Annexure-1

TERMS OF REFERENCE (TOR)

For

Digital Content Repository Management System (DCRMS)

Prepared by

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1. Background

The Department of Information and Communication Technology (DoICT) formulates and executes the Policy Matters relating to Information and Communication Technology (ICT) in pursuance of national objectives and plans. Under the sponsor of ICT Division, DoICT was the executing agency of the project entitled "Establishment of Sheikh Russel Digital Labs" in the educational institutions of the country which has established 4176 digital labs across the country from January, 2015 to September, 2019. The project entitled "Establishment of Sheikh Russel Digital Labs- 2nd Phase" has established 5000 digital labs (SRDL) and 300 School of Future (SoF) across the country from January, 2020 to December, 2022. In sync with vision 2021, a pledge of Bangladesh government to transform the future of Bangladesh into a technologically advanced one, the project "Sheikh Russel Digital Labs-2nd Phase (SRDL) in educational institutions", has been conceptualized and came into being. The project seeks to light up the young minds with essential ICT skills in remote parts of the country, to make ICT education accessible ever than before, build a large ICT skilled work-force and equip them with adequate skills so that they can excel in global market. The project objectives are ensuring the quality education, and trained and skilled human resources development by establishing the necessary ICT infrastructure and software-based language education.

Concept of Sheikh Russel School of Future

There is no substitute for high-quality technological education. The "School of Future" is built on the foundation of pedagogical change in education, school architecture, critical thinking & problem-solving skills and modern technology. To achieve this visionary goal, we need to go beyond the conventional classroom and integrate new technological improvements with hardware, digital content, software, School of Future Management Systems and new technologies (3D Printer, MR Tools, Robotics, Programmable etc) suitable for coping with the competition of 4th Industrial Revolution. The Sheikh Russel School of Future aims to equip our students with all classroom facilities such as creative & constructive thinking, innovative skills and imparting knowledge and skills in the ICT sector through training in coding and programming education. The components of the Sheikh Russel School of Future have been selected based on these three concepts: education, architecture and technology. Students will be more interested to learn about the technologies of the 4th Industrial Revolution - especially the unique combination of new technologies like Nano, Cloud, lot, Robotics, Artificial Intelligence, Sensitive Drones, Blockchain as well as Electronics, Microchip and Robotics. They also get practical ideas about other technologies, including Lego sets, Arduino Starter Kit, Brick Pie Set, Mac Block Ultimate etc.

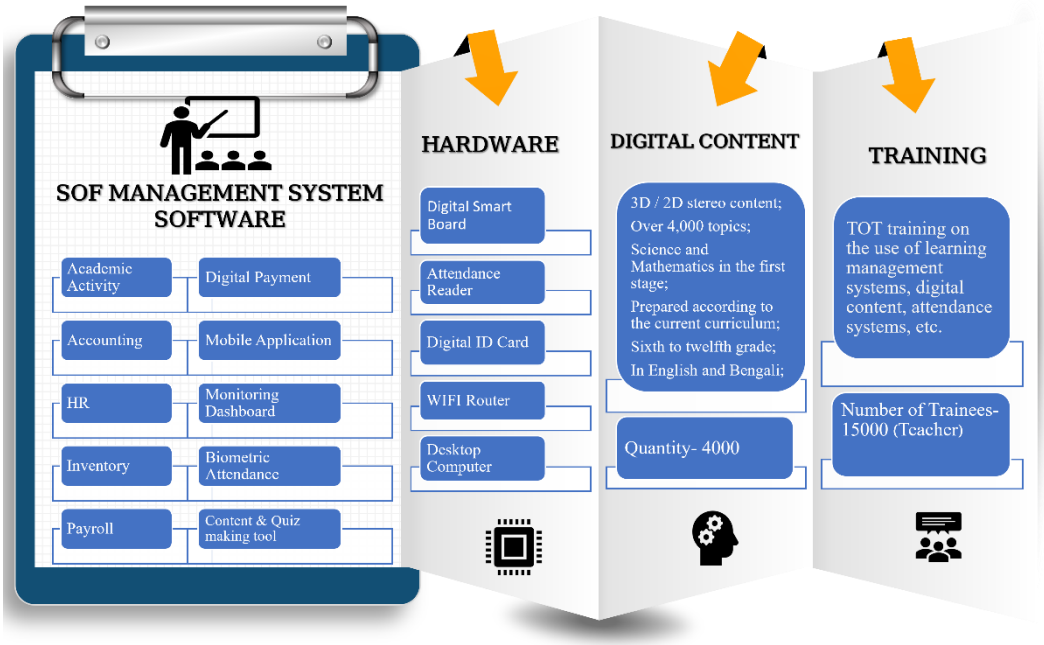


Figure 1: Sheikh Russel School of Future

Digital Content Repository System:

