already been researched by other authors.

According to the paper in [5], this study proposes the development of a mobile application for e-learning targeted at kindergarten kids. The application is specifically focused on teaching colors to children, named "Color App." This solution includes functions such as web-based video learning, where kids are educated through the app by providing web-based video lessons integrated with their app; interactive learning, where the app asks kids questions in an interactive way to assess their understanding of the lesson content, and immediate feedback is provided accordingly; and a software

agent, integrated into the app, that provides feedback based on the answers provided by the kids. Specifically, a gap identified in this solution is the lack of a proper assistance system for kids. Since kids often have more doubts than older students, it is crucial to provide an effective assistance system to address their queries while they are learning.

Authors in the paper [6] provide a mobile solution for "Learning Math through Mobile Game for Primary School Students," focusing on math education through games. This approach aims to engage students in a fun and entertaining way, attracting them to learn math while playing games and ultimately enhancing their math knowledge. Furthermore, the paper highlights crucial aspects of the solution, such as utilizing feedback that kids can provide after playing a game and receiving user feedback. However, the authors implement a system for assisting kids with doubts through a forum. In this setup, kids can post questions, and experts in the forum respond to their queries. This approach is identified as a gap due to potential difficulties in maintaining the safety and privacy of kids. The method may lead to challenges in distinguishing what information can be shared, raising concerns about data leaks or privacy exposure. Consequently, this solution requires constant parental monitoring. Another issue arises when the number of kids increases; the expert count should also rise to handle all student requests adequately. Without a proportional increase in experts, there may be a high demand for human resources, impacting the efficiency of the system. While the solution offers benefits such as improved communication skills and increased peer-to-peer learning, these positive aspects are counterbalanced by notable issues that cannot be overlooked. The proposed solution, despite its merits, is deemed inefficient due to these identified risks.

So, finally, we have identified these gaps in the current systems. Therefore, we need to provide a better and optimal solution than the proposed solutions mentioned above. We made clear comparison in Table 1.

Table 1 - Comparison our system with existing system

Research Papers	Provide an assistance System	Using AI	Using Native language
Narrative-based learning platform [2]	✓	✓	
AI based Kids Interactive Learning Platform [3]	✓	✓	

Chatbot Assistance System [4]	✓	✓	
Color App [5]			
Learning Math through Mobile Game [6]		✓	
Our Solution	✓	✓	✓

5.4. Research Problem

E-learning is growing globally, especially in developing countries like Sri Lanka. Despite some limiting factors such as technological infrastructure, traditional learning methods are still preferred. With the help of the Sri Lankan government, which has actively involved itself in promoting ICT initiatives, including E-learning, continued support and policy adjustments can further stimulate the growth of E-learning in the country [7].

An effective e-learning platform for kids should include an assistance system to help them when they encounter doubts while learning. Especially with the advancement of technology like AI, there is a need to reduce human interaction and move beyond traditional methods to assist kids. Therefore, it is essential to provide an efficient way of addressing kids' doubts, making it beneficial for their learning experience. Simply providing generated processes or sentences is not an effective approach. In simpler terms, kids should be able to input their questions into the system, and the system should provide answers to those questions. Providing output should at least offer a way to resolve the doubts that kids may have. Most importantly, the platform should be interactive for kids.

There are existing systems that provide assistance for kids, each with its own set of pros and cons. However, the cons of these systems can be quite critical. That's why we have come up with a proper solution.

In order to provide an efficient assisting system for kids, we have come up with some important research questions.

- How to assist kids when they are getting doubts?
- How to get input from kids?
- How to provide the suitable answer for their doubts?
- How to identify the kids questions even those are not properly structed?

- What are the ways to provide the answers?

If we can obtain proper answers to these questions, we can finally come up with a proper solution.

Moreover, currently available research has been conducted primarily in the English language, even though it may not be the native language of the participants. To provide a basic idea for kids, the best approach is to teach them in their native language. Learning through the native language has several benefits. It enhances the understanding of concepts for students, even when the concepts are complex, as they can grasp them more easily than when learning in another language. This, in turn, boosts their confidence and creates a positive learning environment, allowing students to focus more on what they are learning.

Furthermore, this approach reduces cognitive load, enabling students to concentrate on the content rather than struggling with language comprehension [8-9]. Research indicates that students who receive education in their native language tend to perform better academically in the long run. This success can be attributed to a deeper understanding of concepts and improved language skills [9]. Therefore, addressing this research problem requires finding solutions to effectively teach or assist kids in their own language.

