

**EduCare: AI Tutor and Health Assistant for Autism Support**

**FINAL YEAR PROJECT PHASE-I**

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**FINAL YEAR PROJECT PHASE-I DOCUMENTATION**

**STATEMENT OF SUBMISSION**

This is to certify that Saira Arshad Roll No. 70126012, Haseeb Tariq Roll No. 70109359 and Maheen Qamar Roll No. 70126610 have successfully submitted to the University of Lahore in partial fulfillment of the requirement for the award of degree of Bachelors of Science in Software Engineering (BSSE)

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ABSTRACT

This AI-driven platform offers holistic support for children with Autism Spectrum Disorder (ASD) and their caregivers. By initiating with a personalized assessment to determine the child’s developmental stage and ASD level, the app customizes its features to suit individual needs. It incorporates an AI-powered chatbot to guide parents on autism-related concerns and enhance their decision-making. For children, the app provides an AI tutor delivering tailored learning modules, interactive games, and activities to foster cognitive, social, and behavioral growth. Additionally, the platform includes a progress-tracking system, offering caregivers detailed insights into developmental milestones and achievements. With its user-friendly design and integration of learning, parental guidance, and progress monitoring, the app empowers families to navigate ASD challenges with comprehensive and meaningful support.

**DEDICATION**

With hearts full of gratitude and compassion, we dedicate this project to our Almighty God, whose guidance and blessings have illuminated every step of this journey.

To our beloved parents, who have been our unwavering pillars of strength, and to our mentors, whose wisdom and encouragement have shaped our vision—your faith in us has been our greatest inspiration.

This work is also a tribute to the courageous children living with Autism Spectrum Disorder and their extraordinary parents, whose resilience and love transcend all challenges. It is our hope that this platform serves as a beacon of support, empowerment, and understanding for all who walk this path.

May this endeavor bring comfort, growth, and hope to the lives it touches.

Acknowledgement

First and foremost, we are incredibly appreciative of **Allah Almighty**, whose unending blessings and direction have made it possible for us to start and finish this endeavor. None of this would have been possible if it weren't for His kindness and mercy.  
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**Haseeb Tariq**

**Saira Arshad**

**Maheen Qamar**

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# **Chapter 01: Introduction to the Problem**

# **Introduction:**

Our app is a comprehensive, AI-driven platform designed to support children with Autism Spectrum Disorder (ASD) and their caregivers. It begins with an **initial assessment** to evaluate the child’s ASD level and developmental stage, ensuring a fully personalized experience tailored to their unique needs. The app features an **AI-powered chatbot** that provides parents with expert guidance on autism-related concerns, enhancing their understanding and decision-making.

For children, the app offers an **AI tutor** delivering personalized learning modules, interactive games, and activities that promote cognitive, social, and behavioral development. Parents and caregivers can leverage the **progress tracking system** to monitor their child’s achievements and developmental milestones through detailed, data-driven insights.

With its **intuitive design and accessibility**, the app seamlessly integrates learning, parental guidance, and progress monitoring into a single, cohesive platform. This innovative tool empowers families by addressing both educational and caregiving needs, providing meaningful support for children with autism and their loved ones.

# **Purpose**:

The purpose of this app is to create a comprehensive, technology-driven solution that supports children with Autism Spectrum Disorder (ASD) and their caregivers in meaningful ways. By offering personalized learning experiences through AI-driven activities and educational modules, the app aims to enhance the cognitive, social, and behavioral development of children with autism. It also provides caregivers with reliable resources, including an AI-powered chatbot for expert guidance and decision-making support, making it easier to navigate the challenges of autism care. Additionally, the app simplifies progress monitoring by delivering data-driven insights that help families and educators track and evaluate the child’s growth and achievements over time. By addressing the fragmentation found in existing solutions, the app integrates learning, guidance, and progress tracking into a user-friendly and cohesive platform, ultimately improving the quality of life for both children with autism and their families.

# **Objective:**

**Add an Initial Assessment Feature:** Implement an assessment at the start of the app to evaluate the child’s ASD level (e.g., mild, moderate, severe) and age group. This assessment will help personalize the app experience, suggesting activities, games, and educational modules that best match the child’s abilities and developmental needs.

