DEVELOPMENT OF A MOBILE-BASED GAMIFIED TECHNOLOGY TUTOR FOR CHILDREN (LEARNIFY)

BY:

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN COMPUTER ENGINEERING

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CERTIFICATION

This is to certify that **AJITERU, Emmanuel Dolapo (CPE/17/3099)**, a final year student pursuing Computer Engineering, has completed and submitted the final year project report. Throughout this project, he has demonstrated commendable dedication, academic rigour, and a profound understanding of the subject matter. The project report encapsulates his original research, analysis, and critical thinking skills in the field.

______________________________	____________________
AJITERU EMMANUEL DOLAPO	**DATE**
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______________________________	____________________
PROFESSOR E. O. OGUNTI **(HEAD OF DEPARTMENT)**	**DATE**

DEDICATION

I dedicate this project solely and humbly to the Divine Presence of God. Without profound gratitude, I acknowledge His unwavering guidance, grace, and blessings throughout this endeavour. His wisdom and strength have illuminated every step of this journey, and I am deeply thankful for His infinite support.

ACKNOWLEDGEMENT

I express profound gratitude to my supervisor, Professor (Mrs.) Dahunsi, for her unwavering guidance, mentorship, and constant support throughout this academic journey. Her expertise has significantly contributed to the successful completion of this project. I extend my deepest appreciation to the Department of Computer Engineering in the School of Engineering and Engineering Technology for providing an environment conducive to academic excellence. The resources and facilities offered by the department have played a crucial role in shaping the outcomes of this research.

Special thanks are due to my parents for their enduring love, endless support, and numerous sacrifices that have been instrumental in reaching this academic milestone. To my family, I express gratitude for being a constant source of support and encouragement. Your understanding and unwavering belief in my capabilities have been invaluable. I am thankful to my siblings for being my pillars of strength and consistently cheering me on throughout this academic endeavour.

Appreciation also goes to my friends for their encouragement, understanding, and steadfast support through both challenges and successes. Your unwavering belief in me has been a constant source of motivation and joy.

Each individual mentioned has played an invaluable role not only in shaping this project but also in shaping my academic and personal growth. I consider myself fortunate to have such exceptional support from my loved ones, and I am forever grateful for their presence in my life.

ABSTRACT

This project develops a mobile application tailored to cultivate an engaging and educational learning environment for children by seamlessly integrating gamified elements and technology tutorials. Rooted in contemporary technology, the application offers an interactive platform designed for children to explore diverse technological concepts and advancements in an entertaining manner. With features encompassing a user-friendly interface, interactive learning modules, and gamification techniques aligned with children's learning needs, the application seeks to introduce and familiarize young minds with technology. The curriculum embedded within the application employs engaging games, quizzes, and interactive tutorials to impart technology-related subjects in an easily understandable format. Integral components include user authentication, a robust database for storing user profiles and progress data, technology lessons presented intuitively, and a feedback system to enhance user engagement. Back-end systems, notably Firebase, are incorporated for efficient data management. The user interface boasts an intuitive design, ensuring ease of navigation and interaction for children. Implementation involves type declarations and user-defined functions to maintain data consistency, ensuring a seamless learning experience. This project responds to the demand for technology-centric educational tools for children, aspiring to foster early interest and understanding of technology while providing an enjoyable learning atmosphere. The development of this mobile application aims to contribute to the educational advancement and technological literacy of young learners.

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INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

In the ever-evolving digital era, technology has entrenched itself as an indispensable component of our daily lives, fundamentally influencing how we communicate, work, and learn (Su & Cheng, 2014). This digital transformation has propelled the younger generation into a world where proficiency in digital skills is not just advantageous but essential for their future success. Despite this, conventional approaches to teaching technology concepts often struggle to capture the attention and enthusiasm of children, resulting in disinterest and limited engagement. For children growing up in this technology-saturated environment, the demand for innovative and effective educational tools has become increasingly pronounced. It is against this backdrop that the concept of Learnify, a mobile-based gamified technology tutor, emerges as a response to the challenges faced in imparting technology education to young learners.

Learnify seeks to revolutionize the educational landscape by amalgamating the power of interactive mobile applications, educational content, and gamification to create a dynamic and immersive learning environment for children. The rationale behind this initiative lies in the recognition that traditional teaching methods often fall short in maintaining the engagement of tech-savvy youngsters. The integration of game-like elements into the learning process offers a novel approach. By infusing fun challenges, rewarding achievements, and collaborative experiences, Learnify aims to make the exploration of the fascinating world of technology an enjoyable and interactive journey for children. This not only aligns with their learning preferences but also ensures that they are better equipped with the digital skills required for the future.

Learnify's unique proposition lies in its ability to bring technology education directly into the hands of children through smartphones and tablets, capitalizing on their familiarity with these digital devices. The incorporation of gamification elements, including rewards, points, and friendly competition, adds an extra layer to the learning experience. This approach is anticipated not only to enhance motivation but also to encourage active participation and foster a sense of accomplishment as children progress through their educational voyage. As technology continues to advance, the Learnify platform endeavours to redefine how technology is introduced and taught to children. By transforming the educational paradigm into a dynamic, interactive, and enjoyable experience, Learnify strives to equip young learners with the essential digital skills necessary for their future endeavours. Through this project, we aim to bridge the gap between traditional teaching methods and the evolving needs of a technologically literate generation, ensuring that the journey of learning technology is as exciting as the destination it leads to.

1.2 STATEMENT OF PROBLEM

In an ideal educational setting, classrooms would brim with the vibrant energy of young minds eager to delve into new ideas and explore the wonders of learning. Unfortunately, many current educational environments starkly contrast this vision. Children, natural explorers with an inherent hunger for knowledge, often find themselves adrift in uninspiring learning atmospheres. Traditional teaching methods, which prioritize memorization and standardized assessments, have the tendency to stifle the innate curiosity that propels their enthusiasm for learning. Textbooks and worksheets, rather than being tools of discovery, transform into monotonous.

This stagnation in education has far-reaching consequences. Engagement dwindles, replaced by a sense of obligation. Learning becomes uneven, leaving some students grappling with challenges while others succumb to boredom. The inflexible, one-size-fits-all approach fails to accommodate diverse learning styles, fostering frustration and limiting overall success. Additionally, persistent barriers to quality education, such as geographical and financial constraints, loom large, casting shadows over the aspirations of numerous children. This educational disparity further perpetuates cycles of inequality, obstructing their full potential.

Amidst the seemingly bleak educational landscape, a beacon of hope emerges: the potential of technological revolution. Through the introduction of the mobile-based gamified technology tutor for children, known as Learnify, we aspire to bridge the gap of disinterest and create an environment where every child not only survives but thrives in their learning journey.

1.3 SIGNIFICANCE OF PROJECT

Through the development and analysis of Learnify, this research aims to tackle crucial challenges in today's Education, leading to notable advancements in:

1. Heightened Engagement and Motivation: Standard teaching methods sometimes stifle children's inherent curiosity. This study delves into how gaming elements such as points, badges, and leaderboards can convert learning into an enthralling adventure, stimulating intrinsic motivation and nurturing a passion for exploration and acquiring knowledge.
2. Tailored and Efficient Learning: The one-size-fits-all approach often leaves some students struggling or disinterested. This research investigates the effectiveness of adaptive algorithms in customizing the learning process to suit each child's unique requirements and pace, ensuring comprehensive understanding and optimal skill development for all learners.
3. Inclusive Education Access: Numerous children face barriers due to geography or financial limitations. This study explores how mobile technology can democratize access to quality

education, making it accessible anywhere, anytime, and empowering children regardless of their socioeconomic status or location.

4. Strengthening Parental Involvement in Learning: Conventional methods sometimes disconnect parents from their children's educational journey. This research examines how interactive elements and shared progress tracking can bridge the gap between home and school, encouraging collaboration, support, and a shared enthusiasm for learning within families.

1.4 AIM AND OBJECTIVES OF THE PROJECT

1.4.1 Aim of The Project

The project aims to develop a mobile-based gamified technology tutor for children (Learnify) to make learning more engaging and effective.

1.4.2 Objectives of The Project

The objectives of the project are to:

(a) develop a mobile gamified technology tutor for children (Learnify);

(b) include personalized feedback and adaptive learning in (a); and

(c) evaluate the performance of (a) and (b)

1.5 SCOPE OF STUDY

This study is dedicated to the comprehensive exploration, development, and assessment of Learnify, a mobile-based gamified technology tutor. It involves the detailed design and execution of the Learnify platform, emphasizing user interface, interactive modules, and gamification elements. The technological framework, particularly the utilization of Firebase, will be implemented with a focus on robust data management. The study includes the creation of an engaging curriculum to introduce children to diverse technological concepts, employing games, quizzes, and interactive tutorials. Furthermore, it incorporates the integration of gamification elements to enhance motivation and user participation, aiming to instill a sense of accomplishment in children. The scope also encompasses strategies for user engagement through a feedback system and explores methods to maintain and enhance engagement throughout the study. Lastly, rigorous evaluation and testing will be conducted to ensure the functionality, usability, and scalability of the Learnify mobile application, aiming to contribute valuable insights into its potential impact on children's technology education.

CHAPTER TWO

LITERATURE REVIEW

2.1 RELATED WORKS

The project will commence with an extensive literature review to understand existing research, studies, and best practices related to gamified technology education and mobile learning. This review will provide valuable insights into effective gamification techniques, educational game design principles, and the impact of technology education on children.

A Mobile-based technology refers to a technology or application that is designed to be used on mobile devices such as smartphones or tablets. It implies that the gamified technology tutor you are developing will be accessible and usable on mobile platforms. Gamification is incorporating game elements and mechanics into non-game contexts to make them more engaging and enjoyable. In the context of your project, it means that the technology tutor will have interactive and game-like features to motivate and incentivize children's learning. A technology tutor is an educational tool or platform that provides guidance, instruction, and support for learning specific technological skills or concepts. In this case, the technology tutor you are developing will focus on teaching children about various aspects of technology in a fun and interactive way. Children refers s a stage of human development between birth and puberty, or the period between infancy and puberty. The term may also mean a human being who is not yet born. The term "child" as used in law typically refers to a minor, also known as a person under the age of majority. In general, children are subject to fewer rights and obligations than adults. They are considered incapable of making important decisions (JetLearn, 2023; Diana, 2023; Jennilyn, 2023).

In Mehdipour and Zerehkafi (2013), Education and training were the processes through which one generation's wisdom, knowledge, and skills were passed on to the next. At that time, there were two primary forms of Education and training: conventional education and distance education. Mobile learning, known as "M-Learning," provides modern ways to support learning through mobile devices, including handheld and tablet computers, MP3 players, smartphones, and mobile phones. Patricio et al. (2019) presented the first version of the PlanetarySystemGO project, an evolution of SolarSystemGO, a Mobile Augmented Reality game previously created with the Unity3D/Vuforia game engine. While both projects aim at providing awareness of several Astronomy concepts, for PlanetarySystemGO a web-based back-end system was implemented, and developed under the .NET technology allows the instructor to manage several aspects of the game.

The educational system played a crucial role in the development of nations, and the impact of early Education empowered knowledge acquisition. In their research, technology-assisted second language learning (English) with a peaceful context was used to reveal the impact of information and communication technologies (ICT) on learning. The study was conducted on 5-year-old pre-schoolers, representing four classes with an average of 17 students in each, and a total of 60 sample students. Knowledge acquisition and tests were conducted with in-class gamification training (Kayımbaşıoğlu et al., 2016).

Gamification represents the utilization of game mechanics and strategies in non-game contexts. At the time, various reports indicated that it had emerged as a significant trend in multiple application fields, including Education. Its primary aim was to incentivize behaviour change and enhance problem-solving skills (González et al., 2014). In the paper Gamifying Children's Linguistic Intelligence with the Duolingo App: A Case Study from Indonesia, the focus was on the utilization of the Duolingo App to enhance the linguistic intelligence of children. Linguistic intelligence pertains to the skill of effectively and efficiently applying vocabulary. The Duolingo App, designed for the Android platform, served as a tool to assist children in mastering foreign languages, enabling them to practice speaking, reading, listening, and writing playfully (Fadhli et al., 2022).

Special Education represents an educational service offered by both private and public schools, specifically tailored to meet the needs of students with disabilities. One prevalent behavioural disorder is Attention Deficit Hyperactivity Disorder (ADHD), which can manifest from infancy through adolescence and even into adulthood. This study had a primary focus on providing an interactive supplementary tool to support ADHD children in their learning journey, encompassing Mathematics, Language, and Basic Hygiene. The tool took the form of a gamified system, designed as an Android mobile application featuring Level 1 lectures presented through animated content. The primary objective was to provide parents and teachers with a means to monitor the progress of students or children with ADHD as they engaged in various activities within the e-tutor system. The results of the user acceptance testing indicated that the Android application was well-received in terms of its content and suitability for use in the context of special education services (Supangan et al., 2019).

‘Game-Based Learning for Young Children: A Case Study’ discussed the adoption of technologies such as tablets or smartphones for children at home or at school, and the challenges it posed for suitable teaching methodologies and practices. The study presented the introduction of game-based learning techniques for young children in Cape Verde, using the Code Karts app (Pombo & Lamas, 2022). The paper discussed the design of a gamified application that effectively integrated augmented reality to support learning (Farooq et al., 2022). The authors argued that early childhood learning was an important concern for the concept-building of children and that students had been taught with traditional methods from the beginning, which lacked kids' attention. The paper presented an ABCD-AR mobile-based application designed to overcome the flaws in the traditional education system. The application used augmented reality (AR) to help students engage better and learn more effectively. The study proposed 23 usability principles for AR-based learning applications for kids, which human experts validated. The results of experiments carried out to evaluate the application in terms of efficiency, effectiveness, learnability, user satisfaction & engagement indicated that the developed game-based application was highly effective and efficient because the mean of marks obtained by students before using ABCD-AR application was lower (M = 4.97, SD = 1.650) than the marks obtained after using ABCD-AR application (M = 7.97, SD = 1.608). Similarly, results indicated that the mean time taken to perform tests without using the ABCD-AR application (M = 7.97, SD = 1.650) was higher than with using it (M = 4.37, SD = 1.608). The majority of the students were entertained by playing the game while learning and felt motivated to continue based on the game's scenario due to the variety of activities included.

'An Adaptive Learning with Gamification and Conversational UIs: The Rise of CiboPoliBot' discussed an adaptive learning system called CiboPoliBot that incorporates gamification and conversational user interfaces (UIs). The authors explored how these technologies can enhance the learning experience for users (Fadhil & Villafiorita, 2017). 'Gamified Smart Mirror to Leverage Autistic Education-Aliza' discussed using a gamified smart mirror called "Aliza" to teach basic Education to children with autism. "Aliza" consisted of four core components: a writing mentor for pre-writing, a math tutor for mathematics, a verbal trainer for speech, and an attentiveness tracker for emotion detection. The interactive games provided by "Aliza" impacted the learning process, and the generated report from the Deep Learning evaluation system could inform parents and tutors about the children’s progress (Najeeb et al., 2020).

The research on ‘What to Do and What to Avoid on the Use of Gamified Intelligent Tutor System for Low-Income Students’ discussed good and bad pedagogical practices when using a gamified intelligent tutor system (ITS) in elementary Education for low-income students in Brazil. The study aimed to identify practices that can improve teaching and learning processes using a gamified ITS. The results showed significant improvement in the Portuguese Language and Mathematical skills (Joaquim et al., 2022). The research discussed the integration of natural language processing (NLP) and gamification techniques into mobile applications to enhance children’s reading skills (Voicu et al., 2023).