Currently available solutions mostly focus on interactive approaches to assist kids. For example, According to S. Ruan et al [2], the authors are providing feedback-augmented learning to kids using chatbot technology. However, their emphasis is more on the chatbot than the user interface (UI), as they specifically create a wizard interface integrated with their chatbot.

According to S. Pawar et al [3], their solution involves the use of neural networks in their system, but the primary focus is on the UI side. Ultimately, the output presented to the kid is in the form of an image. Therefore, there is a need to provide a proper output for kids that is not only interactive but also useful. It is crucial to prioritize delivering an appropriate output to assist kids, rather than merely focusing on interactivity.

Our external supervisor has suggested that we improve the output to enhance the critical thinking of kids. Currently available solutions, such as S. Ruan et al's solution [2] and S. Pawar et al's solution [3], do not focus on improving the critical thinking of kids. Enhancing critical thinking in children offers numerous benefits, proving valuable not only in academics but also in real-life situations. These skills enable students to analyze information, identify problems, and develop effective solutions.

Critical thinking abilities empower primary students to make informed decisions based on evidence, logic, and reasoning. This skill is essential for navigating challenges and

evaluating the consequences of their actions in both academic and real-world scenarios. Cultivating critical thinking skills in primary students instills a love for learning, curiosity, and a desire to seek knowledge. These skills are transferable across various subjects and disciplines, laying a strong foundation for continuous learning and growth [10].

6. Objectives

6.1. Main Objective

In simple manner the main objective **is develop a customized kids' assistance system to provide real-time support for learning challenges by implementing a structured breakdown of identified problems and promote their critical thinking**.

That's why we are proposing a solution to address above mentioned issues, as mentioned above in the gap. We gather input from kids in either English or Tamil language. We receive questions in their native language, Tamil, as asking questions in English might be difficult for them. However, they should provide some keywords in English to articulate their exact doubts. If the question is in their native language, it will be easier for them. Afterward, we extract keywords from the question. The reason for extracting keywords is that when they ask questions, they may not fully understand what they are asking for. Therefore, there might be some unnecessary parts in their questions. To address this issue, we extract keywords from their questions, identify them, and provide an output in the form of a breakdown structure to the kid in the Tamil language.

6.2. Specific Objectives

6.2.1. Design a interactive and user-friendly interface for kids.

We must design an interactive, attractive, and user-friendly interface for the app. Initially, we need to create some prototypes and present them to kids, gathering feedback to improve the interfaces. To design usable interfaces for kids, it's important to follow specific guidelines and consider key elements. Firstly, in terms of navigation, we should provide a simple and intuitive system that allows kids to move easily between pages or sections. It is crucial to ensure that kids can understand their current location, where they have been, and where they can go next. Secondly, regarding text, we should use readable fonts with appropriate sizes and styles. Small fonts should be avoided, and it may be beneficial to provide options for changing font sizes. Additionally, text should contrast well with the background to ensure easy readability. Thirdly, in terms of content, information should be presented in a clear and concise manner. The interface should not be overloaded with unnecessary information. To

engage kids and reduce cognitive load, a mix of text, graphics, and animations can be utilized. There are more elements to consider when designing the UI [11].

6.2.2. Get the input from kids (Voice / Image) and transfer it to Text Format.

We have found that the best way to obtain input from kids is through voice or image inputs. Voice input has been identified as one of the most effective methods, as proven in a research study [3]. These methods are more efficient for children compared to using a keyboard. After acquiring the input, the next step is to extract the text from both the image and the voice.

6.2.3. Translate the text to English if it's from another language.

We have identified the research problem of receiving input and delivering output in the English language. As part of our solution, we aim to support native languages, specifically focusing on a research study in a Tamil medium school in Sri Lanka. Consequently, we have chosen Tamil as the native language for our research. However, it's important to note that the extracted text may need translation only if it is in another language, as our knowledge base contains content only in English.

6.2.4. Design a flexible and expandable Knowledge Base Agent

There are various ways to implement the main system to process requests and display output. Many research studies, especially those focused on assistance, directly utilize chatbots [2], [4]. However, as we discussed earlier about the negative aspects of chatbots, we have identified Knowledge-Based Agents (KBAs) as one of the best alternatives. Some research has been conducted, and e-learning platforms have been implemented using this agent system [12]. We have chosen this solution because, for assisting children, it is essential to have proper resources. Therefore, we have come up with the idea of providing an assistance system with a Knowledge-Based Agent.

