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# Software Requirements Specification

for

## VIRTUAL STEM

Version 1.0 approved

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### Revision History

Name	Date	Reason For Changes	Version

# **1. Introduction**

The introduction of the Software Requirements Specification (SRS) provides an overview of the entire SRS with purpose, scope, definitions, acronyms, abbreviations, references and overview of the SRS. With this document we aim present a detailed description of the project Interactive Learning System. The detailed requirements for the working are provided in this document.

## **1.1 Purpose**

This document covers the software requirement specifications for our Final Year project. The idea is to create an interaction-based learning system for the education of children. Such a product may be useful while teaching children and building their basic concepts in schools and at home. This project will use a projector and a depth sensor for object detection on the projector screen, and will use the objects making contact with the screen and use it for interactions. The projector will show different learning-based interactive activities for the student.

## **1.2 Document Conventions**

### **1.2.1 Headings**

Heading are prioritized in a numbered fashion, the highest priority heading having a single digit and subsequent headings having more numbers, per their level.

All the main headings are titled as follows: single digit number followed by a dot and the name of the section (All bold Times New Roman, size 18, Centered).

All second level sub headings for every sub section have the same number as their respective main heading, followed by one dot and subsequent sub heading number followed by name of the sub section (All bold Times New Roman, size 16).

Further subheadings, i.e. level three and below, follow the same rules as above for numbering and naming, but different for font (All bold Times New Roman, size 14).

### **1.2.2 Figures**

All figures in this document have captions, and are numbered. Context and flow diagrams are based on UML standards.

### **1.2.3 Reference**

All references in this document are provided where necessary, however where not present, the meaning is self-explanatory. All ambiguous terms have been clarified in the glossary at the end of this document.

### **1.2.4 Links to web pages**

All links have been provided with underlined font, the title of the web page is written at the top of the link and the title may be searched on Google to pinpoint to the exact address.

### **1.2.5 Basic Text**

All other basic text appears in regular, size 12 Times New Roman. Every paragraph explains one type of idea.

## **1.3 Intended Audience and Reading Suggestions**

The intended audiences for the interactive learning system include the project supervisor, the BESE 23 FYP groups (developers), UG project evaluation team, and other personnel at MCS CSE Department.

### **1.3.1 Project Supervisor**

It will help the supervisor to supervise the project and guide the team in a better way. This document will be used by him to check whether all the requirements have been understood and, in the end, whether the requirements have been properly implemented or not.

### **1.3.2 BESE 23 FYP group**

For FYP group members, this document will provide a guideline for developing and testing the project.

### **1.3.3 UG Project Evaluation Team**

It will help the evaluation team to evaluate the progress of the FYP project. The document will provide the evaluators with the scope, requirements, and details of the project to be built. It will also be used as the basis for the evaluation of the implementation and final project.

### **1.3.4 Reading suggestions**

The SRS begins with the title and table of contents. All level 1 and level 2 headings are given in the table of contents, but the lower subheadings are not included. Each main heading is succeeded by several subheadings, which are all in bold format. The product overview is given at the start, succeeded by the complete detailed features, including both functional and non-functional requirements. The entire interfaces are also described. The SRS ends with appendices, including a glossary.

## **1.4 Product Scope**

The project can help educational institutions to modernize their education system and bring interactivity to the system which has been stale for a long period of time. The software can provide different activities for the learning of different subjects in schools and at home.

## **1.5 References**

### **1.5.1 IEEE Computer Society Conventions**

- **Use Case Modeling Guidelines**, which documents the guidelines used to develop the use case model specifying the functional requirements in this

specification.

[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?arnumber=787548](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=787548)

**System Requirements Specification Content and Format Standard**, which specifies the content and format of this specification.

[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?tp=&isnumber=15571&arnumber=720574&punumber=5841](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?tp=&isnumber=15571&arnumber=720574&punumber=5841)

**System Requirements Specification Template**, which provides the skeleton for this specification.

[http://ieeexplore.ieee.org/xpl/freeabs\\_all.jsp?tp=&isnumber=16016&arnumber=741940&punumber=5982](http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?tp=&isnumber=16016&arnumber=741940&punumber=5982)

## 2. Overall Description

### 2.1 Product Perspective

The main idea behind this project is to help children learn and grasp the concepts in a new and interactive way. The idea can easily be implemented in existing classrooms. A teacher cannot teach each and every student of a classroom equally there will always be a disparity between the understanding of the students so such a system can make sure that student receive a better understanding overall. Due to the ongoing pandemic it is essential to find such innovative ways for education, such methods can help students to cover their syllabus quicker by using such methods and techniques.

### 2.2 Product Functions

The main features of our product will be the following:

1. The sensor will calibrate with the projector screen.

2. The desired application will be started by the user.
3. The sensor will sense the objects being used to interact with the screen.

## 2.3 User Classes and Characteristics

### 2.3.1 Summary of User Classes

The following section describes the types of users

- **Education System:** The product will be used for education where it will be used by children to perform different educational activities.

## 2.4 Operating Environment

### 2.4.1 Hardware

**GeForce GTX 1080 Ti or similar:** The graphics card will be used in fast processing for three-dimensional reconstruction.

**Kinect Version 2:** The sensor used for object detection.

### 2.4.2 Software

- Linux
- IDE: PythonIDE(python3)

## 2.5 Design and Implementation Constraints

This software does come with its own design and implementation constraints:

- The product will be used for primitive and some form of special education only, in selected subject areas.
- The product will have a essential ingredient in some form of external input from the object used to interact with the system.



## 2.6 User Documentation

The user will be able to use the following as guides for using the software:

- User Manual that contains textual and pictorial help for users in guiding them to use the software correctly and troubleshoot it.
- A webpage in the website interface for the software that answers frequently asked questions and has a guide on using the software.