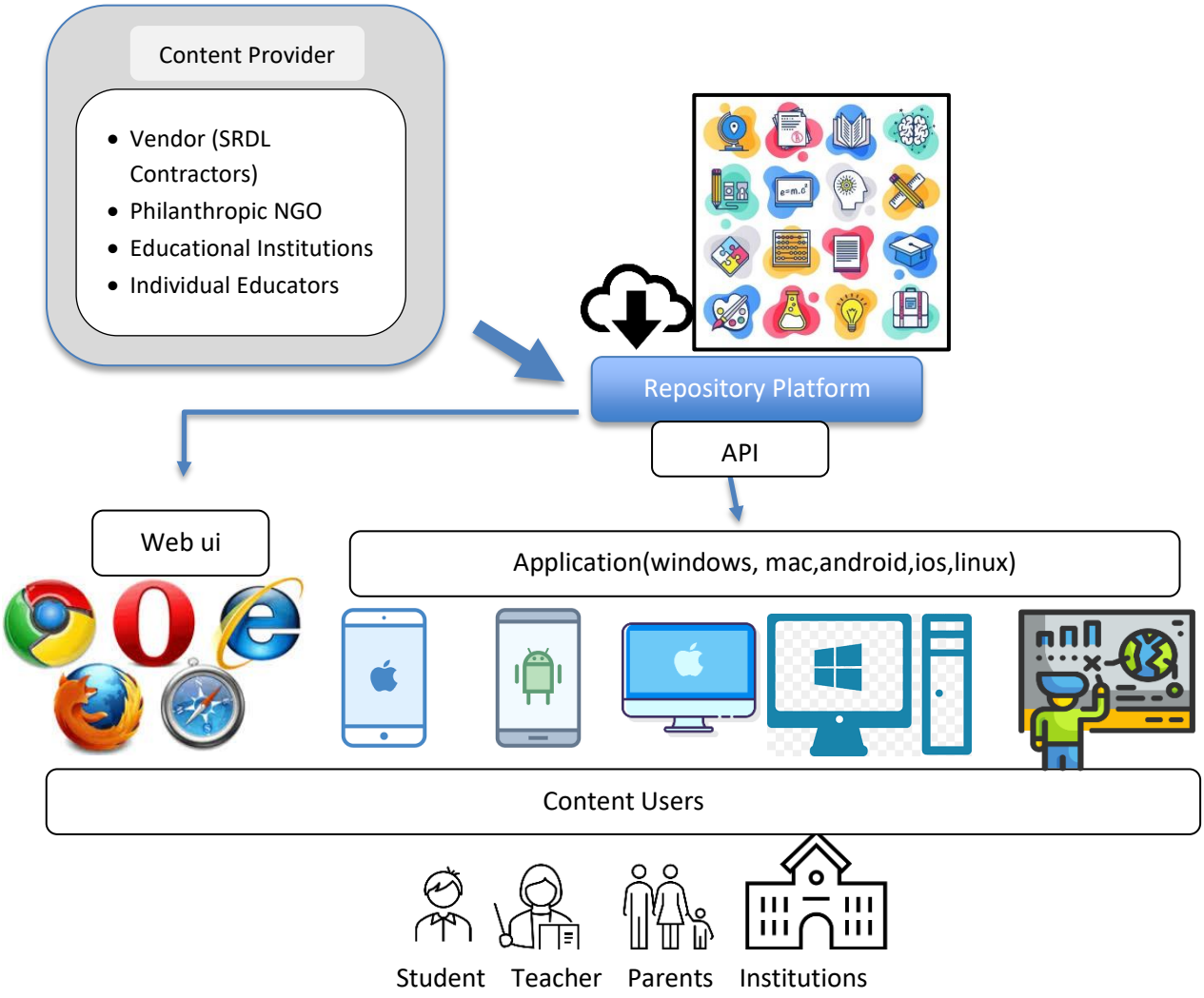
The project is developing 4000 digital content for using in Sheikh Russel School of Future as teaching assistance content. The planned contents would be developed by five vendors already contracted by the PIU. The contents will be packed as fixed layout ebook formatted using HTML, CSS, and javascript. The digital content repository system will be a system for processing, storing, and efficiently distributing those book formatted contents among teachers, students, and parents. Besides, Digital Content Repository System is a warehouse of digital material that any interested content creator can upload and distribute their contents to educators, students, and parents. The system collections of digital content such as documents, videos, images, audio, 3d scane etc. in a digital format to provide free access to students and teachers. The system lets the user search, view and download offline.