6.2.5. Provide a compact problem breakdown structure to kids.

According to our external supervisor's suggestion, we aim to enhance the critical thinking skills of kids through our output. Our idea is to provide a breakdown structure of a problem rather than giving a direct answer. By presenting the information in this way, children are encouraged to think and solve their doubts independently, leading to an improvement in their critical thinking skills. This approach is inspired by our external supervisor, who, when faced with kids' queries, refrains from providing direct answers but guides them on how to find the solution.

7. Methodology

7.1. Overall System Diagram

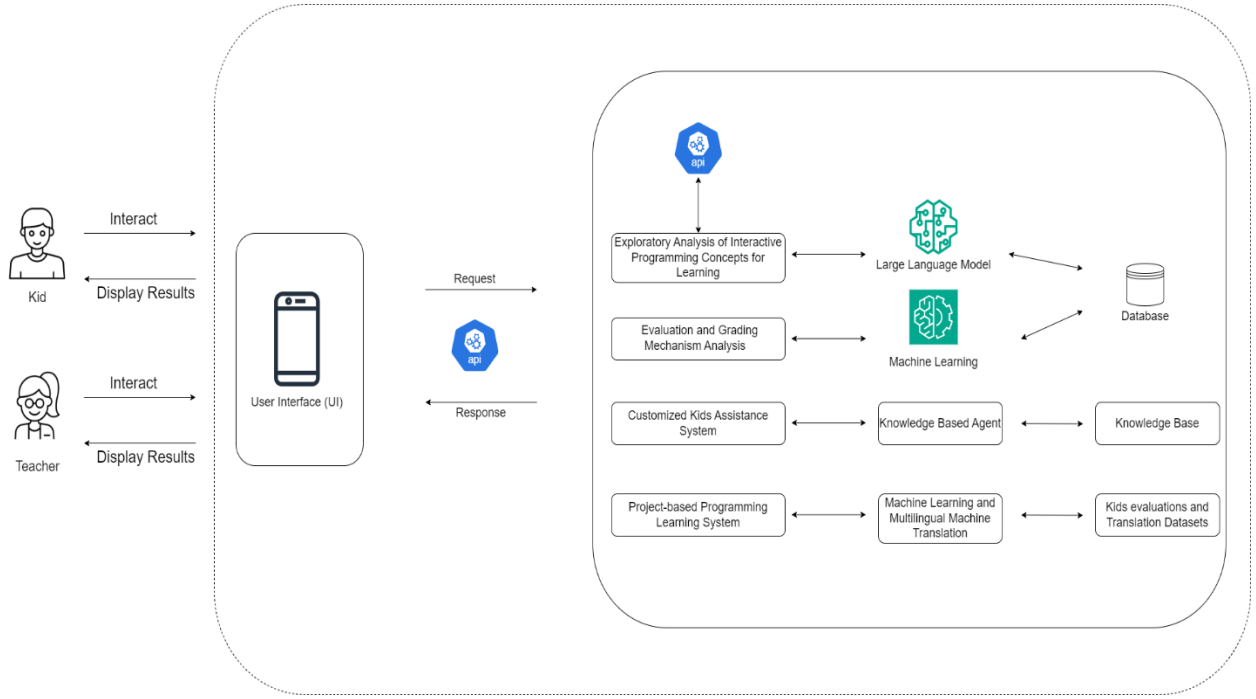

Figure 5 - Overall System Diagram

The image depicted in Figure 5 represents the overall system diagram of our solution. Initially, both kids and teachers can interact with our app through their smartphones. The smartphone hosts only the frontend, while our backend has been deployed to the system. The frontend connects to the backend through REST API (API requests). In our backend, there are four main components. The first is the Exploratory Analysis of Interactive Programming Concepts for Learning, which is responsible for teaching basic programming concepts to kids. It retrieves data from the database. The second component is the Evaluation and Grading Mechanism Analysis, which evaluates the knowledge gained by kids and provides a grading for them. It also retrieves data from the database. The third component is the Customized Kids Assistance System, which assists kids when they encounter doubts during their learning process. It retrieves data from the knowledge base. The fourth component is the Project-based Programming Learning System, which provides an experience similar to the real-world IT industry. It retrieves data from kids' evaluations and Translation Datasets.