## 2.7 Assumptions and Dependencies

The product will need calibration for successful operation and new calibration will be required to redo the setup.

# 3. External Interface Requirements

## 3.1 User Interfaces

The front-end user interfaces will have the following main screens available to the user:

- **Launch Screen:** Once the application is started, the first page that is displayed is the launch menu which gives a prompt that the sensors are calibrated correctly and that everything is ok and the application is ready to start.
- **Main Menu:** This is the main menu of the application; it will show different applications that have been deployed in the system and are ready to use.

The user can interact with these application by gestures and movement, and/or by action such as throwing object (such as ball, .etc.) on the screen.

## 3.2 Hardware Interfaces

- GPU integrated Device will be needed to run this software such as GeForce GTX 1080 Ti integrated computers.
- Short throw projector will be used to display information to the user
- Visual input and Motion Detection will be captured via Kinect v2 sensor

### 3.3 Software Interfaces

- **Python:** We will be using python programming language because its more interactive support to our project.
- **Visual Studio:** We will use Visual Studio as a platform to run our python program
- **Operating System:** Linux for its user-friendliness and compatibility

### 3.4 Communications Interfaces

- **Pykinect:** A wrapper library providing access to the Kinect device. It provides interactions with the Kinect cameras including skeleton tracking, video camera, as well as the depth camera.
- **Kinect SDK:** The SDK enables the creation applications that support gesture and voice recognition, using Kinect sensor running on Windows.

## 4. System Features

This section describes in detail the system features of the system.

### 4.1 Launch Screen

#### 4.1.1 Description and Priority

Once you start the application, the first page that is displayed is the launch menu which gives a prompt that the sensors are calibrated correctly and that everything is ok and the application is ready to start. The priority of this is low, since it is not necessary for the system.

#### 4.1.2 Stimulus/Response Sequences

Powering on the system.

#### 4.1.3 Functional Requirements

REQ-1: Application shall be installed properly.

REQ-2: If the system is correctly booted:

- A prompt is displayed that tells you that the system booted up correctly.
- An 'OK' button to move on to the next screen.

## 4.2 Main Menu

### 4.2.1 Description and Priority

This is the main menu of the application; it will show different applications that have been deployed in the system and are ready to use. This holds a medium priority in this product

### 4.2.2 Stimulus/Response Sequences

1. Boot the system.
2. Press OK on the launch screen.

### 4.2.3 Functional Requirements

REQ-3: Application shall boot up properly.

REQ-4: Different options that are available:

- A list of applications is shown to choose from.
- Help menu.
- Exit option.

## 4.3 Interactive Learning Application

### 4.3.1 Description and Priority

This is the main application that will be installed in the system which displays a stream of letters falling from the projected screen and the user can interact with the screen using a ball and animations will be shown according to the letter the user hits. This is a high priority task since this is the core function of this product.

### 4.3.1 Stimulus/Response Sequence

1. The user selects the application from the main menu.
2. The application shows a stream of letters falling down.
3. User performs an interaction with the screen by throwing a ball.
4. It is detected which letter the ball hits and an animation is shown accordingly.

The user can exit the application by clicking on the exit screen.

### 4.3.2 Functional Requirements

- REQ-5: Application is available on the menu.
- REQ-6: User can select the application by clicking on it.
- REQ-7: The application is able to detect where an object hits it.
- REQ-8: The application is able to detect if and what letter is hit.
- REQ-9: The application shows an animation according to the letter hit.

## 4.4 Help Menu

### 4.4.1 Description and Priority

Help menu holds a medium priority. It will contain all the instructions needed to use the application.

### 4.4.1 Stimulus/Response Sequence

- 1- The user selects Help Menu from Main Menu.
- 2- An instructions manual is displayed to guide the user

### 4.4.2 Functional Requirements

- REQ-10: Choosing Help Menu option shall show Instruction Manual.

## 5. Other Nonfunctional Requirements

### 5.1 Performance Requirements

#### 5.1.1 Response Time

The system shall be working within 3 minutes of opening it.

#### 5.1.2 Platform

The system application shall be compatible with Linux.

### **5.1.3 Efficiency**

The system shall be able to detect the characters and make a word out of it in no more than 30 seconds.

## **5.2 Safety Requirements**

The use of the software product has no harms whatsoever; nor does it have any possibility of loss or damage that might be inflicted however during the use of the application, users have to be careful that they should maintain a safe distance from the Kinect sensor and the screen, however the user should not hold any eatable or anything that can result in the damage of the hardware equipment. User can experience eye strain and they should take a break from using the device to avoid further strain and/or possible damage.

## **5.3 Security Requirements**

Application running on the system shall not need any additional or personal information. There are no connections to other devices or servers so no data will be sent or received or used in any way.

## **5.4 Software Quality Attributes**

### **5.4.1 Usability**

The graphical user interface of virtual stem is to be designed with usability as the first priority. The virtual stem will be presented and organized in a manner that is both visually appealing and easy for the user to navigate and use the system.

### **5.4.2 Accuracy**

The system shall provide 60% accuracy in order to make the project more useful for the E-Learning industry.

### **5.4.3 Legal**

The system will follow the customer privacy policy strictly.

#### **5.4.4 Reliability**

The system shall be able to work in a normal way after restarting due to an error.

#### **5.4.5 Ease of Use**

The teaching staff will need training of one day to completely understand the system.

#### **5.4.6 Modifiability**

Virtual Stem can be modified as per the requirements and will be adaptive to the changes. Such as new applications can be developed for the same hardware for different age groups for educational purposes and can also be modified by other developers for different purposes.

#### **5.4.7 Operating Constraint**

The system requires a Kinect Sensor to detect what character is selected by the user.

### **5.5 Business Rules**

According to NUST policy.