The objective of the Digital Content Repository System is:

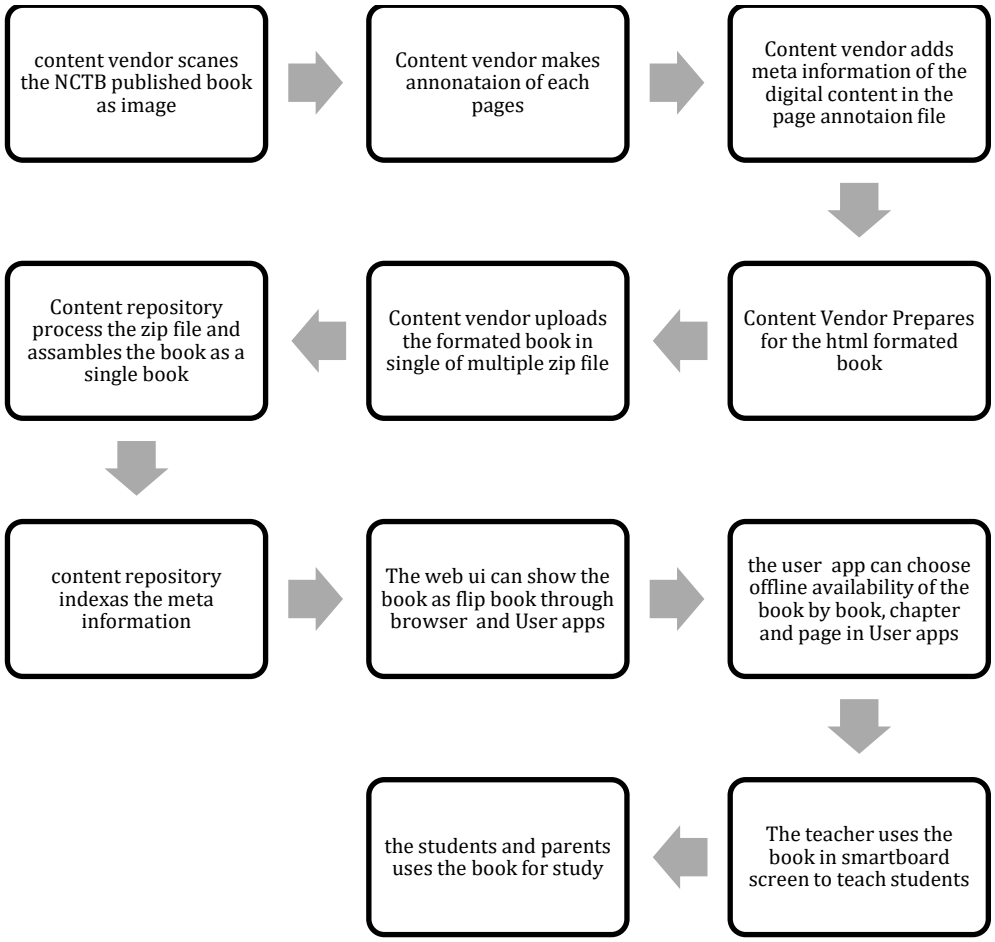
1. Store and Distribute digital content over the cloud
2. Provide digital content and tools for teacher's assistance in the classroom with a smartboard.

Specific objectives:

1. Develop a web portal for hosting and viewing digital content over the cloud
2. Develop natively compiled apps for digital content viewing, downloading for offline use, and taking a class for windows, android, IOS, Linux, MacOS
3. 3-year service contact bug fixing and system maintenance.
4. 3-year cloud hosting management.


Content Provider
Vendor (SRDL Contractors)
Philanthropic NGO
Educational Institutions
Individual Educators
Repository Platform
API
Web ui
Application(windows, mac,android,ios,linux)
Content Users
Student
Teacher
Parents
Institutions

Project PIU contracted Digital Content vendor's content upload process:



What is a digital content book in this project?

A digital content book is a fixed-layout digital book. The look and feel of the book are like the original NCTB-published book. In addition, the book can be interpreted in many ways such as searching and browsing or selecting texts and illustrations, or zooming, moving, and arranging text and illustrations. Most importantly, the book consists of additional explanatory digital content such as super-resolution images, interactive images, audio, video, 3d, simulation, etc.