7.2. Customized Kids Assistance System Diagram

The proposed solution for the "Customized Kids Assistance System " is Knowledge Base Assistance (KBA). We have determined that this approach is the most effective

way to assist kids as it offers greater customization and accuracy compared to chatbots mentioned in the above-mentioned researchers [2], [4]. To establish our methodology, we first need to create a system diagram outlining how our components will interact with the system is displayed in Figure 5. For this purpose, we found an architecture in a research paper [13] and customized it to suit our specific needs.

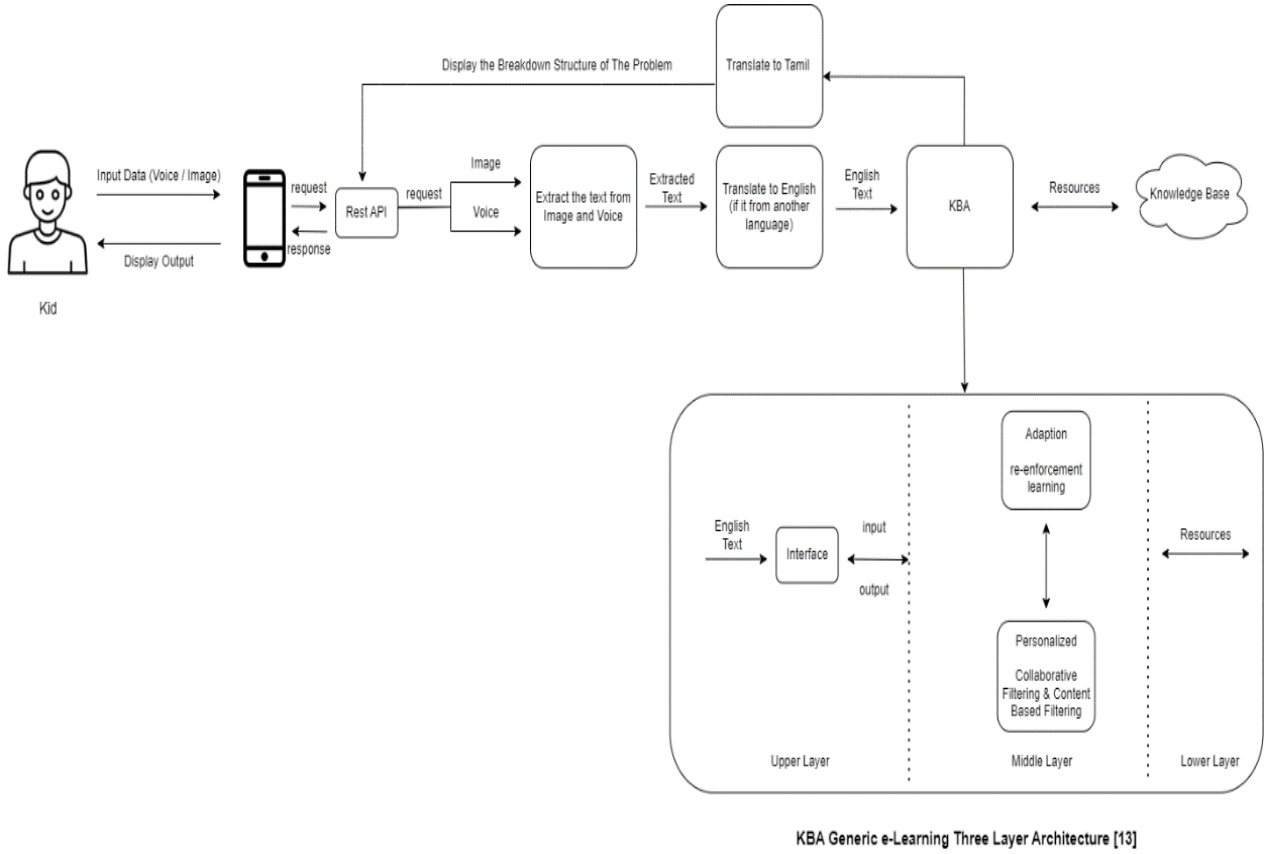

Figure 6 - System Diagram of Customized Kids Assistance System

a) Rest API – The interface where frontend and backend communicate.
b) Extract the text from Image and Voice – This is where the extraction will happen after kid ask question or doubt.
    a. Extract the text from Image: use Libraries: ex: pytesseract
    b. Extract the text from Voice: use Libraries: ex: Google Cloud Speech-to-Text.
c) Translate to English – This is where translated will happen if input from another language (in this scenario language: Tamil)
    a. Example: Cloud Translation API
d) KBA (Knowledge Base Agent) – This is where the processing will happen.
    a. Interface: This is the place where the input happen to the KBA (Knowledge Base Agent) system.