The paper (Jamshidifarsani et al., 2019) discussed the use of technology-based or technology-assisted reading interventions for elementary grades between 2000 and 2017. The authors analyzed various aspects of these studies and classified them into six categories: phonological awareness, phonics, vocabulary, comprehension, fluency, and multi-component. The results showed that vocabulary interventions and the use of mobile, tablet, and other non-computer technologies were overlooked.

The paper by Chan, Santally and Whitehead (2022) discussed the use of gamification as a technology enabler in special educational needs (SEN) and deaf and hard of hearing (DHH) education. The research aimed to show how gamification of French learning resources can positively affect SEN and especially DHH students’ understanding and level of achievement in the language. The study explored the difficulties students face in learning French, how gamification of textual resources can improve learning, and the impact of games on students. A paper published in the ANP Journal of Social Science and Humanities, volume 2, issue 2, pages 74-81 in 2021, discussed the development of a gamified e-quiz and strategy game mobile application aimed at increasing students' motivation and continuance usage intention (Roslan, Ayub, Ghazali, & Zulkifli, 2021). The paper discussed the framework for developing a foreign language teaching software for children that utilizes Augmented Reality (AR), Voicebots, and ChatGPT (Large Language Models) (Topsakal & Topsakal, 2022).

Rodríguez-Pérez et al. (2020) discussed the development of a secure Health application for attention deficit and hyperactivity disorder (ADHD) that provides a platform for monitoring and managing ADHD symptoms. The application uses a secure communication channel to transmit data between the patient and the healthcare provider.

Research by Tan and Ng (2022) discussed the development of a gamified mobile sensing storytelling application aimed at enhancing remote cultural experience and engagement. The application uses gamification and mobile sensing technologies to provide an interactive and engaging way for users to learn about different cultures. Zhang et al. (2022) discussed the use of virtual reality technology as an educational and intervention tool for children with autism spectrum disorder (ASD) and its current perspectives and future directions. The results showed that games and interactive simulations were more dominant for cognitive gain outcomes across people and situations (Vogel, et al., 2006).

Pingmuang and Koraneekij (2022) discussed the use of mobile-assisted language learning (MALL) with a task-based approach and gamification to enhance writing skills in English as a Foreign Language (EFL) students. Furthermore, in Hakak et al. (2019) Cloud-assisted gamification for education and learning–Recent advances and challenges, recent advances and challenges in cloud-assisted gamification for Education and learning were explained. The findings indicated that the learning effectiveness of the learners within both groups (multi-sensory scaffolding teaching materials were applied) showed a significant increase. The results also showed that the design of the multi-sensory scaffolding met the learning needs of learners with total blindness in science education (Chang et al., 2022).

Finally, a study aimed at investigating whether children can learn programming basics and transfer this capability in the context of Intelligent Environments (IEs). The researchers performed a user study with 15 children aged 7-12 years old using a block-based, gamified AR spatial coding prototype that allowed them to manipulate smart artefacts in an Intelligent Living room (Stefanidi et al., 2021).

The above-reviewed projects, research and papers provide the basis for the project, ‘The Development of a Mobile-Based Gamified Technology Tutor for Children’ (Learnify). Insights were obtained from the above, both published and unpublished articles.

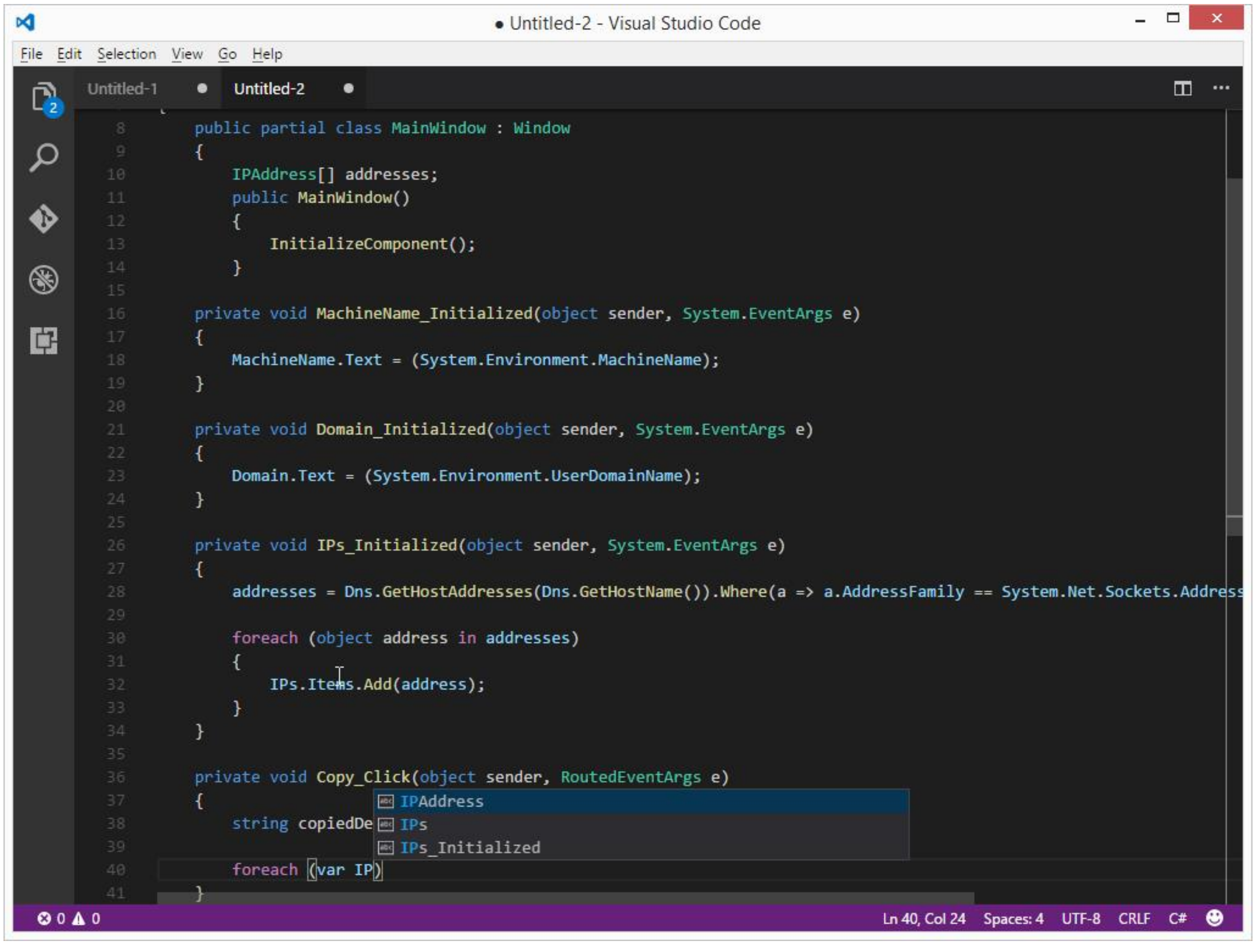
2.2 DEVELOPMENT TOOLS

The development tools encompassed a wide array of software applications, platforms, and utilities utilized throughout the software development lifecycle. These tools assist in coding, testing, debugging, and optimizing the application.

2.2.1 Visual Studio Code

Visual Studio is integral to Learnify's development, supporting cross-platform mobile app creation using C#. The IDE provides a robust UI designer, aiding in user-friendly interface design. Debugging tools ensure code reliability, while testing frameworks validate functionality. Source control integration enables collaborative development, crucial for team-based projects. Azure integration facilitates cloud services if required, seamlessly aligning with Learnify's needs. Visual Studio's Application Lifecycle Management tools contribute to structured project management.

The IDE supports various extensions and plugins, enhancing productivity and customization. Learnify benefits from Visual Studio's versatility, aiding in the entire development lifecycle. The IDE's capabilities extend beyond coding to encompass planning, testing, and release management.

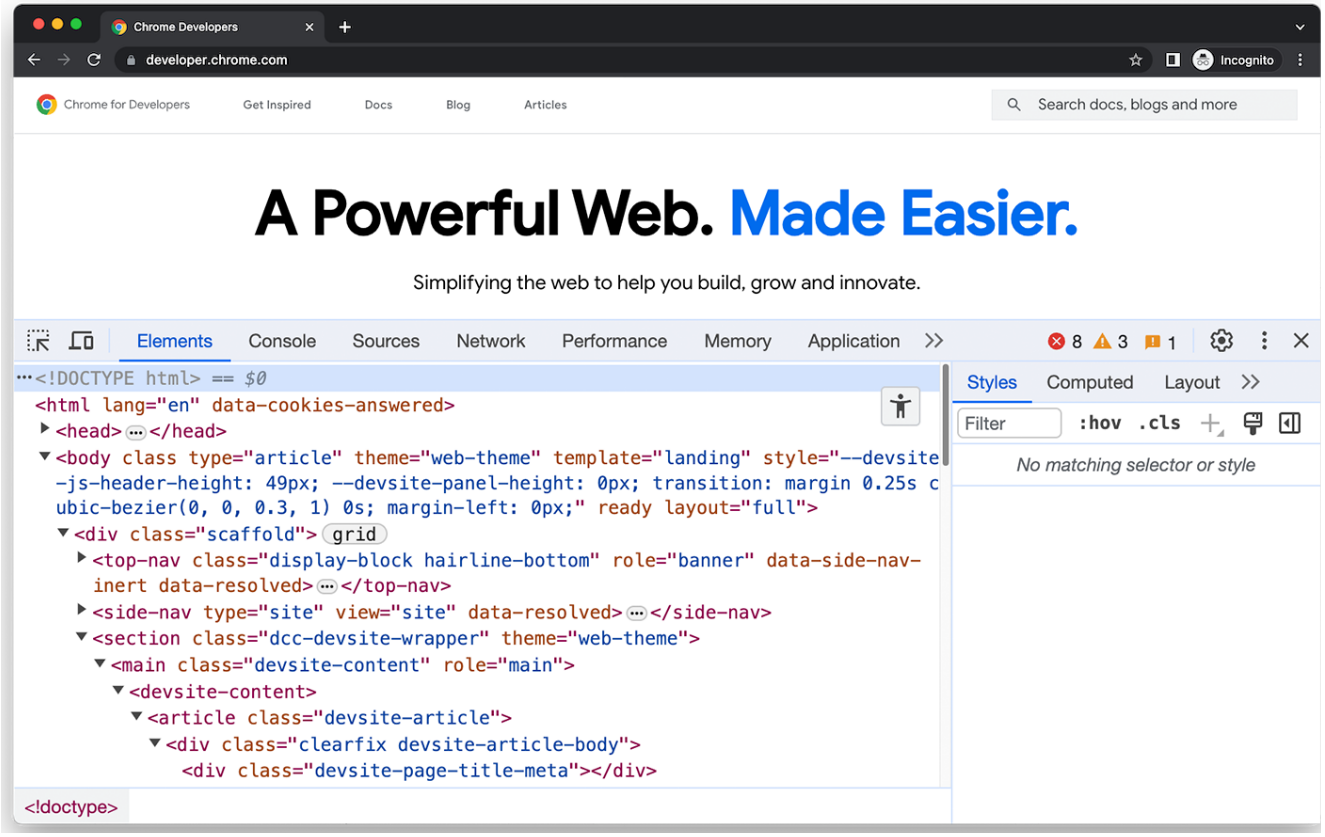


```
    public partial class MainWindow : Window
    {
        IPAddress[] addresses;
        public MainWindow()
        {
            InitializeComponent();
        }

    private void MachineName_Initialized(object sender, System.EventArgs e)
    {
        MachineName.Text = (System.Environment.MachineName);
    }

    private void Domain_Initialized(object sender, System.EventArgs e)
    {
        Domain.Text = (System.Environment.UserDomainName);
    }

    private void IPs_Initialized(object sender, System.EventArgs e)
    {
        addresses = Dns.GetHostAddresses(Dns.GetHostName()).Where(a => a.AddressFamily == System.Net.Sockets.Address

        foreach (object address in addresses)
        {
            IPs.Items.Add(address);
        }
    }

    private void Copy_Click(object sender, RoutedEventArgs e)
    {
        string copiedDe

        foreach (var IP)
    }
```

Figure 2.1: Visual Studio Code

2.2.2 Google Chrome Developer Tools

Google Chrome Developer Tools, an integral part of the Google Chrome browser, are a suite of tools designed specifically for web developers. These tools offer a range of functionalities, empowering developers to edit pages in real time, troubleshoot issues, experiment with features, and enhance performance. Comprehensive information about these tools is available in the official documentation or on the Google Chrome website (https://developer.chrome.com/docs/devtools/)