1. Each book is directly converted from the NCTB books. The pages are images.
2. Each book will be a zip archive and will have the following files folders

- Book name
  - Index file
  - Folder for Each page
    - Page image
    - Page annotation text file
    - Self-assessment file

- Self-assessment resource folder
- Page Resource folder
  - Digital content sub folders
    - Index and meta information of the digital content
    - Digital contents files (video, image, 3d, html, javascript, css) May organize into

3. Page annotation files: Each page image is separately annonated with text word, line paragraphs, image, question area. Etc. The annotation text file has following information:

- What: word, line, para, image, digital content link
- Whare: the pixel position and shape
- Parent: word<line< para
- Content: text or image description
- Digital Content link: resource link of digital content if any
- Placeholder: none, icon, text, etc.

4. Index file
   - Consist of book meta data
     - Book title, editor, Author, publisher, chapter
     - Index of illustration
     - Index of digital contents
   - Consist of the index of page annotation files and image files
   - Consist of the index of self-assessment files

5. Self-assessment files
   - Self-assessment files are organized into assessment types such as quizzes, fill-in-the-blank, correct alignment, etc.
   - Assessment questions and answer
   - Where to place them: page number, pixel position, icon

6. Digital content files

- Digital content could consist of one or several files and subfolders.
- Used file formats for digital content resources
  - 3d: VRML/X3D, obj, fbx (each in all 3 formats)
  - Images: jpg, png, tiff (4k/6k, 2k, hd, and low resolution) (files in all combinations)
  - Interactive images: interaction must be made using html5, css3, and pure javascript
  - Vector image: SVG
  - Video: mp4, webM, MOV (each in all 3 formats)
  - Audio: mp3, aac, wav (each in all 3 formats)
  - Simulation: html5, css3, pure javascript, and library framework should be bundled
  - Games: any framework but compiled for web, android, ios, mac, windows, Linux

2. Scope of works

2.1. System Scope

The vendor will be required to complete the development and deployment of Digital Content Repository System for this division as an application following the SDLC methodology and perform the relevant activities accordingly within a proposed stipulated time.

This system's implementation project can be divided into 4 major phases which are described hereunder.

2.2. Phase-I: Requirement Analysis & Design

This is the starting phase, in this phase project plan, requirement fixation & high-level design will be completed for the entire project. The entire functional scope that will be finalized in the "System Requirement Analysis & Design" phase may be divided into separate independent multiple packages. Each package may contain a number of components, modules and features based on the implementation priority, dependency, and integration complexity. This entire system must be designed and developed following micro service architecture so that inter dependencies and integration functions among the modules and features of different components of multiple packages will be smooth but very organized.

1. Arrange workshops
2. Do individual stakeholder interview
3. Deliver draft report
4. Get final approval with the signature of the Project Director

2.3. Phase-II: Development & Release:

Each package's components/modules and features will be developed and released in an iterative methodology with predefined steps passed LLD, development, Integration , and Testing. After the successful completion of this package development as per the predefined expected standard and result only this iteration cycle will be completed and will release the developed and tested application as Beta version of this package.

2.4. Phase-III: UAT and Deployment:

After releasing the packages developed and tested application as Beta Version, this will enter the phase i.e. UAT and Deployment. In this phase, the actual user feedback and review will be taken and finally, the application will be accepted by the User Authority after passing certain tests. Then the required training as per the predefined training plan will be provided and also after taking necessary measures, the deployment will be done successfully to make this application LIVE as per the plan that will be prepared in the Project Management plan at the inception phase.

2.5. Phase-IV: Pilot & Maintenance

After the final deployment and going live with the acceptance of implementing organization, the piloting implementation and maintenance support service will be started at this phase pilot implementation will be conducted for a certain period with close intervention, caring & support of the vendor. After the expiration of the piloting period, this maintenance support service will be continued as per the agreement.