b. Adaption: We are using re-enforcement learning to provide adaptive to base on usage of user.
c. Personalized: In here only filtering happens according to the user's usage; in here two methods have been used content base filtering and collaborative filtering.
d. Resources – This is the connection between KBA (Knowledge Base System)
e. Knowledge Base – This is like a database but not exact database, stores all the data regarding the knowledge, Maintain the resources.
f. Translate to Tamil - Cloud Translation API

Initially, we selected the technology stack that we are using: Frontend - Flutter & Dart. Flutter is a cross-platform language that supports more third-party libraries than React Native, allowing us to customize our app extensively. For the backend, we have mainly two options. The first one is Python, a very popular language that supports many libraries and models directly. The second one is Java, which is better for scaling the app, and we can easily implement microservices with it. Additionally, we plan to use Firebase as the database since accessing Firebase is very easy. The central part of the "Customized Kids Assistance System" is the Knowledge Base, and for this, we are considering Dokuwiki or MediaWiki. We are also planning to deploy our system on the Hostinger server.

7.3. System Requirements

According to the solution proposed by this research, it requires hardware such as a smartphone running on Android OS with a version greater than Android 9 (Code Name: Pie), but the latest version is recommended. The phone should have an internet connection, and the internet connection speed should be normal for general usage.

7.4. Functional Requirements and Non-Functional Requirements

For the convenient, Functional Requirements and Non-Functional Requirements are shown in Table 2.

Table 2 - Functional Requirements and Non-Functional Requirements

Functional Requirements	Non-Functional Requirements
User should be able to input data as image or voice	Performance
User should be able to see breakdown structure of problem	Reliability

User should be able to use English or Tamil language to input data	
User should be able to see the output in Tamil language	

8. Description of Personal and Facilities

8.1. Personal

We are a group of four students pursuing undergraduate degrees in IT at SLIIT, specializing in Software Engineering. Our research focuses on developing a Learning Programming App for Kids with the primary goal of providing a basic understanding of programming concepts to bridge the IT knowledge gap between students in Sri Lanka and India. Our research is structured into four main components to achieve our objective. The first component involves imparting basic IT concepts to kids through storytelling. We have found that teaching through stories is more effective than traditional methods. The second component is a Customized Assistance System for Kids. This system aims to help children when they encounter difficulties while learning. We provide a structured breakdown of doubts or questions raised by kids. The third component is an examination and evaluation system to ensure that kids have truly grasped the content. The fourth component is a Project-Based Learning Programming System. This component is designed to provide kids with hands-on experience, simulating the working environment of the IT industry. Through these components, we aim to make learning programming an engaging and effective experience for kids, ultimately reducing the IT knowledge gap between students in Sri Lanka and India.

As undergraduates specializing in Software Engineering, we possess knowledge of the proper methods to plan and implement the software development lifecycle. Our experience includes numerous projects in software engineering, providing us with both theoretical understanding and practical skills. While we are currently in the process of learning about Machine Learning components such as LLM and Reinforcement Learning, we are confident that we can successfully complete this project by applying the knowledge we have gained.

8.2. Facilities

For our research, we are taking sample students from CP/K/W/Al-Aqsa Muslim Vidyalaya, Gunnepana, and there are a total of 19 students studying from grade 3 to grade 5, and we confirmed that 95% of the students' houses have touch-screen mobile facilities.

9. Budget and Budget Justification

9.1. Budget

We have come up with a draft budget for our research shows in Table 3. This may differ in the actual process.

Table 3 - Budget Plan

NO	Expenditure	Cost ($)
1	Domain	14.43$/M
2	Hosting	2.99$/M
3	Traveling Expenses (4 Members)	12.84$/Trip
4	Google Play Developer Fee	25$ (One Time)
Total Cost		55.26$

9.2. Budget Justification

Initially, we need to publish our research documents on a website. For this, we have selected LK Domain Registry, a domain publisher in Sri Lanka, which charges $14.43 per month—an economical choice in the country. Following that, we plan to deploy our backend on a server, and after researching, we found Hostinger to offer reliable servers at a reasonable price of $2.99 per month. Additionally, since our research involves visiting a school in Kandy, there are travel expenses to consider. The cost per round trip from SLIIT to CP/K/W/Al-Aqsa Muslim Vidyalaya, Gunnepana School, is $12.84. Lastly, to publish our app on the Play Store, there is a one-time cost of $25. The total estimated expense comes to $55.26. Please note that these expenses may vary in the actual scenario.