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```
···<!DOCTYPE html> == $0
  <html lang="en" data-cookies-answered>
  ▶<head>⋯</head>
  ▼<body class type="article" theme="web-theme" template="landing" style="--devsite
    -js-header-height: 49px; --devsite-panel-height: 0px; transition: margin 0.25s c
    ubic-bezier(0, 0, 0.3, 1) 0s; margin-left: 0px;" ready layout="full">
    ▼<div class="scaffold"> grid
      ▶<top-nav class="display-block hairline-bottom" role="banner" data-side-nav-
        inert data-resolved>⋯</top-nav>
      ▶<side-nav type="site" view="site" data-resolved>⋯</side-nav>
      ▼<section class="dcc-devsite-wrapper" theme="web-theme">
        ▼<main class="devsite-content" role="main">
          ▼<devsite-content>
            ▼<article class="devsite-article">
              ▼<div class="clearfix devsite-article-body">
                  <div class="devsite-page-title-meta"></div>
```

No matching selector or style

Figure 2.2: Google Chrome Developer Tools

The diverse set of features within Google Chrome Developer Tools includes:

1. Elements: Inspect and modify a page's DOM and CSS.
2. Console: Log messages, run JavaScript, and debug.
3. Sources: Edit files, create Snippets, debug JavaScript, and set up a Workspace.
4. Network: Monitor network requests.
5. Performance: Evaluate and enhance site performance.
6. Memory: Identify and resolve memory-related issues.

7. Application: Inspect, modify, and debug web apps.

8. Recorder: Record and replay user flows.

9. Rendering: Explore options affecting web content rendering.

10. Issues: Identify and rectify website problems.

11. Security: Ensure complete page security through HTTPS.

12. Memory Inspector: Inspect various memory components in JavaScript.

13. Network conditions: Override user agent strings.

14. Media: Debug media players per browser tab.

15. Animations: Inspect and modify animations.

16. Changes: Track changes in HTML, CSS, and JavaScript.

17. Coverage: Analyze unused JavaScript and CSS code.

18. Developer Resources: Check source maps and load them manually.

19. CSS Overview: Identify potential CSS enhancements.

20. Lighthouse: Optimize website speed with Lighthouse panel.

2.3 FRONTEND

Frontend was done using a combination of react + typescript (for proper type declaration) + ionic and styling was done using tailwind and vanilla CSS (CSS3).

2.3.1 Advantages Of Frameworks Used (Ionic)

a. Cross-Platform Development

1. Ionic allows for the development of cross-platform applications using a single codebase.
2. Write once, and deploy on multiple platforms (iOS, Android, web). It allows one to easily build progressive web apps (PWA's)

b. Rich UI Components

1. Provides a library of pre-built UI components for building modern and responsive interfaces.
2. Offers a consistent and native-like look and feel across platforms.

c. Easy Learning Curve

1. Built on popular web technologies like HTML, CSS, and JavaScript/TypeScript.
2. Suitable for developers with web development skills, reducing the learning curve.

2.4 IONIC

a. Limitations of Ionic

1. Performance: While suitable for many applications, performance-intensive apps may benefit more from native development.
2. Access to Native Features: Ionic relies on Capacitor or Cordova plugins to access native device features, which may introduce overhead.

b. Creating A Project With Ionic

(i) Installing Ionic CLI (If Not Installed)

‘npm install -g @ionic/cli’

(ii) Creating A New Iconic Project

‘ionic start myApp blank –type=react’

1. myApp: Replace this with the desired name of the project.
2. Blank: This is the template for the project. In this example, it's a blank template, but one can choose other templates like tabs, side menu, etc.
3. -type=react: Specify the desired framework for the project. Options include angular, react, or vue. Choose the appropriate framework for the application.

4. Navigate to Project Directory: cd myApp
5. Serve (Start) the Ionic App Locally: ionic serve

c. Managing The Project With Ionic

(i) Capacitor Plugins

1. The capacitor is used for accessing native features in Ionic apps.
2. Plugins such as apps, haptics, keyboard, and status bar are available for additional functionalities.

(ii) Cordova Plugins

1. Ionic can leverage Cordova plugins for native features in hybrid apps.

(iii) Dependencies

1. The project uses various dependencies managed through package managers (e.g., npm).
2. Versions are specified for each dependency to maintain compatibility.

d. State Management

(i) Redux

1. State Management

(I) Redux is a predictable state container for JavaScript applications.

(II) Centralizes the application's state in a single store.

(III) Enables predictable and traceable state changes.

2. Core Concepts

(I) Actions: Plain JavaScript objects describing changes.

(II) Reducers: Pure functions that specify how the state changes in response to actions.

(III) Store: Holds the application state.

3. Benefits

(I) Single source of truth for the application state.

(II) Enables debugging and time-traveling through state changes.

(III) Suitable for complex state management needs.

(ii) Redux Toolkit

1. Simplifying Redux

(I) Redux Toolkit is the official opinionated toolset for efficient Redux development.

(II) Bundles together commonly used Redux libraries and tools.

2. Key Features

(I) createSlice(): A function to create Redux slices (reducers + actions) in a more concise way

(II) configureStore(): A function to set up the Redux store with middleware and other configurations.

(III) createAsyncThunk(): A utility for handling asynchronous actions.

3. Advantages

(I) Reduces boilerplate code.

(II) Encourages best practices.

(III) Improves developer experience.

(iii) Dependencies In The Project

1. Redux

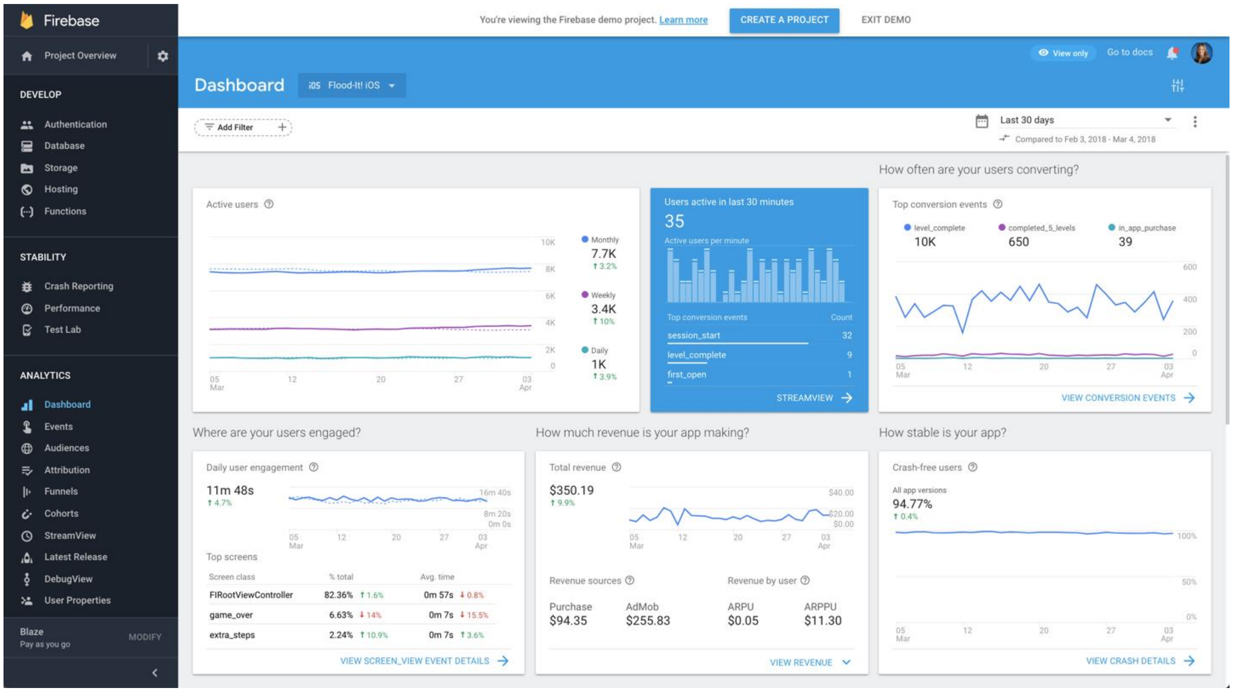
(I) @reduxjs/toolkit: The official toolkit for efficient Redux development.

2. Additional Dependencies

(I) Other dependencies like react-redux, @reduxjs/toolkit, and specific versions of related libraries as indicated in the provided project details.

2.5 FIREBASE: BACKEND FRAMEWORK/DATABASE

Firebase is a set of backend cloud computing services and application development platforms provided by Google. It hosts databases, services, authentication, and integration for a variety of applications, including Android, iOS, JavaScript, Node.js, Java, Unity, PHP, and C++.



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Top conversion events	Count
session_start	32
level_complete	9
first_open	1

Screen class	% total		Avg. time	
FIRootViewController	82.36%	↑ 1.6%	0m 57s	↓ 0.8%
game_over	6.63%	↓ 14%	0m 7s	↓ 15.5%
extra_steps	2.24%	↑ 10.9%	0m 7s	↑ 3.6%

Figure 2.3: Firebase

a. Advantages Of Firebase

Relating Firebase to the development of Learnify for children involves leveraging its features and benefits to enhance the app's functionality, user experience, and overall performance:

1. Real-time Progress Tracking: Firebase's real-time database can store and update a child's progress instantly. It allows the tutor app to track their learning journey dynamically and adapt content based on their performance.

2. Authentication and Child Safety: Utilizing Firebase's authentication services ensures a secure login for children. Implementing safety measures within the app to protect personal information aligns with the platform's robust security features.
3. Engaging Gamification with Real-time Updates: Firebase's real-time capabilities enable live updates within the gamified learning environment. As children complete tasks or achieve milestones, the app can instantly provide rewards, and progress notifications, or unlock new levels.
4. Content Storage and Distribution: Firebase's cloud storage facilitates the seamless storage and distribution of educational content, including videos, quizzes, and interactive lessons, ensuring quick access and smooth delivery.
5. Analytics for Personalized Learning: By integrating Firebase Analytics, the tutor app gathers data on children's interactions and learning patterns. This data-driven approach helps tailor content to individual learning styles and needs.

b. Setting Up The Backend With The Framework Used (Firebase)

In setting up the backend for Learnify using Firebase, several steps were involved to establish a robust and functional framework:

1. Creating a new project on the Firebase Console. I configured project settings, including project name, region, and other preferences as per the requirements of the gamified tutor app.
2. Implementing Firebase Authentication to manage user authentication and secure user data. I configured authentication methods suitable for children, such as email authentication with additional security measures.

3. Utilizing Firebase Realtime Database to store data in a NoSQL cloud database. I designed the database structure to organize and store game progress, user profiles, educational content, and other relevant information.
4. Integrating Firebase SDKs into the mobile app development environment for both Android and iOS platforms. I implemented Firebase APIs and SDKs to enable features such as authentication, database access, storage, and analytics within the app.
5. Testing the backend functionalities, including user authentication, data storage, and real-time updates. I utilized Firebase Analytics and Crashlytics to monitor user interactions, and app performance, and identify any issues or improvements needed.

2.6 USER-DEFINED FUNCTIONS

A user-defined function (UDF) is a function provided by the user of a program or environment, in a context where the usual assumption is that functions are built into the program or environment. UDFs are usually written for the requirement of their creator.

In the context of the project, user-defined functions play a significant role in providing personalized learning experiences for children using the mobile-based gamified technology tutor (Learnify). These functions were utilized to create tailored learning modules, interactive quizzes, or customized progress-tracking mechanisms. By employing user-defined functions, I could enable flexibility in content delivery, allowing children to engage with the material based on their learning pace and preferences. This adaptable approach aligns with the project's goal of creating a dynamic and personalized educational platform for children.

CHAPTER THREE

METHODOLOGY

The project is developed using some state-of-the-art technologies to develop a mobile-based gamified technology tutor for children that will make learning more engaging and effective.

3.1 SYSTEM OVERVIEW