**Develop an AI-Powered Chatbot:** Create a chatbot that provides parents with reliable answers to general autism-related questions, including behavioral concerns and guidance to enhance parental understanding and decision-making.

**Implement an AI Tutor for Learning and Activities:** Design an AI-driven tutor that offers children with autism personalized learning modules, interactive games, and activities aimed at improving cognitive skills, engagement, and social development.

**Enable Progress Tracking and Monitoring:** Develop a progress tracking feature that allows parents and caregivers to monitor their child’s development, learning achievements, and activity progress, providing data-driven insights for informed decision-making. The progress tracker will generate report, allowing parents and educators to assess improvements in learning, attention, and interaction over time.

**Enhance User Experience and Accessibility:** Ensure the app is easy to navigate, user-friendly, and accessible for both children with autism and their parents, with intuitive interfaces and clear guidance.

**Integrate a Comprehensive Support System:** Combine learning, parental guidance, and progress monitoring into one cohesive platform, offering a well-rounded tool that addresses both the educational and care needs of children with autism and their families. These objectives aim to deliver a comprehensive autism support app that enhances learning, simplifies parental guidance, and tracks child development in a meaningful and accessible way.

# **Existing Solution:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature** | **Cognoa** | **Prologue2Go** | **Autism iHelp** | **AutiSpark** | **Inner Voice** | **Otsimo** | **Proposed Solution** |
| **Target Audience** | Parents and clinicians working with children suspected of autism | Nonverbal children, including those with autism | Children with autism, educators and caregivers | Children on the autism spectrum | Children with autism, particularly nonverbal or minimally verbal | Children with autism, educators and caregivers | Children with autism and their caregivers, including parents and educators |
| **Key Features** | AI-powered diagnostic tool, personalized activities, developmental insights | AAC tool for nonverbal individuals, customizable interface, progress tracking | Early intervention educational app, visual learning (flashcards, interactive tasks), progress tracking | Interactive learning activities (sorting, matching, memory games), progress reports | Communication aid using pictures and symbols, generates spoken words | Educational games for language and social skills, progress tracking | Initial assessment, AI-driven learning, chatbot for parental guidance, progress tracking, integrated support system |
| **Communication Support** | ❌ | ✅ | ❌ | ❌ | ✅ | ❌ | ✅ |
| **Educational Activities** | ✅ | ❌ | ✅ | ✅ | ❌ | ✅ | ✅ |
| **Progress Tracking** | ✅ | ✅ | ✅ | ✅ | ❌ | ✅ | ✅ |
| **Parental Support (Chatbot)** | ❌ | ❌ | ❌ | ❌ | ❌ | ❌ | ✅ |
| **Therapeutic Guidance** | ❌ | ❌ | ❌ | ❌ | ❌ | ❌ | ✅ |
| **AI-Driven Personalization** | ✅ | ❌ | ❌ | ❌ | ❌ | ❌ | ✅ |
| **Integrated System** | ❌ | ❌ | ❌ | ❌ | ❌ | ❌ | ✅ |
| **Pricing** | Paid (may be insurance-covered) | Paid (one-time purchase) | Free with in-app purchases | Paid (one-time or subscription) | Paid with optional customization | Freemium with subscription | Freemium with optional premium features |

# **Gap Analysis and Proposed Solution:**

**Problem with Existing Systems**

1. **Fragmentation**: No single platform addresses communication, education, parental guidance, and therapeutic needs together.
2. **Limited Parent Involvement**: Existing systems do not adequately equip parents with tools to monitor and guide their child’s progress.
3. **Absence of Integration**: Parents often must rely on multiple tools, leading to inefficiencies and incomplete support.
4. **Underutilized AI Potential**: Current systems fail to harness AI to provide personalized and adaptive learning or behavior management.

**Addressing the Gaps**

The proposed app is designed as a comprehensive and user-centric solution for children with Autism Spectrum Disorder (ASD) and their caregivers. It begins with an initial assessment feature that evaluates the child’s ASD level and developmental stage, enabling the app to personalize the experience by recommending suitable activities, games, and educational modules aligned with the child’s unique needs.