10. Reference List

[1] https://invedus.com/blog/outsourcing-statistics/

[2] S. Ruan et al., “Supporting children’s math learning with feedback-augmented narrative technology,” in Proceedings of the Interaction Design and Children Conference, 2020.

[3] S. Pawar, K. Chavan, A. Sirsat, V. Ingle, and S. Kawane, “Research on Application of Artificial Intelligence in Kids Interactive Learning Platform,” International Journal of Innovative Science and Research Technology, Vol. 8, no. 4, 2023.

[4] K. Kutubuddin, S. Sirisha, B. Sreedhar, and P. Arulprakash, "A Path Towards Child-Centric Artificial Intelligence based Education," International Journal of Early Childhood Special Education, Vol. 14, 2022, DOI: 10.9756/INT-JECSE/V14I3.1145.

[5] A. Fawaz, Al-Zaghoul, K. Sabri, and E. Al-Thwaib, “Software Agent in E-Learning Mobile Application for Kindergarten Students,” Apr. 2017.

[6] N. Anwar, P. Dedy, S. Kristiadi, Kuwera, P. Tanto, and K. Septha, “Learning Math through Mobile Game for Primary School Students,” Jun. 2020.

[7] L. K. P. D. Gunawardhana, “Review of E-learning as a platform for distance learning in Sri Lanka,” Social Science Research Network, 2020.

[8] A. G. Soosai Raj, E. Zhang, S. Mukherjee, J. Williams, R. Halverson, and J. M. Patel, “Effect of native language on student learning and classroom interaction in an operating systems course,” in Proceedings of the 2019 ACM Conference on Innovation and Technology in Computer Science Education, 2019.

[9] S. Hudelson, “The role of native language literacy in the education of language minority children,” Lang. Arts, Vol. 64, no. 8, pp. 827–841, 1987.

[10] A. Suhandi et al., “Improving Primary Students’ Critical Thinking Skills Through Experiential Learning Assisted Tools Of Science For Kids (EL-TSK) On Magnetic Force Concept Improving Primary Students’ Critical Thinking Skills Through Experiential Learning Assisted Tools Of Science For Kids (EL-TSK) On Magnetic Force Concept,” Article in International Journal of Scientific & Technology Research, Vol. 1, p. 497, 2019.

[11] H. S. A. Latiff*, R. Razali*, and F. F. Ismail, “User Interface Design Guidelines for Children Mobile Learning Applications,” International Journal of Recent Technology and Engineering (IJRTE), Vol. 8, no. 3, pp. 3311–3319, Sep. 2019, doi: https://doi.org/10.35940/ijrte.c5434.098319.

[12] H. Al-Sakran, “Developing e-Learning System using Mobile Agent Technology,” in *2006 2nd International Conference on Information & Communication Technologies*, 2006, Vol. 1, pp. 647–652.

[13] K. Sakthiyavathi and K. Palanivel, “A generic architecture for agent based E-learning system,” in 2009 International Conference on Intelligent Agent & Multi-Agent Systems, 2009, pp. 1–5.

11. Appendices

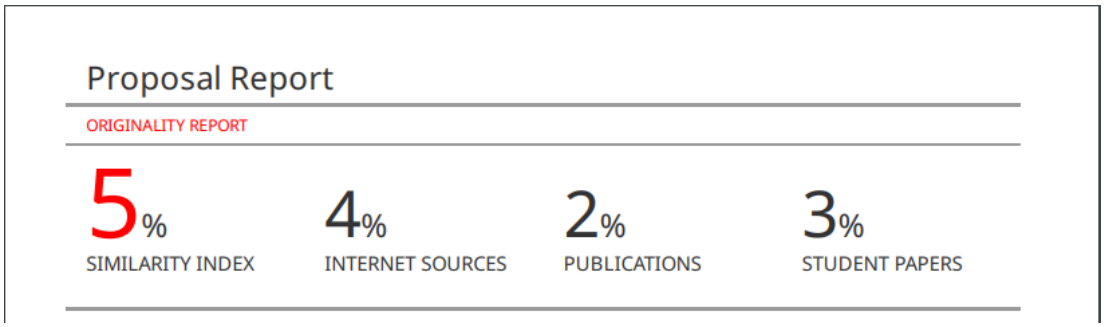

Figure 7 - Plagiarism Report