The flowchart begins with the user login or sign-up process, where users enter their credentials to access the Learnify platform. Following this, the system initiates the authentication phase to ensure secure user identity verification. Once successfully authenticated, users are directed to the lesson section, where they can explore and engage with various educational modules and content tailored to their preferences. Additionally, the flowchart incorporates a settings section, allowing users to customize and adjust their Learnify experience according to their preferences. Overall, the flowchart represents a streamlined journey, starting from user authentication and progressing through lessons, with the option for users to personalize their experience through settings.

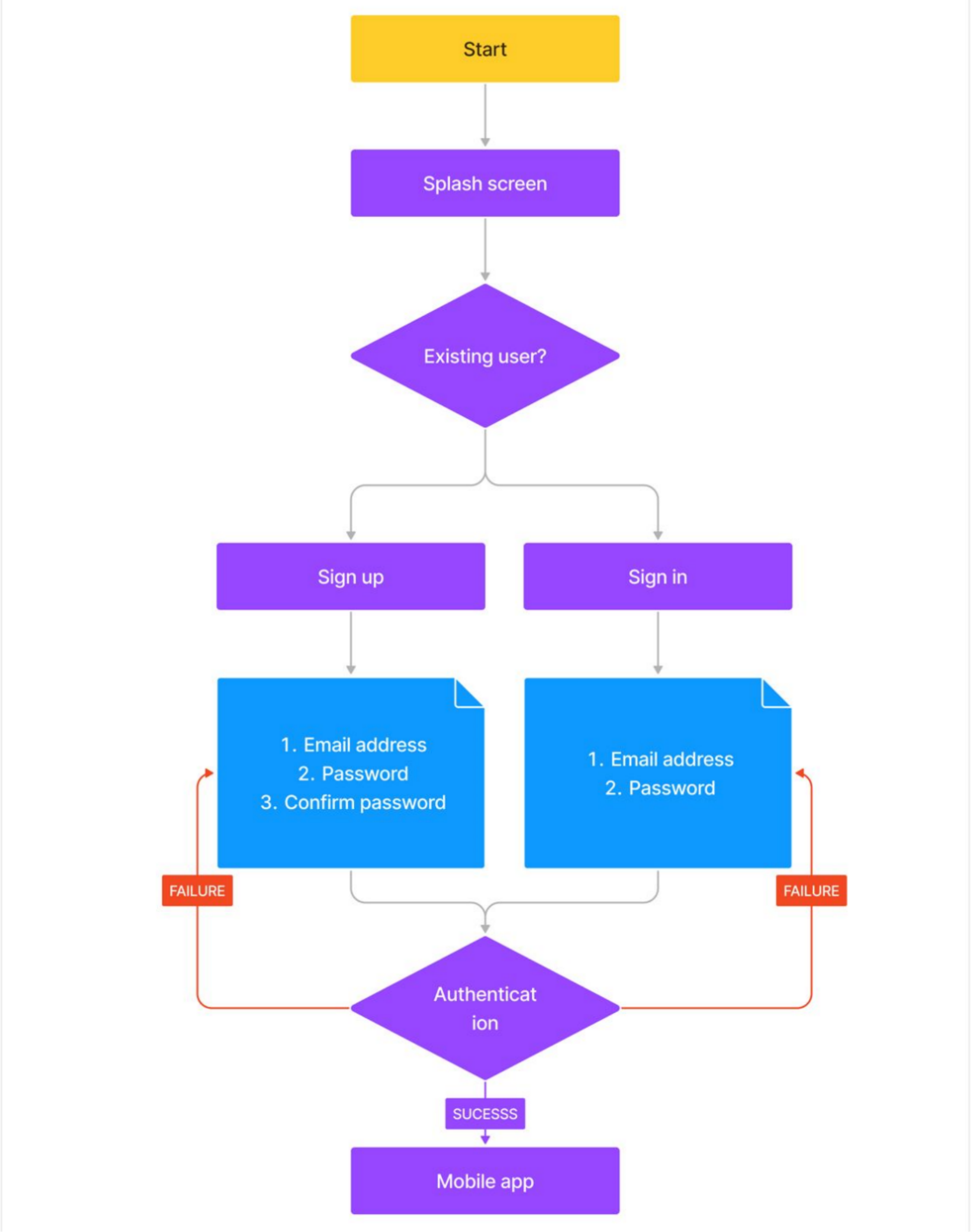


Figure. 3.1: Flowchart

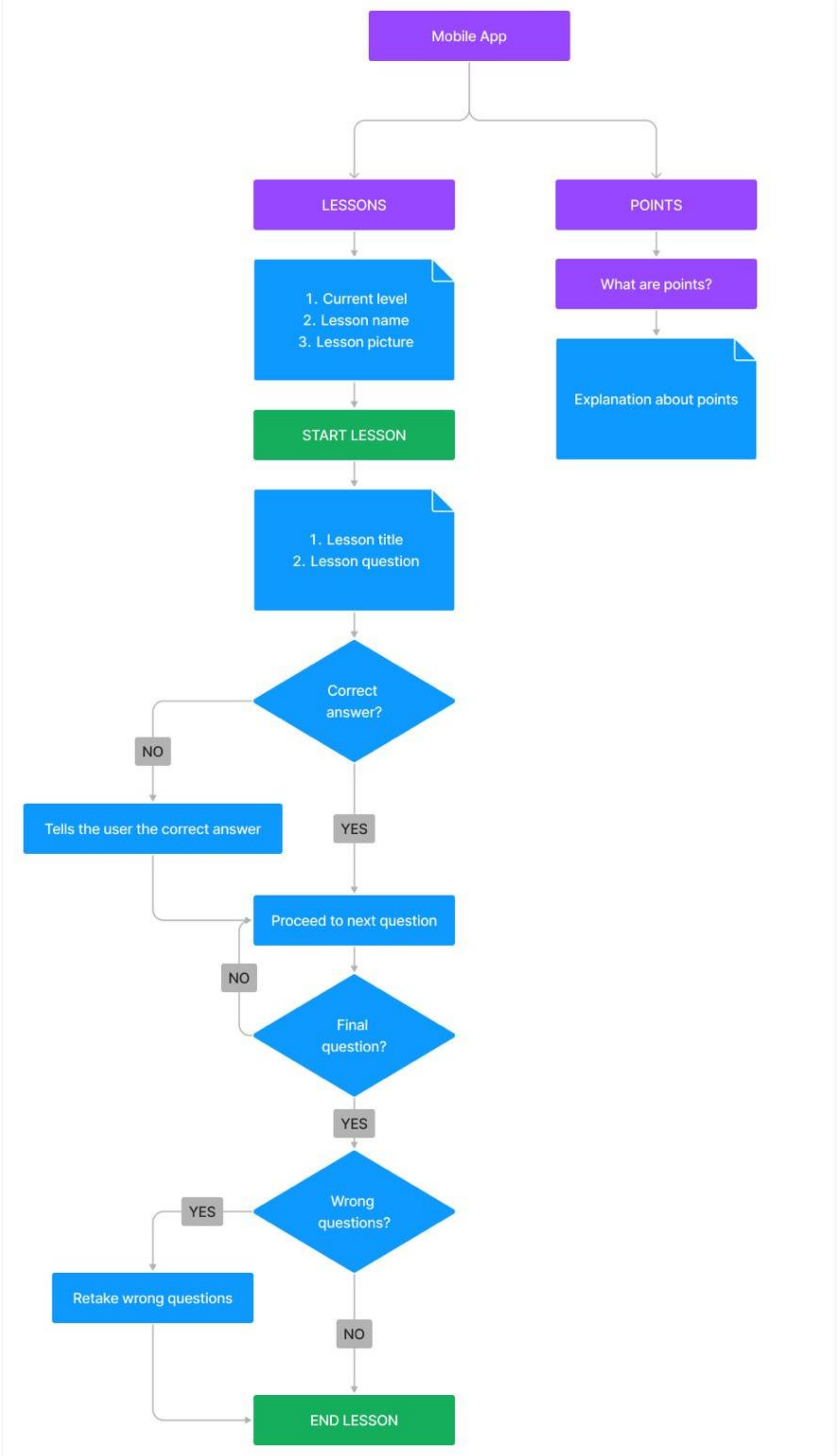


Figure 3.2: Flowchart (Cont.d)

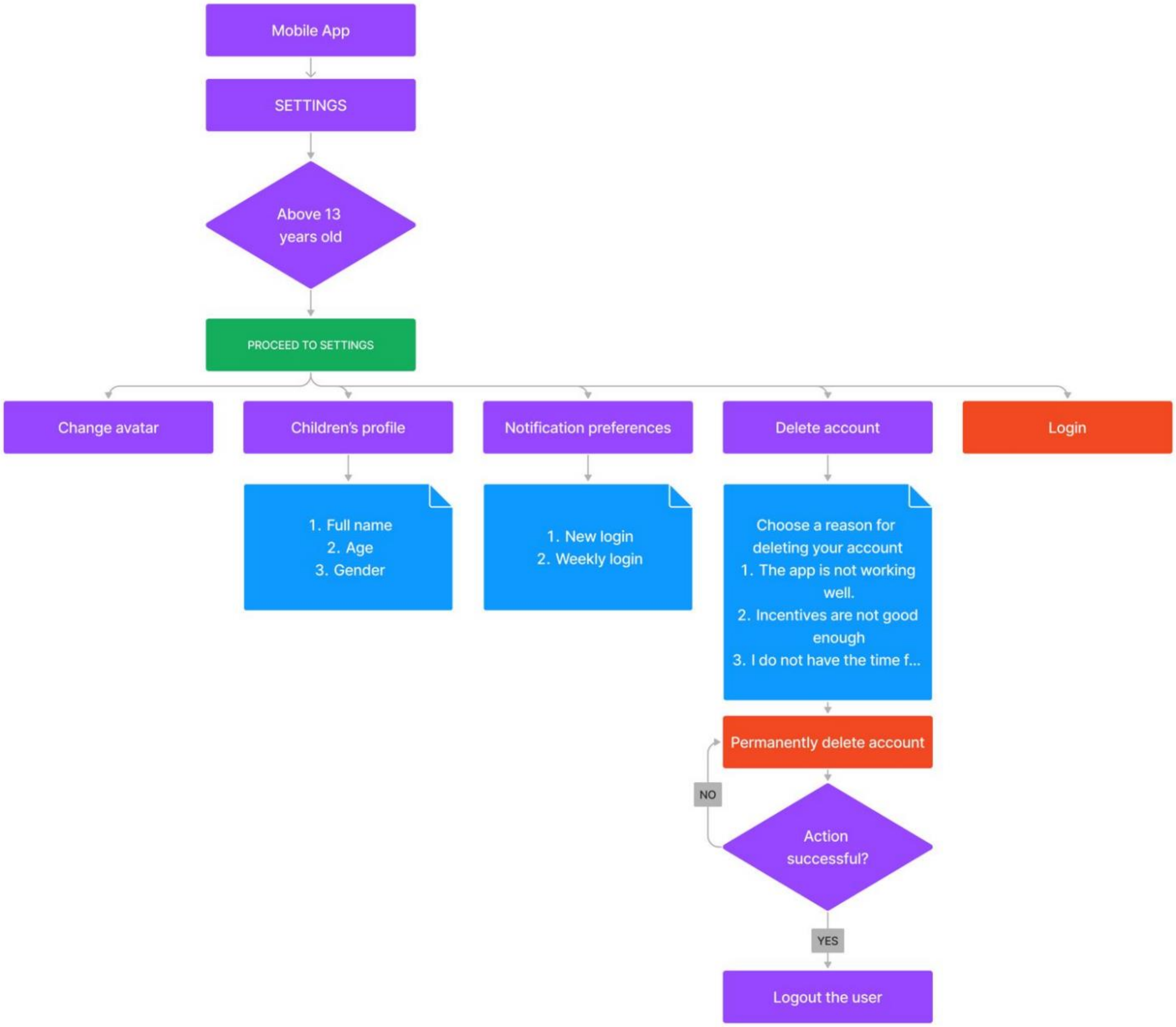


Figure 3.3: Flowchart (Cont.d)

3.1.1 Set-Up Of The Content Block

The first step is to get enough content for the children to read, which serves as the foundation for which the basis of the application is been built on:

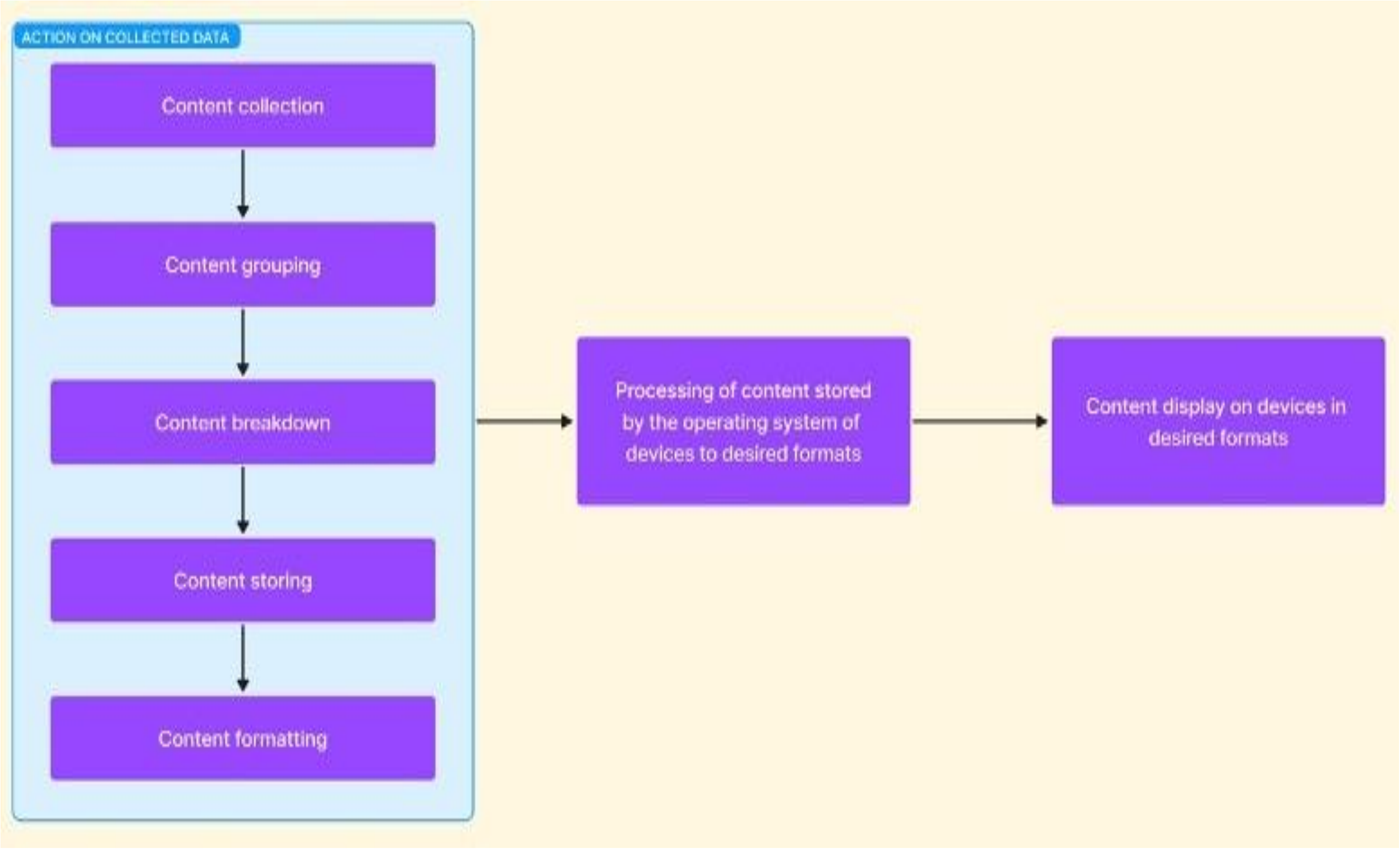

ACTION ON COLLECTED DATA
Content collection
Content grouping
Content breakdown
Content storing
Content formatting
Processing of content stored by the operating system of devices to desired formats
Content display on devices in desired formats

Figure 3.4: Content Block

To implement each part of the block above, comprehension of each part is necessary:

a. Content Collection

A systematic and methodical approach was employed to procure data from diverse online sources, with a predominant focus on educational materials related to engineering courses, encompassing a comprehensive array of key terms and terminologies. In its initial phase, this data collection endeavour was exclusively dedicated to acquiring materials specifically associated with the Internet of Things (IoT), including its terminology and conceptual foundations. The systematic gathering of data from a multitude of online repositories served the purpose of enriching educational resources and promoting an in-depth understanding of engineering disciplines. This meticulous process ensured the acquisition of accurate, relevant, and high-quality educational content, vital for advancing knowledge in engineering and related fields. The targeted concentration on the nomenclature and principles of the Internet of Things underscores the significance of this emerging technological domain in contemporary Education. By focusing on IoT-related materials, this initiative aims to facilitate a thorough exploration of IoT concepts, thereby contributing to a more profound comprehension of this transformative technology within the educational landscape.

b. Content Grouping

Content grouping constitutes a systematic and strategic approach employed within content management and organization. Its fundamental objective is classifying and coherently arranging disparate pieces of information into well-defined clusters or categories. This method serves the overarching purpose of optimizing the utilization of collected data and presenting it lucidly and systematically within a mobile application context. The process of content grouping essentially involved transforming unordered and disorganized data inputs into structured and logically organized data outputs. This systematic structuring of content significantly contributed to the overall effectiveness of content presentation and accessibility, particularly within the framework of mobile applications. The underlying principle of content grouping is to enhance the user experience by offering a streamlined and intuitive navigation system. It allows users to efficiently access information that is relevant to their needs while minimizing the cognitive load associated with searching for specific content. Content grouping simplifies the user's interaction with digital platforms, contributing to improved user satisfaction and engagement.

c. Content Breakdown

It was necessary to divide the narrative into pieces adapted to the cognitive capabilities of children. Great importance will be given to using robustly-tested and evidence-based approaches to achieve that goal. The key idea is to make sure that the message comes across in formats that are user-friendly and appropriate for facilitating comprehension for the targeted young readers.

d. Content Storing

The storage and management of content was facilitated through the utilization of third-party software, namely Firebase. Firebase Realtime Database represents a cloud-hosted NoSQL database solution designed to enable organizations to store and synchronize data seamlessly in real time across multiple user devices. This functionality ensures that applications remain consistently updated, even when users find themselves in offline environments. Such a capability enhances the user experience by ensuring data availability and synchronization across various devices, thereby offering uninterrupted and up-to-date access to content.

e. Content Formatting

A standardized formatting protocol was devised to ensure uniformity across all content elements. All data holdings were subsequently converted to conform to this prescribed format and were meticulously configured within the device operating system. This configuration will be executed to minimize disparities or discrepancies that may arise when the content is accessed across disparate operating systems. The objective is to establish a seamless and consistent user experience, irrespective of the specific operating system in use.

3.1.2 Integral Parts Of The System

All the parts of the block also functioned together to examine the key parts of the mobile application which are:

1. Gamification Engine
2. Learning Content
3. User Interaction

To implement these integral parts, the following were noted:

a. Gamification Engine

(I) Game mechanics, such as points, badges, leaderboards, and challenges were implemented to engage children and motivate their learning progress.

(II) A rule-based system to track their achievements and provide rewards accordingly was used.

b. Learning Content

(I) Interactive educational materials, lessons, quizzes, and activities tailored to children's needs and learning objectives were developed.

(II) Multimedia elements like images, videos, and audio to enhance engagement and understanding were incorporated.

(III) The content was organized into structured modules or levels to provide a sense of progression and accomplishment.

c. Interaction

(I) An intuitive user interface with child-friendly visuals, icons, and colours was designed.

(II) Features like progress tracking, personalized profiles, and feedback mechanisms to keep children motivated and informed about their learning journey were implemented.

3.1.3 Block Diagram Of The System

The block diagram for Learnify delineates the systematic flow and interconnection among its key components. At the forefront is the "Interaction" section, representing the user's phone as the primary point of engagement. Users interact with the Learnify platform through the "Frontend UI," where a visually appealing and user-friendly interface facilitates navigation, lesson exploration, and interaction with gamified features.

Beneath the surface lies the robust "Backend/Application Logic," the engine that powers Learnify. This component executes the essential processing of user requests, manages data, and orchestrates the core functionalities of the application. Serving as a pivotal bridge between the frontend and backend is the "API" (Application Programming Interface), enabling seamless communication and data exchange. The "Database" section serves as the repository for storing and managing critical data, including user profiles, lesson content, and gamification elements. Interactions between the backend logic and the database are integral for retrieving and updating data based on user actions and system requirements.

Lastly, the "Admin" component embodies the administrative interface, providing authorized personnel with the tools to oversee and manage the Learnify platform. This section ensures the smooth administration, moderation of content, and configuration of the system. In synergy, these interconnected sections form a cohesive system that delivers an engaging and well-administered educational experience through the Learnify platform.

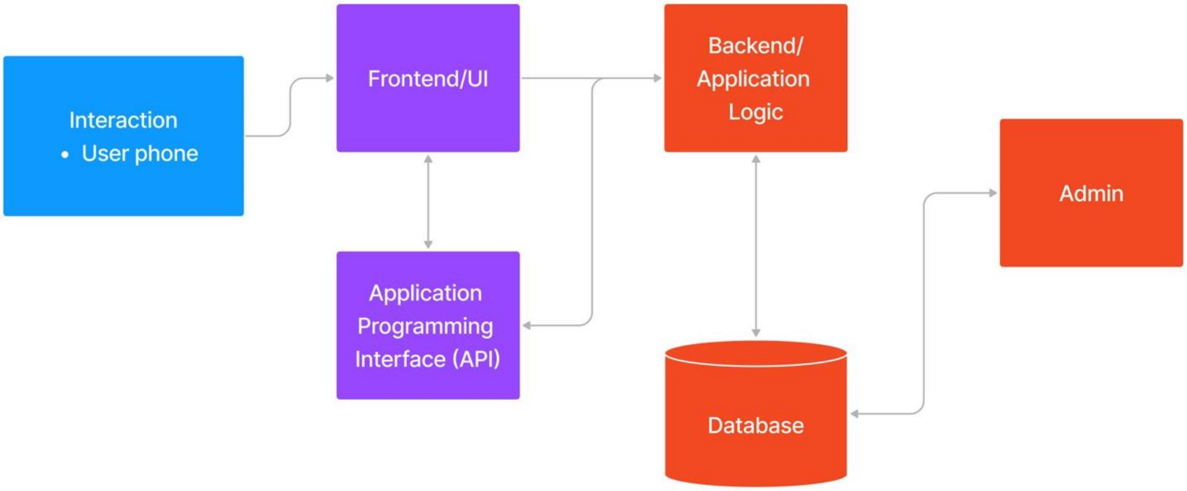


Figure 3.5: Block Diagram

3.1.4 Class Diagram

A class diagram for Learnify involves identifying the key entities (classes), their attributes, and the relationships between them. The figure below is the class diagram for Learnify, with the classes, relationships and associations highlighted. This class diagram represents a simplified view of Learnify, capturing the core entities and their relationships. Users can enroll in lessons, earn points through gamification, and have personalized dashboards. The authentication process ensures secure user access.

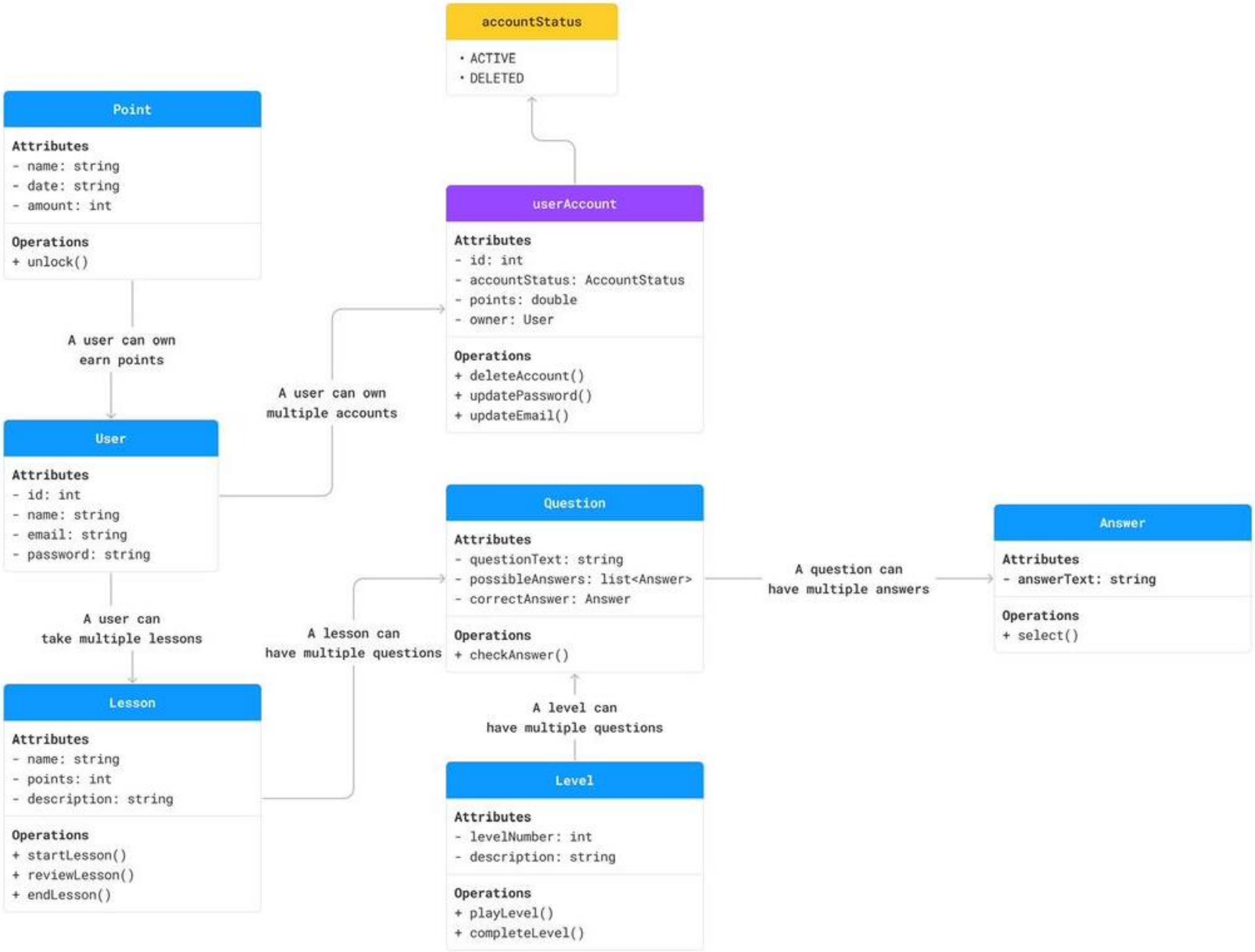


Figure 3.6: Class Diagram

3.1.4 Activity Diagram

The figure below shows the features-lesson, level, player, question, answer, and points-form integral components within the Learnify system, contributing to its interactive and gamified learning environment.

(i) Lesson: Represents the educational content or topic that users can select and explore within the Learnify platform. Lessons serve as the building blocks for the user's learning journey.

(ii) Level: Indicates the difficulty or complexity level associated with a particular lesson. Levels provide a structured progression, allowing users to gradually advance in their understanding and proficiency.

(iii) Player: Refers to the user engaging with the Learnify system. Each player interacts with lessons, answers questions, and accumulates points, contributing to their personalized learning experience.

(iv) Question: Represents the interactive component within a lesson. Questions challenge users to apply their knowledge, encouraging active participation and comprehension of the lesson content.

(v) Answer: Denotes the response provided by the player to a specific question. Correct answers contribute to the player's progress and points, reinforcing a sense of achievement and understanding.

(vi) Points: Serve as a gamification element, rewarding players for their active participation, correct answers, and overall progress within lessons. Points contribute to the motivational aspect of the learning experience, making it engaging and enjoyable.