An AI-powered tutor forms the core of the app’s learning functionality, offering interactive modules and activities to enhance cognitive skills, promote social development, and maintain engagement. This feature is complemented by an AI-powered chatbot that provides caregivers with expert advice on autism-related concerns, including behavioral guidance and strategies to improve decision-making and care.

The app includes a progress tracking system that allows parents and caregivers to monitor their child’s developmental milestones, learning achievements, and activity performance. This feature generates detailed reports, equipping families and educators with data-driven insights to evaluate the child’s growth and make informed interventions.

Designed with accessibility in mind, the app ensures a seamless user experience with intuitive navigation and a child-friendly interface. Its integrated support system combines learning, parental guidance, and progress monitoring into a single cohesive platform, providing a holistic tool that addresses both educational and caregiving needs. This solution empowers families by simplifying autism care and fostering the child’s overall development in a personalized, meaningful way.

# **Chapter 02: Software Requirement Specification**

# **Introduction**

This Software Requirements Specification (SRS) document serves as a foundational guideline for the development team and stakeholders involved in the creation of our AI-driven platform supporting children with Autism Spectrum Disorder (ASD) and their caregivers.

## **Purpose**

The purpose of this document is to provide a clear, detailed, and structured overview of the system’s requirements, ensuring alignment between stakeholders and the development team. It establishes a shared understanding of the project’s scope, objectives, and deliverables, acting as a bridge between conceptualization and implementation. This document will outline the functional, non-functional, and technical requirements essential for developing a system that meets the highest standards of usability, accessibility, and performance.

By adhering to this SRS, the development team will ensure the successful realization of a solution that aligns with stakeholder expectations while delivering meaningful and impactful support to its users.

## **Scope**

The software product, **EduCare: AI Tutor and Health Assistant for Autism Support**, is a comprehensive platform designed to assist children with Autism Spectrum Disorder (ASD) and their caregivers. This AI-driven application integrates advanced technologies to deliver personalized learning experiences, caregiver guidance, and developmental progress monitoring within a single, cohesive system.

**EduCare will do:**

* **Personalized Support:** Provide tailored learning modules and interactive activities to support the cognitive, social, and behavioral development of children with ASD.
* **Caregiver Assistance:** Offer AI-powered guidance to caregivers through an intuitive chatbot for addressing autism-related queries and enhancing decision-making.
* **Progress Tracking:** Enable caregivers to monitor the developmental milestones and achievements of children through detailed analytics and reports.

**EduCare will not do:**

* The application does not serve as a replacement for professional medical advice, diagnosis, or therapy.
* It does not provide real-time clinical intervention or therapeutic services.

**Application and Benefits:**  
EduCare is intended to be a valuable tool for families and caregivers, designed to:

* Improve the learning and developmental outcomes for children with ASD through engaging and personalized approaches.
* Empower caregivers with knowledge and resources to better support their child’s growth and well-being.
* Provide an accessible, user-friendly interface to simplify the caregiving and educational journey for families.

## **Definitions, acronyms and abbreviations**

** Definitions:**

* **Autism Spectrum Disorder (ASD):** A developmental condition characterized by challenges with social interaction, communication, and repetitive behaviors, varying in severity across individuals.
* **AI Tutor:** An artificial intelligence system designed to deliver personalized educational content and activities tailored to a child’s developmental needs.
* **Caregiver:** A parent, guardian, or individual responsible for the care and support of a child with ASD.
* **Personalized Learning:** An educational approach tailored to meet the unique abilities, interests, and developmental needs of an individual learner.
* **Progress Tracking:** The systematic monitoring and reporting of a child’s developmental milestones and achievements over time.

** Acronyms:**

* **ASD:** Autism Spectrum Disorder
* **AI:** Artificial Intelligence
* **UI:** User Interface
* **UX:** User Experience
* **SRS:** Software Requirements Specification
* **API:** Application Programming Interface
* **DBMS:** Database Management System

** Abbreviations:**

* **EduCare:** AI-powered Learning and Tutoring Assistant for Autism Support (Project Name)
* **ML:** Machine Learning
* **DL:** Deep Learning
* **NLP:** Natural Language Processing

# **Overall Description**

## **2.2.1 Product Perspective**

The **EduCare: AI Tutor and Health Assistant for Autism Support** is an independent and self-contained application designed to address the unique educational and caregiving needs of children with “Autism Spectrum Disorder (ASD)” and their families. This product differentiates itself through its focus on accessibility, inclusivity, and a user-friendly interface, ensuring it meets the diverse needs of its users.