Incorporating these features, Learnify leverages a gamified structure that combines educational content, progression levels, interactive challenges, and a reward system. This approach aims to enhance user engagement, motivation, and comprehension within the platform.

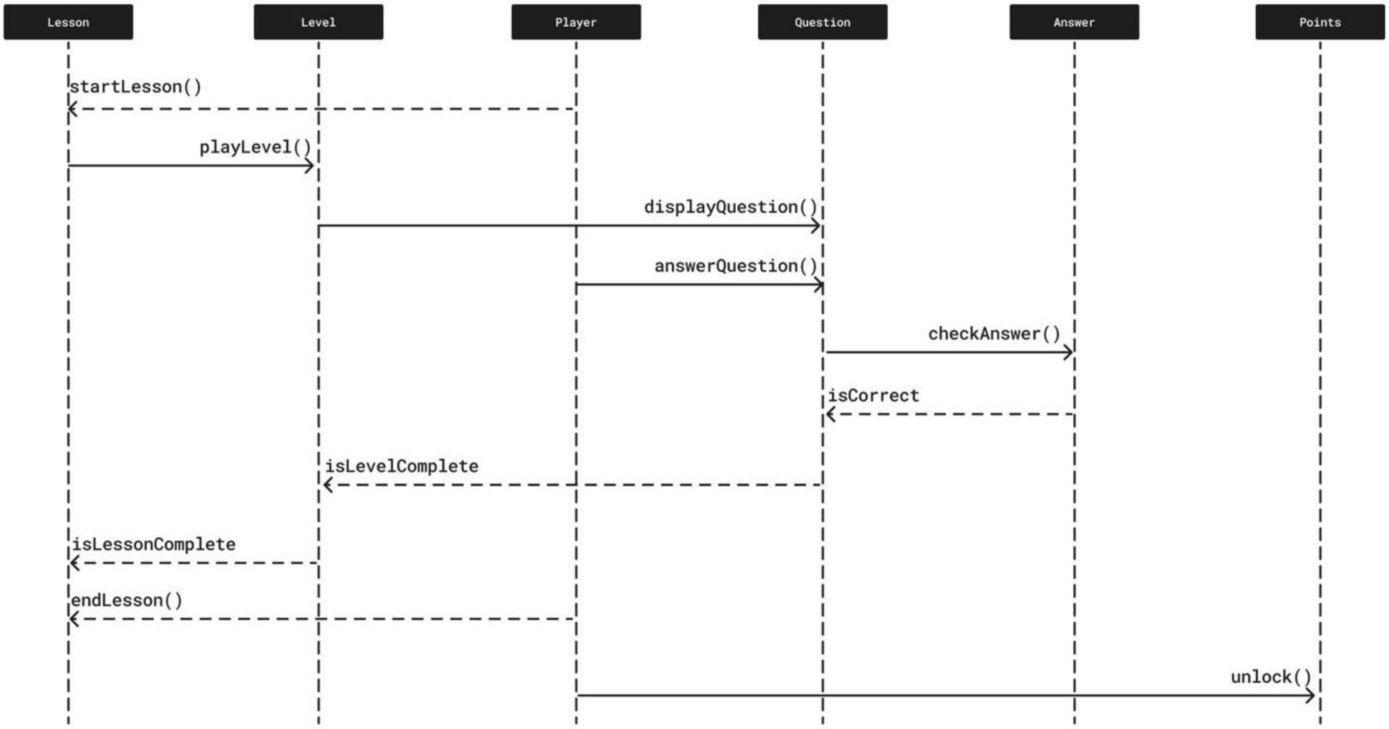


Figure 3.7: Activity Diagram

3.2 SOFTWARE REQUIREMENTS SPECIFICATION (SRS)

3.2.1 Hardware Requirements

The hardware requirements for developing a mobile-based gamified technology tutor for children are as follows:

a. Development Machine

(i) Processor: A multi-core processor (e.g., Intel Core i5 or higher) for efficient development and testing.

(ii) RAM: At least 8GB of RAM to handle resource-intensive tasks associated with development environments.

b. Mobile Devices for Testing

(i) Android Device: A physical Android device for testing the app on real hardware.

c. Development Tools

(i) Android Studio: For Android app development.

(ii) Integrated Development Environment (IDE): Suitable for the chosen development framework, such as Visual Studio Code.

d. Graphics and Animation Development

(i) Graphics Card: A dedicated graphics card for handling 2D/3D graphics and animations, especially if the app involves complex gamification elements.

e. Storage

(i) Sufficient storage space for the development environment, code repositories, and project assets.

f. Internet Connection

(i) A reliable internet connection for downloading libraries, frameworks, and updates during development.

g. External Devices

(i) Additional devices such as tablets and child-friendly gadgets to test the app's usability on various screen sizes.

3.2.2 Functional Requirements

Functional requirements define the specific features, capabilities, and behaviours that the mobile-based gamified technology tutor for children must have to meet its intended purpose. Here are some functional requirements for such a project:

a. User Registration and Profiles

(i) Users should be able to create accounts, and child users may require parental consent.

(ii) The system should allow users to create and manage profiles, tracking individual progress and achievements.

b. Gamification Elements

(i) Incorporate game-like elements, such as points, badges, levels, and rewards, to motivate and engage children in the learning process.

(ii) Provide interactive challenges, quizzes, and activities within the app.

c. Learning Content Management

(i) Admins or content creators should be able to manage and update educational content.

(ii) The system should support various media types, including text, images, videos, and interactive simulations.

d. Adaptive Learning Paths

(i) Implement adaptive learning algorithms that adjust the difficulty and content based on a child's progress and performance.

e. Progress Tracking and Reporting

(i) Users and parents should have access to progress reports, detailing completed lessons, achievements, and areas for improvement.

(ii) Include analytics to monitor user engagement and learning effectiveness.

f. User Interaction

(i) Intuitive and child-friendly user interfaces that allow easy navigation and interaction within the app.

(ii) Provide feedback and positive reinforcement during and after learning activities.

g. Parental Controls and Monitoring

(i) Parental controls to manage account settings and monitor their child's progress.

(ii) Regular updates and notifications to keep parents informed about their child's activities.

h. Feedback Mechanism

(i) Include a mechanism for users to provide feedback on content, usability, and overall experience.

i. Security Measures

(i) Implement secure user authentication and data encryption to protect user information, especially considering the target audience of children.

j. Device Compatibility

(i) Ensure compatibility with a range of mobile devices, screen sizes, and resolutions.

3.2.3 Technical Requirements

Technical requirements outline the specifications and technologies needed to implement the functional features of the mobile-based gamified technology tutor for children.

a. Development Tools

(i) Android Studio for development.

(ii) Integrated Development Environment (IDE) suitable for the chosen cross-platform framework.

b. Database Management

Utilize a NoSQL database (e.g., Firebase) for storing user profiles, progress data, and content information.

c. Backend Development

(i) Node.js for server-side scripting.

(ii) Express.js or other web application frameworks for building the backend.

d. APIs for Integration

(i) Develop or utilize APIs for integrating external services, such as authentication (OAuth 2.0, Firebase Authentication) and analytics (Google Analytics, Firebase Analytics).

e. Gamification Engine

(i) Implement a gamification engine to handle point systems, badges, and levels. Content Management System (CMS):

f. Responsive Design

(i) Design the app to be responsive, ensuring compatibility with various screen sizes and resolutions.

3.3 FEASIBILITY STUDIES

The mobile-based gamified technology tutor for children, feasibility studies encompasses various dimensions such as:

(i) Technical Feasibility: Evaluated the technical aspects of developing and implementing Learnify. This includes assessing the availability and suitability of the required technology, ensuring compatibility with different mobile devices, and examining the feasibility of integrating gamification elements seamlessly.

(ii) Economic Feasibility: Analyzed the economic viability of Learnify, considering the costs associated with development, maintenance, and ongoing operations. Assessed potential revenue streams, such as subscription models or partnerships, and project the return on investment over time.

(iii) Operational Feasibility: Evaluated the operational feasibility of Learnify by examining how the platform aligns with existing educational practices. Considered the ease of integration into educational systems, potential challenges in user adoption, and the overall impact on the operational efficiency of educational institutions.

(iv) Schedule Feasibility: Assessed the time required for the development, testing, and deployment of Learnify. Considered any time-sensitive factors, such as aligning with academic calendars or capitalizing on peak periods for educational technology adoption.

(v) Risk Analysis: Identified potential risks associated with the development and deployment of Learnify. This includes technical risks, market risks, and risks related to user adoption. Develop strategies to mitigate or manage these risks effectively.

(vi) Scalability and Future Expansion: Evaluated the scalability of Learnify to accommodate potential growth in user base and content. Assessed the platform's adaptability to future technological advancements and educational trends.

3.4 SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC) MODEL: AGILE MODEL

The Agile Software Development Life Cycle (SDLC) model was chosen as the most suitable approach for the development of Learnify, a mobile-based gamified technology tutor for children.

This decision was based on several key considerations aligning with the project's unique requirements and objectives.

(i) Iterative Development: Learnify is anticipated to undergo iterative enhancements, responding to evolving educational needs and user feedback. The iterative nature of Agile ensures the flexibility to accommodate changes throughout the development process.

(ii) Flexibility and Adaptability: Given the dynamic nature of educational technology and the potential for rapid advancements, the Agile model's adaptability allows for quick responses to emerging trends, ensuring that Learnify stays current and relevant.

(iii) User Involvement: The success of Learnify heavily relies on user engagement, especially with its target audience of children. Agile's emphasis on continuous user involvement ensures that the application aligns closely with the expectations and preferences of its young user base.

(iv) Quick Releases: Agile promotes incremental releases, allowing for the rapid deployment of features. This approach is well-suited for delivering an engaging and evolving learning platform for children, with the ability to introduce new features and improvements in a timely manner.

(v) Collaboration: Agile fosters collaboration and communication within the development team and with relevant stakeholders. This is particularly advantageous for a project like Learnify, which may require close coordination between developers, educational experts, and potentially parents or teachers.

(vi) Adaptability to Changes: As Learnify may introduce new gamification elements or educational content over time, the Agile model's ability to adapt to changing requirements supports the platform's growth and evolution.

3.5 APPLICATION PROGRAMMING INTERFACE (API)

An Application Programming Interface (API) facilitates communication between different computer programs, serving as a software interface that provides services to other software entities. It includes a document or standard outlining how to establish and use this interface, termed an API specification. When a computer system adheres to this standard, it is said to implement or expose an API. The term "API" can refer to both the specification and its implementation. Unlike a user interface that links a computer with a person, an application programming interface establishes connections between computers or software components. It's designed for utilization by computer programmers to integrate into software, rather than direct use by end-users. APIs typically consist of various components acting as tools or services available to programmers. When a program or programmer utilizes one of these components, it's referred to as making a call to that section of the API. These calls can be known as subroutines, methods, requests, or endpoints. An API specification defines these calls, elucidating how they should be employed or implemented. APIs conceal the inner workings of a system, exposing only the relevant and consistent parts for programmers, even if the internal mechanisms change over time. They can be custom-built for specific system pairs or function as shared standards facilitating interoperability among multiple systems.

In the context of the project on developing a mobile-based gamified technology tutor for children, an API served as the bridge between different components of my application. It facilitated interactions between the gamified learning modules, user profiles, progress tracking, and any external services or databases required for content or user management. For instance, the application has various modules for interactive lessons, quizzes, or progress tracking. An API enabled these modules to communicate and share data seamlessly, allowing for a cohesive and integrated learning experience. It connected the app to external resources, such as content databases, enhancing the breadth and depth of educational content while tracking user engagement and progress.

3.6 DESIGN INTERFACE

User interface (UI) design involves crafting interfaces for various devices, emphasizing usability and enhancing user experience. Specifically in software design, UI design concentrates on information architecture, creating interfaces that effectively convey crucial information to users. It encompasses graphical user interfaces and other interface formats, all aimed at simplifying and optimizing user interactions to help them achieve their goals (known as user-centered design).

Designing the interface for Learnify involves creating a user-friendly and engaging environment tailored to children's learning needs. Underlisted are the considerations for each screen:

1. Sign-Up Screen: Focus on simplicity and clarity, guiding users through the registration process with child-friendly visuals and easy-to-understand instructions.
2. Forgot Password Screen: Make this screen accessible, allowing users to reset their passwords effortlessly through a step-by-step process.
3. Login Screen: Keep it straightforward and visually appealing, possibly incorporating vibrant colours and intuitive icons to encourage user engagement.
4. Change Password Screen: Ensure clarity in guiding users through password changes with clear instructions and a user-friendly interface.
5. Profile Screen: Design this screen to be interactive and engaging, allowing children to customize their profiles with avatars or colours while offering easy navigation to access account settings.
6. Lesson Screen: Use bright visuals, interactive elements, and intuitive navigation to make learning modules engaging and easy to navigate.
7. Lesson Summary Screen: Summarize the key points of the lesson with engaging visuals, possibly incorporating quizzes or interactive elements to reinforce learning.

8. Account Settings Screen: Divide this screen into clear sections (like Profile Information and Password Update), using child-friendly icons and visuals for easy navigation.
9. Delete Account Screen: Include clear prompts and confirmations, ensuring that the process of account deletion is straightforward while collecting feedback for improvement.
10. Support/Help Screen: Create an easily accessible section for children to seek help or support, potentially incorporating FAQs or interactive support features.

3.7 TYPE DECLARATION

Type declarations significantly ensure data integrity and consistency within the application. They help maintain a structured approach to handling various elements, such as user profiles, learning modules, and game-related entities, ensuring that the right types of data are stored and processed throughout the application. By defining clear and appropriate type declarations within the codebase, I enhanced the reliability and readability of the application, making it easier to manage and scale.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 RESULT OVERVIEW

The Result Overview provides a snapshot of the key features and user interactions within the Learnify platform. It outlines the user journey from sign-up/login to lesson completion, emphasizing engagement, progress tracking, and user account management. Let's delve into each key point to understand how these features contribute to the overall user experience within Learnify.

1. Sign-Up/Login: New users sign up by creating an account with their details or existing users log in.
2. Dashboard: Upon login, users are directed to a dashboard/home screen providing an overview of available features or subjects.
3. Lessons Selection: Users select a specific subject or topic they wish to explore from the available options.
4. Lesson Interface: Each lesson/topic opens a dedicated screen displaying interactive content, such as texts, images, videos, quizzes, or games, engaging children in learning.
5. Lesson Completion: Upon completing a lesson, users are awarded points or progress markers, encouraging continued engagement.
6. Profile/Account Settings: Users can access their profiles to modify personal details, change passwords, or update profile pictures.
7. Support or Help Section: A section provides support or help if users encounter issues or need guidance.

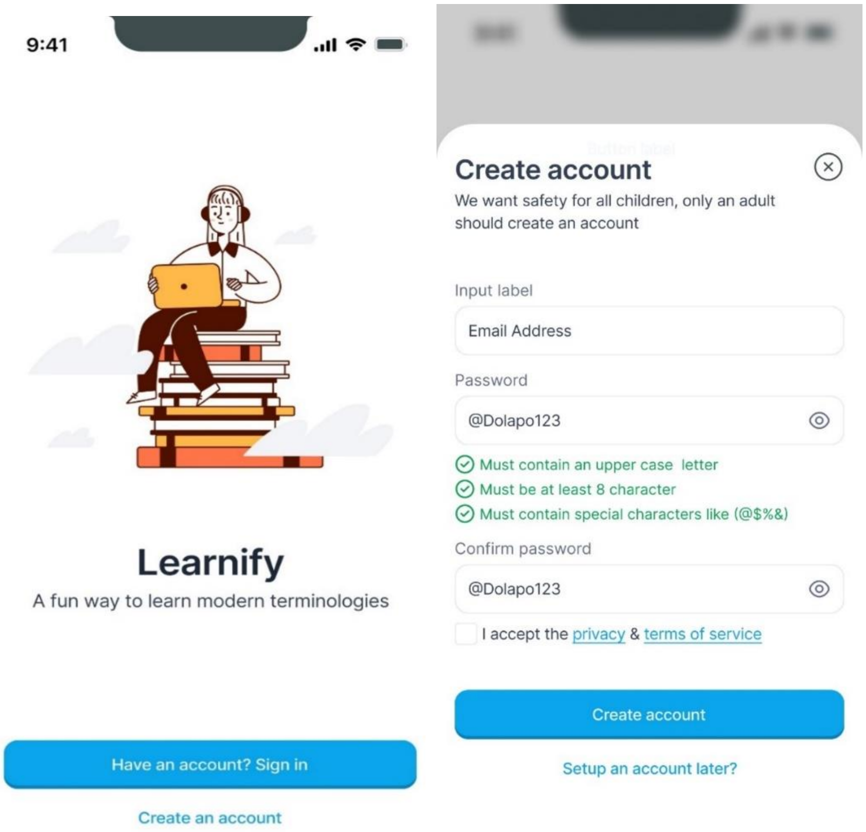
8. Logout/Account Deletion: Users can log out of their accounts or opt to delete their accounts if needed.

4.2 RESULT AND DISCUSSION

In User Interface (UI) design, screens refer to individual visual interfaces or pages within an application or software system. Each screen typically focuses on specific user objectives or functionalities, providing a clear and coherent layout for users to achieve their goals efficiently.

4.2.1 Sign-Up Screen

The sign-up screen marks the starting point for new users entering Learnify. It's designed to collect crucial details like the user's chosen email address and secure password. Additionally, this screen requests further information vital for personalization, such as the child's age. Robust validation measures are implemented to ensure strong password selection and validate accurate email input.



Learnify

A fun way to learn modern terminologies

Create account

We want safety for all children, only an adult should create an account

Input label

Email Address

Password

@Dolapo123

✓ Must contain an upper case letter

✓ Must be at least 8 character

✓ Must contain special characters like (@$%&)

Confirm password

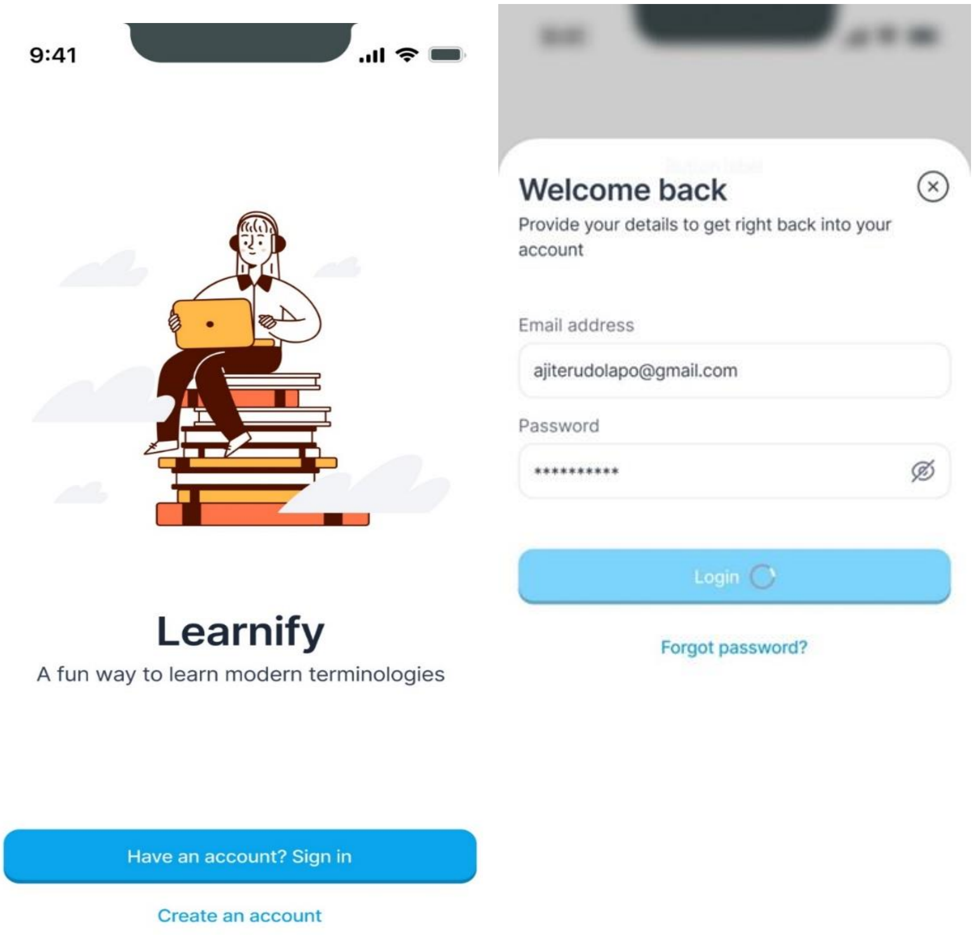
@Dolapo123

□ I accept the privacy & terms of service

Figure 4.1: Sign-Up Screens I

4.2.2 Sign In Screen

The Sign-In screen serves as the gateway for users who've already registered on Learnify. Here, users input their designated username or email and their password to access the application. The layout emphasizes simplicity and security, featuring prominently placed input fields for login credentials. Security measures, such as password masking and authentication protocols, are implemented to safeguard user accounts. User-friendly error prompts assist in case of incorrect login attempts, guiding users through the process smoothly. The screen prioritizes user convenience while ensuring the confidentiality and protection of their account information.



A fun way to learn modern terminologies

Welcome back

Provide your details to get right back into your account

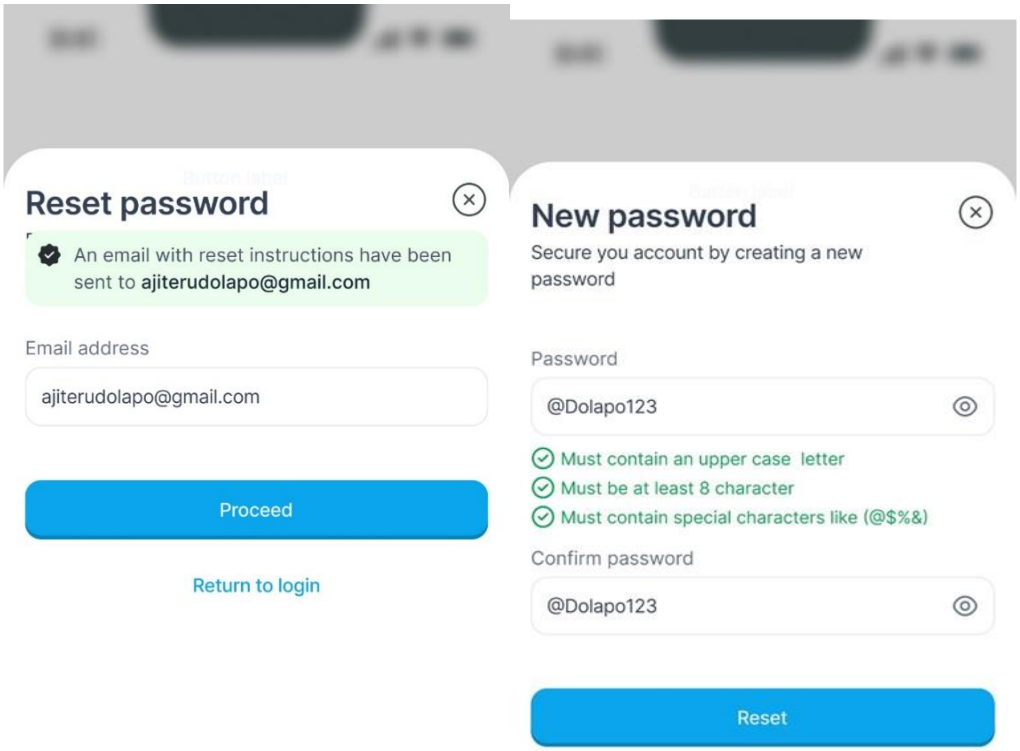
Email address: ajiterudolapo@gmail.com

Password: ***********

Figure 4.2: Sign-In Screens

4.2.3 Reset Password Screen

The Reset Password screen facilitates a secure and straightforward process for users who need to reset their account credentials on Learnify. This screen allows users to reset their password by verifying their identity through a linked email. It prompts users to enter their registered email associated with the account, where a reset link is sent for authentication. Clear instructions guide users through the steps to regain access to their accounts. The layout ensures clarity and simplicity, prioritizing user security and ease of use.



An email with reset instructions have been sent to **ajiterudolapo@gmail.com**

Email address: ajiterudolapo@gmail.com

Secure you account by creating a new password

Password: @Dolapo123

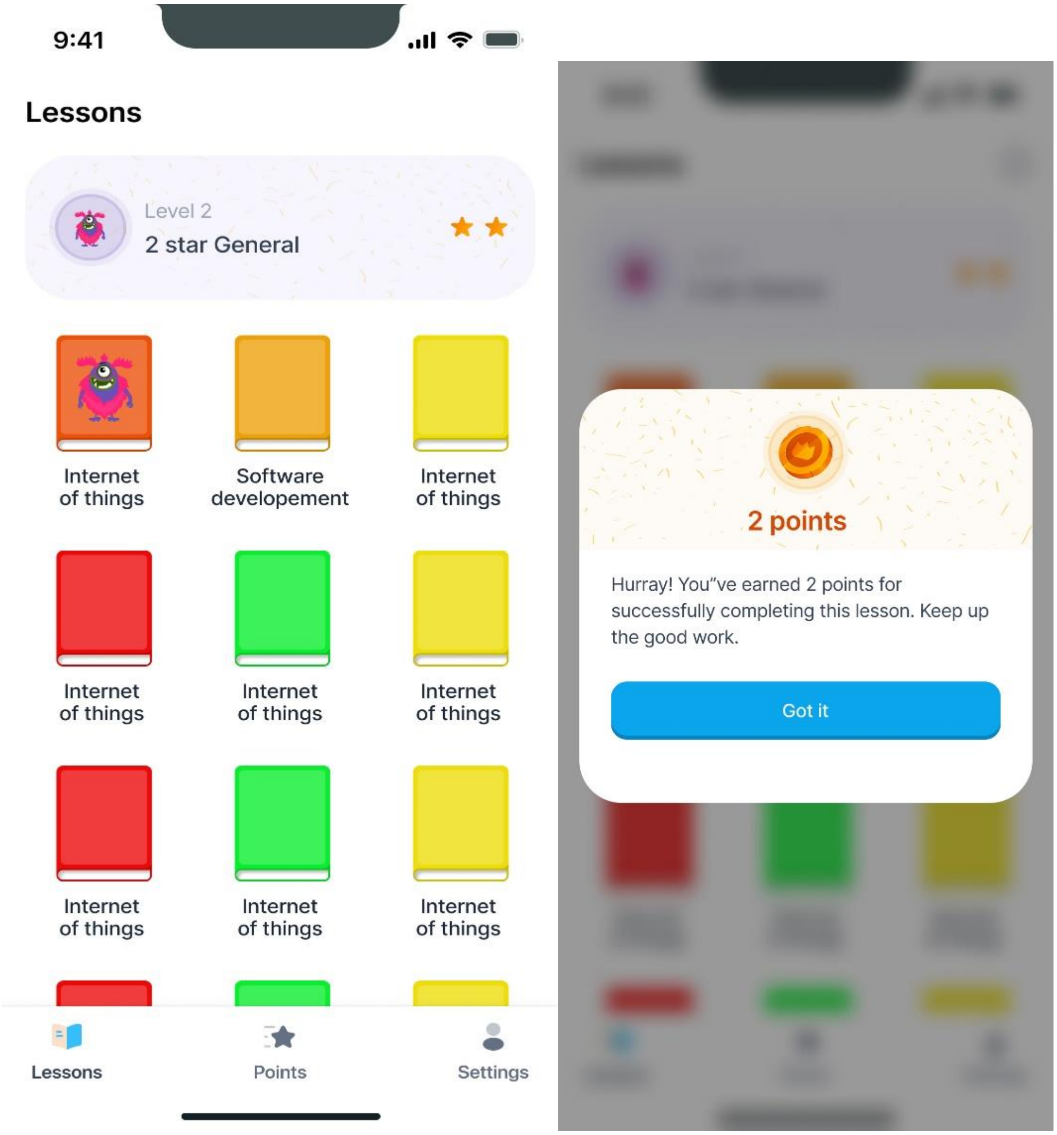
✓ Must contain an upper case letter
✓ Must be at least 8 character
✓ Must contain special characters like (@$%&)

Confirm password: @Dolapo123

Figure 4.3: Reset Password Screens

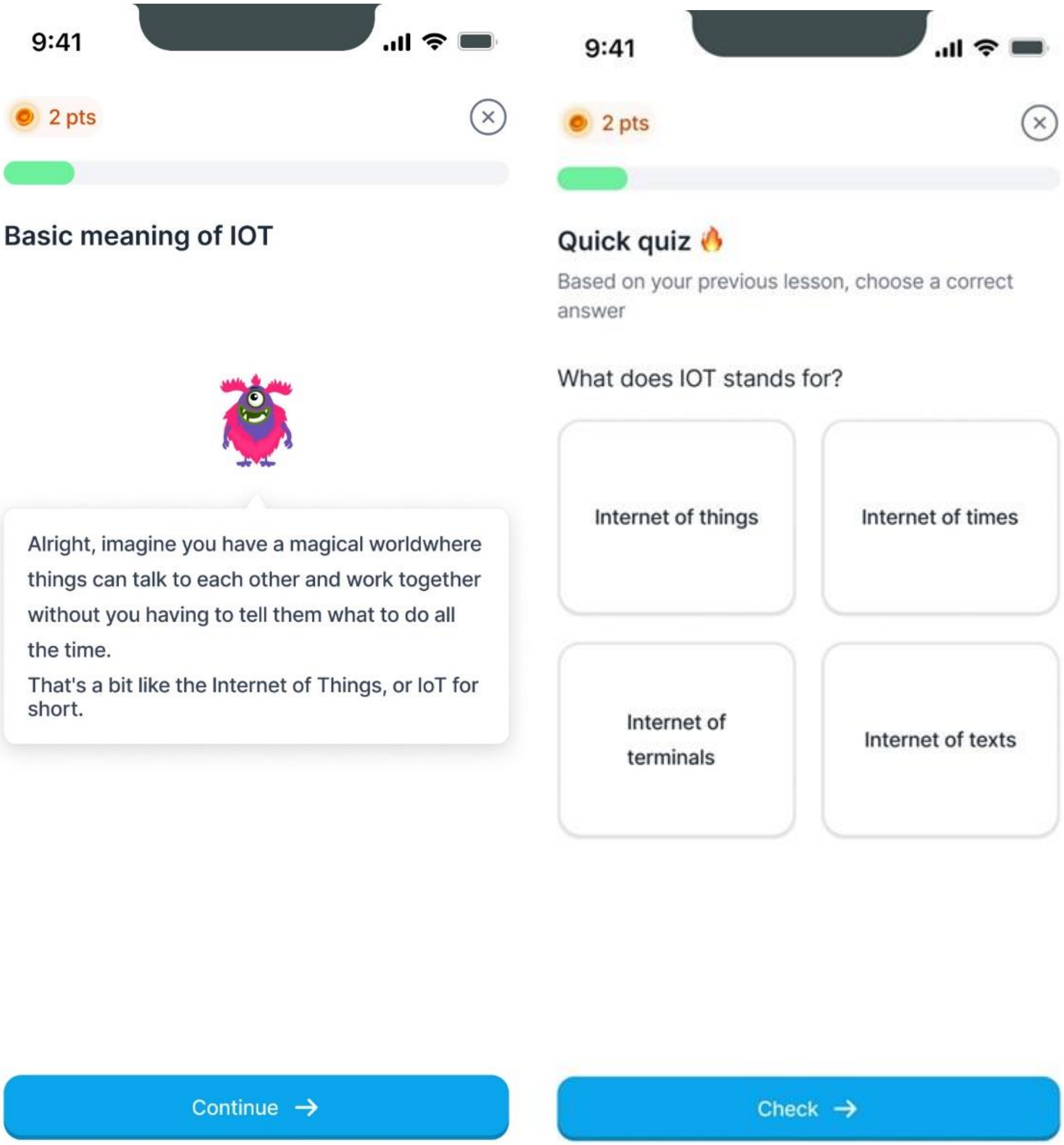
4.2.4 Lessons Screen

The Lessons Screen within Learnify organizes different topics under broader subject categories, fostering a structured learning environment for children. Each lesson is curated to be engaging, informative, and tailored to children's comprehension levels. This screen employs gamification elements to make learning fun and captivating. It provides a summary of each lesson on various technological topics. Each lesson completion rewards children with points.



Hurray! You"ve earned 2 points for successfully completing this lesson. Keep up the good work.

Figure 4.4: Lessons Screens I



Basic meaning of IOT

Alright, imagine you have a magical worldwhere things can talk to each other and work together without you having to tell them what to do all the time.

That's a bit like the Internet of Things, or IoT for short.

Quick quiz 🔥

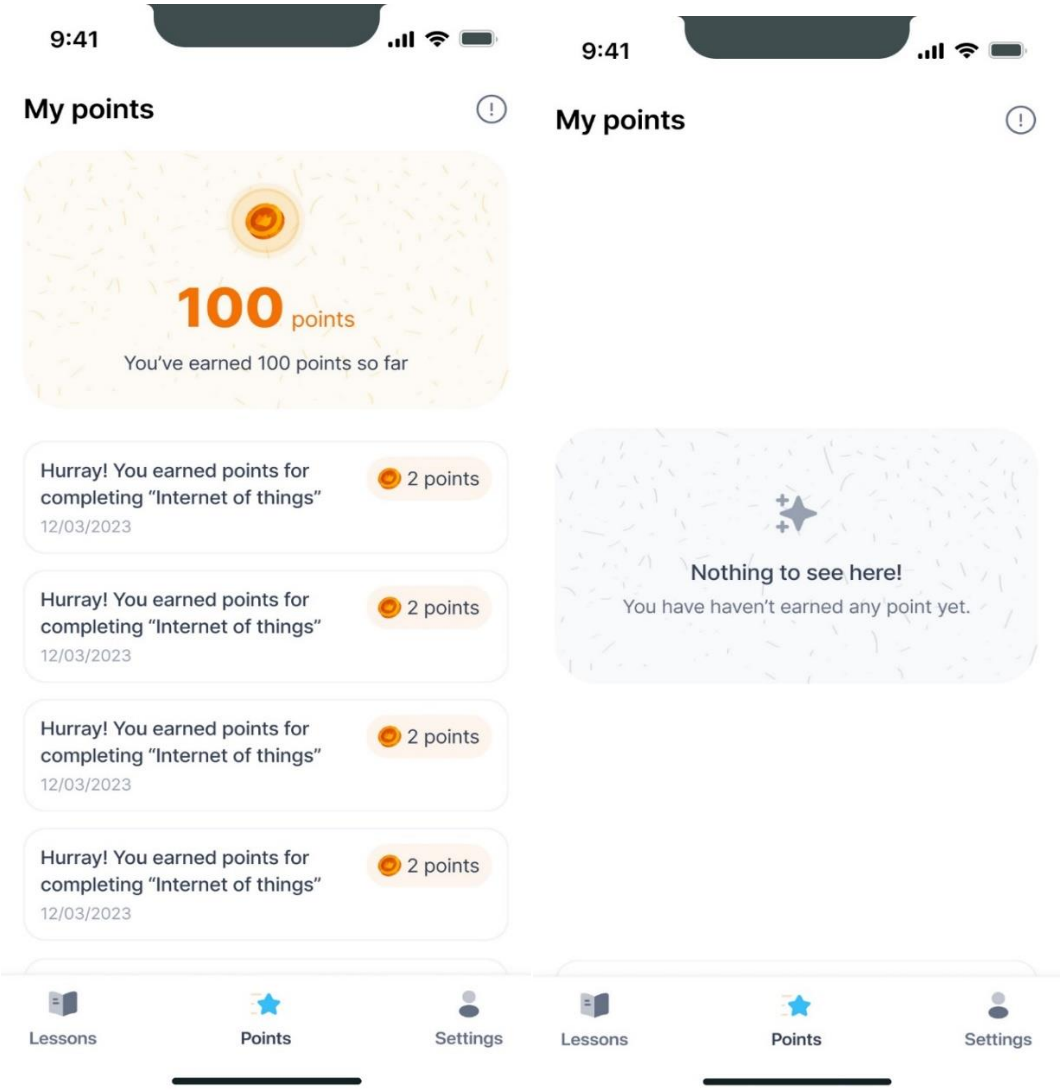
Based on your previous lesson, choose a correct answer

What does IOT stands for?

Figure 4.5: Lessons Screens II

4.2.5 Points Screen

The Points Screen in Learnify is an interactive space designed to showcase a child's progress and achievements. It provides a visual representation of the points earned by the child through lesson completions and activities within the application. This screen offers a motivating way to track and celebrate the child's learning milestones. The Points Screen utilizes engaging visuals and graphics to display the points accumulated by the child.



My points

100 points

You've earned 100 points so far

Hurray! You earned points for completing "Internet of things" 2 points
12/03/2023

Hurray! You earned points for completing "Internet of things" 2 points
12/03/2023

Hurray! You earned points for completing "Internet of things" 2 points
12/03/2023

Hurray! You earned points for completing "Internet of things" 2 points
12/03/2023

My points

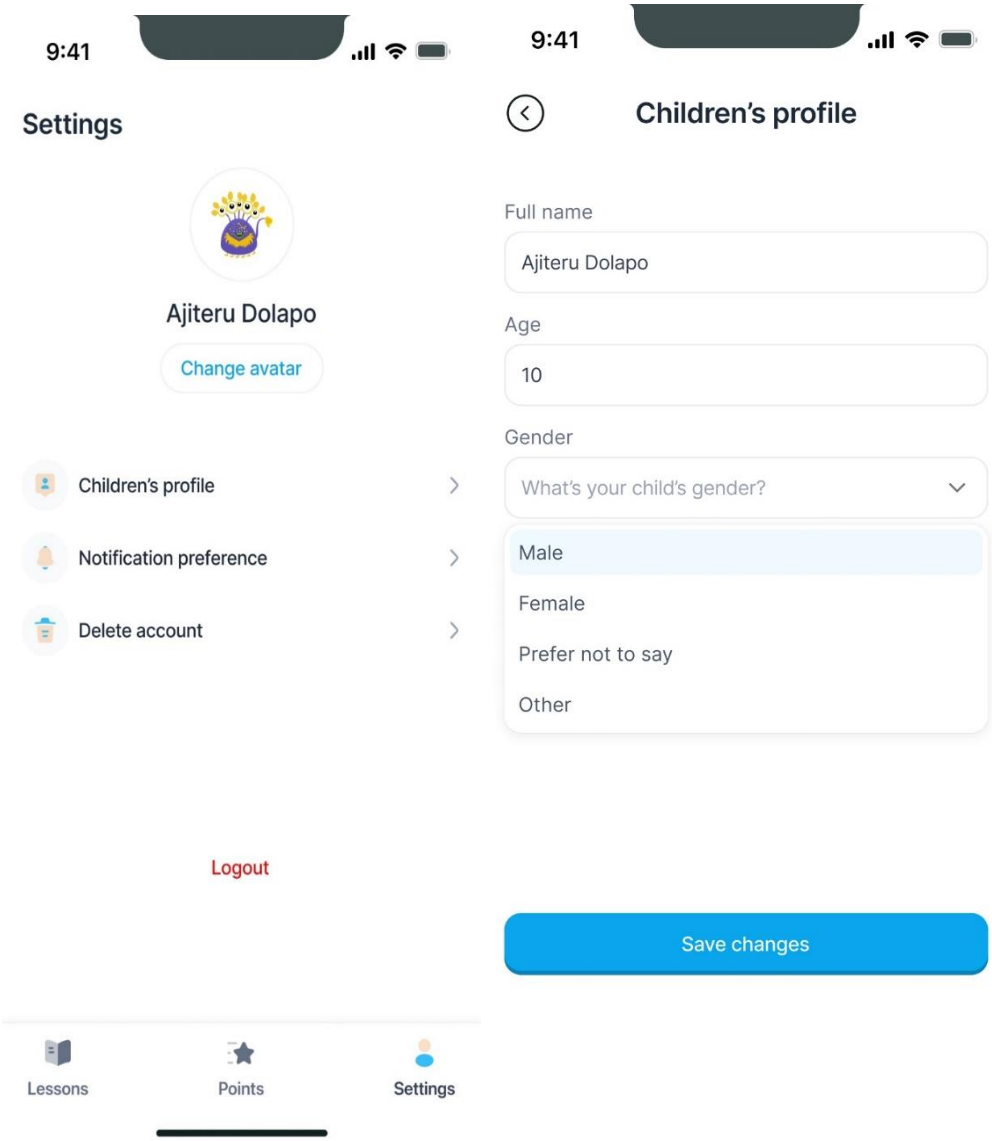
Nothing to see here!

You have haven't earned any point yet.

Figure 4.6: Points Screens

4.2.6 Account Settings Screen

The Account Settings screen within Learnify serves as a hub for managing user preferences and personal information. It provides an intuitive interface allowing children to customize their experience and manage their account details. This screen allows users to update profile information, such as their name, date of birth, and gender. It incorporates options for changing profile images or avatars, giving children a sense of ownership over their account.



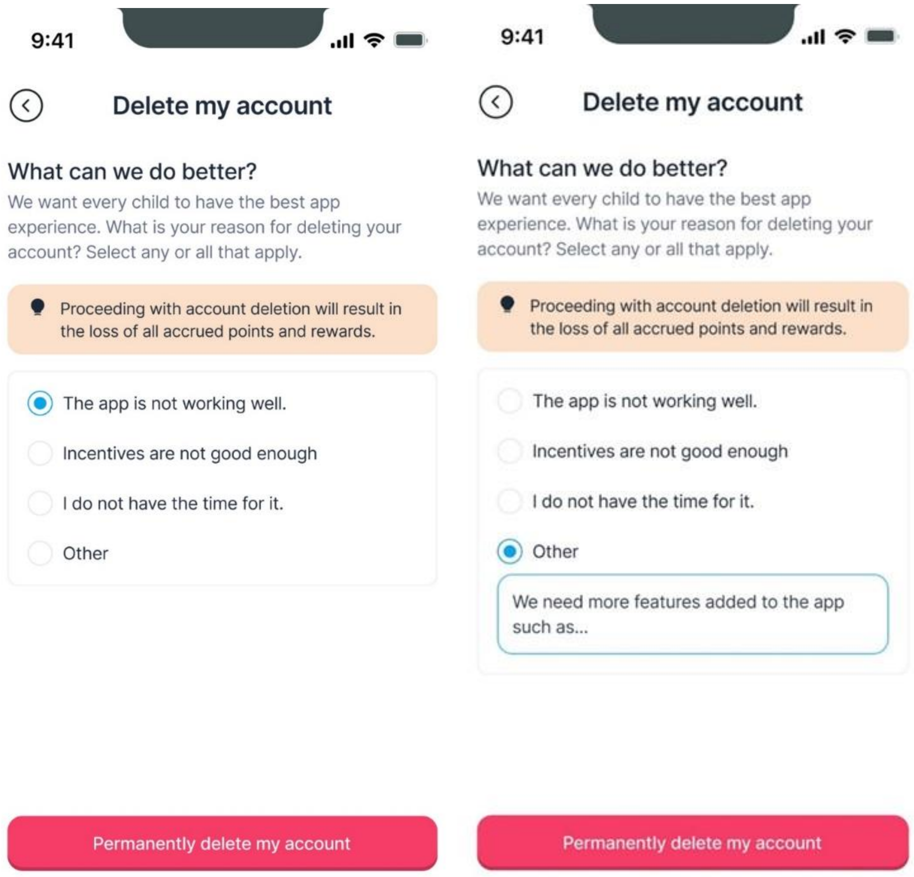
Full name: Ajiteru Dolapo

Age: 10

Figure 4.7: Account Settings Screens

4.2.7 Delete Account Screen