### **2.2.1.1 System Interfaces**

The **EduCare: AI Tutor and Health Assistant for Autism Support** interacts with various system components to deliver its functionality effectively. It includes User Interface (UI), Database Interface, AI Processing interface, Third-Party API Integration, Security Interface, Progress Reporting Interface.

### **2.2.1.2 User Interfaces**

The User Interface (UI) of **EduCare: AI Tutor and Health Assistant for Autism Support** will be user friendly allowing the children with ASD and guardians to easily navigate through the app with ease.

### **2.2.1.3 Hardware Interfaces**

**EduCare** is a software-based platform and does not require strict hardware dependencies. However, to operate it requires (Tablets, Smartphones) and may require internet connectivity in order to download the progress report.

### **2.2.1.4 Software Interfaces**

The **EduCare** may have dependencies on certain software components, such as databases, NLP models and programming languages. These dependencies will be specified during development and deployment process in order to ensure its seamless operation.

### **2.2.1.5 Communication Interfaces**

The **EduCare: AI Tutor and Health Assistant for Autism Support** requires minimal communication interfaces, as it is primarily a mobile application. However, certain interfaces are necessary to ensure functionality, data security, and connectivity. These include **Internet Connectivity Interface, Backend Communication Protocols, Push Notification Interface, Accessibility Tool Integration.**

### **2.2.1.6 Memory**

The **EduCare** will may have certain characteristics and limits on primary and secondary memory, depending on the scale of the platform and data it needs to handle. The specific memory requirements will be determined during system design phase.

### **2.2.1.7 Operations**

The **EduCare** normal operations includes user login, initial assessment, activities, educational contents, progress report. Special operations such as backups and recovery mechanism will be implemented to ensure the data integrity and system reliability in case of data corruption, loss of data etc.

## 2.2.2 Product Functions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_01 | | | |
| Name: | Create Account | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Enter details to create account  for Children and Parents | Name, Email, Password etc. | Account Created | Internet connectivity required | Users enters his/her correct credentials and click submit button.  System save the record in the database. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_02 | | | |
| Name: | Login | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Enter Username and Password to log into the system for Children and Parents | Username  Password | User Login the system successfully | Internet connectivity and  Active account required | Users enters his/her correct credentials.  System checks from the database and matches the Username and Password. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_03 | | | |
| Name: | Profile Management | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Allow to update the profile information for Children and Parents | Children and Parents personal information | Updated Profile information | Internet connectivity and access to users database | Users must login the system  Navigate the profile management section  Update the information  Save the updated information in the database |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_04 | | | |
| Name: | Initial Assessment | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Perform an initial assessment to determine the child’s ASD level | Select answers of pre-defined questions | Categorized Child’s ASD level | Internet connectivity and user must be logged in | Users answers the pre-defined questions.  Process the input through AL/ML model.  Display the child’s ASD level. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_05 | | | |
| Name: | Learning Modules | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Educational learning content based on child’s ASD level | Initial Assessment result | Educational content provided based on the result | Internet Connectivity required | Processes the initial assessment  Categorize the ASD level  Display Educational content based on child’s ASD level |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_06 | | | |
| Name: | Game and Activities | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Provide interactive games and activities | Children’s assessment data, learning preferences | Engaging game and content provided, generate progress result | Internet Connectivity required to store progress results in database, Trained AI model | Based on child’s assessment data provide the game and activity.  Child engages in the game and activity.  Progress result are recorded to track progress. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_07 | | | |
| Name: | Progress Report | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Child’s progress report | Data from learning, games and activities | Progress report generated based on child’s | Internet Connectivity required to download or view progress report | Child will educate from learning module, engage in games and activities and based on its progress/result report will be generated/updated.  Report can be viewed or saved. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_08 | | | |
| Name: | Chatbot | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Chatbot will provide assistance to parent’s queries | Parent inputs query/problem | Solution to the problem will be generated | Internet Connectivity required, trained AI model for assisting the queries | Parent interacts with chatbot and enters their queries.  Chatbot processes the queries using AI trained model.  Chatbot provides relevant response to the query.  Feedback is conducted for the response to improve the model’s accuracy |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_09 | | | |
| Name: | Notification and Reminders | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| The system sends reminders for children to complete specific activities | User schedules activities and preferences | Timely notifications are displayed | Device notifications enabled | Retrieve activity schedule.  Check reminder settings. Generate and send notifications. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_10 | | | |
| Name: | Settings | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Allows users to customize application preferences | Selected preferences | Updated settings in the user profile | User must be logged in  User interface for settings | User accesses settings.  Selects preferences Save changes. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_11 | | | |
| Name: | Feedback | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Enables users to submit feedback or suggestions | User gives feedback | Feedback stored in the database | User must be logged in  Feedback form/ popup, database for storing suggestions | Show feedback form/popup.  Fill and submit feedback. Save response in the database/model. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID: | FR\_12 | | | |
| Name: | Logout | | | |
| Description | Input | Output | Requirements | Basic Work Flow |
| Allows users to securely log out the app | Logout request | User session terminated | User authentication module | User initiates logout.  System ends the session. Redirect user to the login screen. |

## 2.2.3 User Characteristics

**1. Parents/Caregivers**

* **Educational Level**: High school to college-educated; basic knowledge of ASD.
* **Experience**: Limited exposure to ASD tools; familiar with smartphones and basic apps.
* **Technical Expertise**: Basic to moderate; can navigate user-friendly interfaces.
* **Primary Operations**: Viewing and tracking progress, downloading reports, interacting with a chatbot for assistance.

**2. Children with ASD**

* Educational Level: Varies by age and abilities; prefers visual and interactive content.
* Experience: Minimal with specialized tools; some exposure to learning apps or games.
* Technical Expertise: Minimal; relies on intuitive, sensory-friendly design.
* Primary Operations: Completing structured tasks, interacting with age-appropriate content for progress tracking.

## 2.2.4 Constraints

1. **Regulatory Policies**
   * Compliance with **GDPR** and **HIPAA** for data protection.
   * Adherence to **WCAG 2.1** for accessibility standards.
2. **Hardware Limitations**
   * Support for mid-range smartphones and tablets.
   * Offline functionality for essential features.
3. **Interfaces to Other Applications**
   * Seamless integration with accessibility tools and push notifications.
   * Compatibility with native OS features (iOS/Android).
4. **Parallel Operation**
   * Support for multiple users with independent profiles in one household.
5. **Audit Functions**
   * Maintain logs for critical actions (account creation, data updates, etc.).
6. **Control Functions**
   * Admin controls for caregivers to manage profiles and preferences.
7. **Higher-Order Language Requirements**
   * Use of modern, reliable programming languages (e.g., **Flutter**, **React Native**).
8. **Signal Handshake Protocols**
   * **SSL/TLS** encryption for secure data transmission.
9. **Reliability Requirements**
   * 99.5% system uptime and robust error handling for recovery.
10. **Criticality of the Application**

* Prioritize accuracy, responsiveness, and stability in critical features.

1. **Safety and Security Considerations**

* End-to-end encryption for data security.
* Multi-factor authentication (MFA) for user access.
* Regular security audits to ensure compliance.

## 2.2.5 Assumptions and Dependencies

1. **Assumptions**
   * Users are familiar with basic mobile app navigation.
   * Reliable internet connectivity is available for setup and cloud features.
   * The app is compatible with common iOS and Android devices.
   * User data will comply with data privacy laws (GDPR, HIPAA).
   * AI models will be trained on diverse data and continuously improve.
2. **Dependencies**
   * Third-party services for push notifications, cloud storage, and authentication (e.g., Firebase, AWS).
   * Mobile platform features (notifications, accessibility tools) must be available.
   * Integration with external APIs for content and payment gateways.
   * Security updates and compliance with encryption and data protection standards.
   * Device specifications (processing power, memory) affect app performance.

## 2.2.6 Apportioning of Requirements

In the event of software updates, there might be a need for additional requirements to address the issue. In the coming future, we have the opportunity to improve our application by incorporating more authentic and secure features.

# 2.3. Specific Requirements

## 2.3.1 Functional Requirements

## 2.3.2 Non-Functional Requirements