The Delete Account screen in Learnify is a critical element allowing users to deactivate their accounts. It's a thoughtful inclusion in the system, giving users the agency to manage their engagement with the platform. This screen enables users, in this case, children, to opt out or delete their accounts entirely from the system. It prompts for reasons why they are choosing to delete their account, providing predefined options such as "The app is not working well," "Incentives are not good enough," or "I do not have the time for it." Additionally, there may be an optional text box for users to provide more specific feedback or comments.



9:41

Delete my account

What can we do better?

We want every child to have the best app experience. What is your reason for deleting your account? Select any or all that apply.

Proceeding with account deletion will result in the loss of all accrued points and rewards.

● The app is not working well.
○ Incentives are not good enough
○ I do not have the time for it.
○ Other

Permanently delete my account

9:41

Delete my account

What can we do better?

We want every child to have the best app experience. What is your reason for deleting your account? Select any or all that apply.

Proceeding with account deletion will result in the loss of all accrued points and rewards.

○ The app is not working well.
○ Incentives are not good enough
○ I do not have the time for it.
● Other

We need more features added to the app such as...

Permanently delete my account

Figure 4.8: Delete Account Settings

4.3 PERFORMANCE EVALUATION

Performance evaluation is critical for ensuring that the mobile-based gamified technology tutor for children operates efficiently and meets the expectations of users.

4.3.1 Performance Metrics

The following metrics were used to measure the performance of the application:

(i) Response Time: The time it takes for the app to respond to user interactions, ensuring that actions such as navigating between screens and completing activities happen swiftly.

(ii) Load Time: The time it takes for the app to load initially and for subsequent screens.

(iii) Scalability: How well the app scales with an increasing number of users.

(iv) Server Response Time: The response time of the backend server to ensure timely delivery of data to the app.

(v) Network Performance: The app's performance under varying network conditions, including 3G, 4G, and Wi-Fi.

(vi) Battery Consumption: The app's impact on device battery consumption.

4.3.2 Load Testing

(i) Simulated User Loads: Load testing to simulate different user loads and identify performance bottlenecks

(ii) Concurrency Testing: The app's ability to handle multiple concurrent users.

(iii) Stress Testing: Subjecting the app to stress tests to evaluate its behaviour under extreme conditions.

4.3.3 Resource Utilization

(i) Memory Usage: Monitoring the app's memory consumption to identify any memory leaks or inefficiencies

(ii) CPU Utilization: The app's impact on the device's CPU.

(iii) Network Bandwidth: The amount of data transferred between the app and the server.

4.3.4 Real-User Monitoring

(i) Analytics: Utilizing analytics tools to gather real-time data on user interactions,

(ii) Reports: Monitoring and analyzing reports to identify and address any issues causing app crashes.

4.4 CRITICAL ANALYSIS OF RESULT

A critical analysis of the results obtained from the performance evaluation of the mobile-based gamified technology tutor for children is crucial for identifying strengths, weaknesses, and areas for improvement.

4.4.1 Optimal Response and Load Times

If the app demonstrates optimal response and load times, it indicates that the application’s code, assets and server interactions were effectively optimized for a smooth user experience.

4.4.2 Scalability and Concurrency

If the app exhibits good scalability and can handle multiple concurrent users without significant performance degradation, it reflects a well-designed and robust architecture.

4.4.3 Efficient Resource Utilization

Efficient memory usage, low CPU utilization, and minimized network bandwidth consumption were indicators of resource-efficient coding practices.

4.4.4 Low Crash Rates

If the app experiences low crash rates and the development team promptly addresses any identified issues, it suggests a high level of reliability in the application.

4.5 COMPARATIVE ANALYSIS OF RESULT

The comparative analysis of the results from Learnify reveals a nuanced understanding of its impact on users. The Sign-Up/Login process establishes a foundation for user engagement, facilitating accessibility. The Dashboard feature, as the central hub, provides a clear overview, enhancing user navigation and promoting a seamless experience compared to traditional learning platforms.

The Lessons Selection and Lesson Interface components stand out, offering interactive content such as texts, images, videos, quizzes, and games. This approach distinguishes Learnify by creating an immersive learning environment, surpassing the conventional static methods seen in other platforms. The emphasis on gamification, seen in the Lesson Completion stage, contributes to sustained user engagement and motivation, setting Learnify apart in fostering a positive learning experience. The inclusion of Profile/Account Settings aligns with user-centric design, allowing for personalization and easy management. Furthermore, the Support or Help Section demonstrates a commitment to user assistance, addressing potential issues and providing guidance-a feature often lacking in comparable platforms.

The Logout/Account Deletion option reflects a user-focused approach, respecting the autonomy of users over their accounts. Overall, Learnify's comparative analysis showcases its strengths in interactive learning, gamification, user-centric design, and robust support mechanisms, positioning it favorably in the realm of educational technology.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

The culmination of the Mobile-Based Gamified Technology Tutor for Children project marks a significant milestone in the pursuit of enhancing children's technological literacy in a captivating and interactive manner. From its inception to completion, the project has remained steadfast in its commitment to developing an intuitive interface, integrating educational content, and leveraging gamification to make learning an enjoyable experience. Learnify, the outcome of this endeavour, not only meets but exceeds the set objectives, affirming the potential of technology to ignite an early interest in the field among young learners. Its feature-rich design, including user authentication, interactive lessons, and a robust feedback system, exemplifies the successful integration of technology into educational practices. The strategic use of Firebase for backend operations ensures efficient data handling and contributes to the seamless user experiences that are crucial for the success of an educational platform. The user interface, designed with precision and enriched with type declarations and user-defined functions, lays the groundwork for an engaging and consistent learning journey for children.

In addressing the outlined objectives, the project has demonstrated its capacity to develop Learnify as an effective mobile gamified technology tutor for children, incorporate a robust feedback system, ensure adaptive and personalized learning experiences and evaluate the performance of Learnify comprehensively, considering user feedback, engagement, and its impact on technological literacy. It becomes evident that Learnify not only addresses the challenges identified in the initial stages but also sets the stage for continued exploration and improvement.

The outcomes of this project, grounded in a commitment to excellence and innovation, serve as a promising foundation for the ongoing endeavour to enhance technology education for younger learners. This conclusion, therefore, not only marks the end of a project but signals the beginning of a transformative and technology-rich educational landscape for children.

5.2 RECOMMENDATION

Several strategies can be considered to augment further the impact and reach of the Mobile-Based Gamified Technology Tutor for Children. Continuous enrichment of the educational content, expansion of interactive features, and ensuring compatibility across diverse devices are pivotal. Establishing a feedback mechanism for user input and iterative updates would sustain the platform's relevance. Collaboration with educational institutions or technology experts could enhance content credibility and breadth. These steps aim to perpetuate the platform's growth, ensuring an engaging and effective learning environment for young users.

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APPENDIX A (LIST OF PLUGINS AND DEPENDENCIES)

Capacitor Plugins

@capacitor

- **app@5.0.6**

- **haptics@5.0.6**

- **keyboard@5.0.6** - (Latest 5.0.7)

- **status-bar@5.0.6**

Cordova Plugins

Dependencies

@capacitor

- **cli@5.4.1** - (Latest 5.6.0)

- **core@5.4.1** - (Latest 5.6.0)

@ionic

- **react@7.4.2** - (Latest 7.6.2)

- **react-router@7.4.2** - (Latest 7.6.2)

@reduxjs

- **toolkit@1.9.7** - (Latest 2.0.1)

@testing-library

- **jest-dom@5.17.0** - (Latest 6.1.6)

- **react@14.0.0** - (Latest 14.1.2)

- **user-event@14.5.1**

@types

- **firebase@3.2.1** - @types/firebase is deprecated: This is a stub types definition for Firebase API (https://www.firebase.com/docs/javascript/firebase). Firebase API provides its type definitions, so you don't need @types/firebase installed!

- **react@18.2.23** - (Latest 18.2.45)

- **react-dom@18.2.8** - (Latest 18.2.18)

- **react-router@5.1.20**

- **react-router-dom@5.3.3**

@vitejs

- **plugin-legacy@4.1.1** - (Latest 5.2.0)

- **plugin-react@4.1.0** - (Latest 4.2.1)

Other Dependencies

- **autoprefixer@10.4.16**

- **axios@1.6.0** - (Latest 1.6.3)

- **cypress@12.17.4** - (Latest 13.6.2)

- **eslint@8.50.0** - (Latest 8.56.0)

- **eslint-plugin-react@7.33.2**

- **firebase@10.5.0** - (Latest 10.7.1)

- **formik@2.4.5**

- **ionicons@7.1.2** - (Latest 7.2.2)

- **jsdom@22.1.0** - (Latest 23.0.1)

- **postcss@8.4.31** - (Latest 8.4.32)

- **react@18.2.0**

- **react-dom@18.2.0**

- **react-redux@8.1.3** - (Latest 9.0.4)

- **react-router@5.3.4** - (Latest 6.21.1)

- **react-router-dom@5.3.4** - (Latest 6.21.1)

- **react-select@5.7.5** - (Latest 5.8.0)

- **tailwindcss@3.3.3** - (Latest 3.4.0)

- **typescript@5.2.2** - (Latest 5.3.3)

- **vite@4.4.11** - (Latest 5.0.10)

- **vitest@0.32.4** - (Latest 1.1.0)

- **yup@1.3.2** - (Latest 1.3.3)

APPENDIX B (USER-DEFINED FUNCTIONS)

```
import fearfulred from '../assets/dashboard/Settings/avatars/fearfulred.svg'

import fiveeyedsunny from '../assets/dashboard/Settings/avatars/fiveeyedsunny.svg'

export const customDropDownStyles = {

  control: (provided: any, state: {

    menuIsOpen: any;

    hasValue: any;

    selectProps: any; isFocused: any, isDisabled: any

  }) => ({

    ...provided,

    boxShadow: 'none !important',

    '*': {

      boxShadow: 'none !important',

    },

    borderRadius: "12px",

    padding: '12px',

    background: state.isDisabled ? '#F2F4F7' : "transparent",

    border: state.isFocused ? '1px solid #36BFFA' : '1px solid #EAECF0',
    color: "#344054",
    outline: "none",
    '&:focus': {
      border: state.isFocused ? '1px solid #36BFFA' : (state.menuIsOpen && state.hasValue && state.selectProps.error ? "1px solid #EE615F" : '1px solid #EAECF0'),
    },
  }),
  menu: (provided: any, state: any) => ({
    ...provided,
    backgroundColor: 'white', // set the background color here
    borderRadius: "12px",
    padding: "8px"
  }),
  dropdownIndicator: (provided: any, state: any) => ({
    ...provided,
    color: "#344054",
  }),
  indicatorsContainer: (provided: any, state: any) => ({
    ...provided,
    color: "#344054",
    paddingRight: '10px',
    '& .separator': {
      display: 'none',
    },
  }),
  option: (provided: any, state: { isSelected: any; isHovered: any }) => ({
    ...provided,
    backgroundColor: state.isSelected ? '#F9F9FA' : state.isHovered ? "#F0F9FF" : '#FFFFFF',
    color: '#344054',
    '&:hover': {
      backgroundColor: '#F0F9FF',
    },
  }),
  separator: (provided: any, state: any) => ({
    ...provided,
    display: 'none',
  }),
    clearIndicator: (provided: any, state: any) => ({
        ...provided,
        display: 'none',
    }),
    singleValue: (provided: any) => ({
        ...provided,
        color: '#1D2939',
    }),
}


export const CustomToast = (type: ToastType, message: string, title?: string, cancel: boolean = false) => {
    const event = new CustomEvent('show-toast', {
        detail: {
            message: message,
            type: type,
            title: title,
            cancel: cancel
        },
    });


    window.dispatchEvent(event);
};


export const currentAvatar = () => {
    const avatar = localStorage.getItem("current_avatar")


    if (avatar === null) {
        return fearfulred
    } else if (avatar === "Fearful red") {
        return fearfulred
    } else if (avatar === "5 eyed sunny") {
        return fiveeyedsunny
    } else {
        return fearfulred
    }
}
```

```
export const currentAvatarName = () => {

    const avatar = localStorage.getItem("current_avatar")

    if (avatar === null) {

        return "Fearful red"

    } else if (avatar === "Fearful red") {

        return fearfulred

    } else if (avatar === "5 eyed sunny") {

        return "5 eyed sunny"

    } else {

        return "Fearful red"

    }

}
```

APPENDIX C (FORMAT OF LESSON TYPES)

```
type TaskType = {
    id?: number;
    type: "MultipleChoiceQuestion" | null; //comeback to add any new type
    question: string;
    answer: string;
    options: string[];
    isAnswerCorrect: boolean | null;
  };


  type ContentItemType = {
    title: string;
    description: string;
    task: TaskType | null;
  };


  interface LessonType {
    title: string;
    sections: {
      lessonDetails: {
        image: string; // You may replace string with the actual type of networkImage
        topics: string[];
      };
      teacherIntroduction: {
        introduction: string;
      };
    };
    content: ContentItemType[];
  }
```

The type declaration for the avatar followed this format:

```
type AvatarType = "5 eyed sunny" | "Fearful red" | "Fearful reed"
```