3. Content Repository Platform Portal Requirements

3.1.1 Web platform:

The Web Platform has the following user functional requirements of but not limited to:

- System Admins
  - Manage user and Permissions
  - Configure system
  - Manage user experience
  - Content moderation
    - Create moderator pool
    - Set user privilege for auto-approved or moderated content upload
- Content moderator
  - Self-registration
  - Can approve, reject, pause, and unpublish content.
  - Can suspend user
  - Can remove user comments
- Content Provider (Vendor, NGO, Institutions, Individual Educators)
  - Self Registration and verifications
  - Content upload
    - Can upload various content files including but not limited to various audio, video, text, 3d scene, javascript, html, CSS file format
    - Can upload teaching assistance assets such as icons, images, videos, 3d
    - Users (content vendors contracted by SRDL PIU) can upload HTML, CSS, and JavaScript formatted books including digital assets for online and offline viewing
  - Describing the content including but not limited to
    - Description
    - Category and subcategories
    - Relevance tagging
    - Authorship
    - Publisher
    - Etc.
  - Upload fixed self-assessment of learning of the user for the content such as quiz, fill in the blank, correct arrangement, etc.

- Create Course
  - Describe course
    - Description, categories, tagging, authorship, publisher
  - List contents (inside the repository)
  - List suggested external contents/readings
- View user usage statistics including but not limited to
  - By User's type, location, and usage type
- User interaction
  - View Rating (scale of 0 to 5) statistics
  - Switch on/off User comments and answer
  - Flag user

- General User
  - User Registration
    - Self-verification
    - Update information (including but not limited to):
      - Biodata
      - Education
      - Likes
      - Interest
      - Skills
    - Recover account
    - Set privacy
  - View contents
    - Content adjusts to the user's device and speed
    - The user gets content, course, and content list recommendations.
      - Machine learning-based hybrid user recommendation.
      - The system periodically runs training for updating the learned weight for better recommendations.
  - Download contents
  - Interact
    - Users can rate content on a scale of (0 to 5)
    - Users can comment
    - Suggest content descriptions.
    - Flag content with reason
    - Keep personal note
    - Users can take self-assessment
  - User personal list
    - Create and modify personal list
    - Add content to the list.
      - A general function wherever content thumbnails or content is in view to the user
  - General Text Search
    - Filter searched content
    - Sort searched content

  - Browse and Filter content

- Student
  - Has all the functions of a general user
  - Can subscribe to a specific teacher and his/her suggested contents
  - Can be enrolled in specific courses.
- Teacher
  - Has all the functions of a general user
  - Create course
    - Suggest reading for the course
    - Upload assessment questions such as quizzes, fill in the blank, correct arrangement, text answers, etc.
      - The questions can be a time limit or any duration.
      - The questions can be set to within the date and time.
      - The questions can be set to be answered by anyone or a specific group of students.
  - Create, admit, and Arrange student group

Key Features:

- User Management (Teacher, Students, Guardians, Respective Authorities)
- Role Management
- Content Management
  - Content Approval Workflow/ Approval Management
  - Content Dashboard
  - Content Download & Usage Report
  - Automatic cataloging
  - Content version control
  - Content event log history
- Content View
  - Role-based
  - Content Viewer
  - Multi-criteria advanced search features based on contents, boxes, or location reference.
  - Content Ranking, Review & Feedback Management
- Customizable dashboard
- Log Management
- Integrations with different Systems
- Multi-level permissions and security
- Indexing & Optimization/ Verification Management

SN	Requirement
1.	Ability to upload specially formatted html flipbook in multiple zip file archives.
2.	Ability to provide user-defined indexes for easy search and retrieval of files. The text search has to be implemented with Apache Lucene.
3.	Ability to filter search results based on including but not limited to type, duration, author, uploader, etc.
4.	Ability to provide for filing and indexing of documents for quick retrieval
5.	Ability to provide the facility to add keywords with documents to act as a quick reference for the documents
6.	Ability to Support bulk uploading with indexing or import from other applications
7.	Ability to support web interface for viewing image documents
8.	Ability to facilitate zoom-in/zoom-out, zoom percentage and Zoom lens to zoom in on a part of an image and other image operations like Invert, rotate etc.
9.	Ability to support Thumbnails on image documents and viewing of the same.
10.	Ability Upon completion of search, immediately to display all selected images and support quick navigation through documents.
11.	The system shall support the definition of Users, Groups and Roles relation in the system
12.	The system shall support access permissions on Folders, documents, and object level
13.	The system shall support multiple levels of access rights (Delete/ Edit/ View/ Print/ Download)
14.	The system shall support system privileges like Create/Delete Users, Defining indexes etc.
15.	The system shall support secure login id and passwords for each user and passwords shall be stored in encrypted format in database
16.	The system shall support extensive password validations like passwords must be of minimum 8 characters, shall be alphanumeric, locking of user-id after three unsuccessful attempts, password expiry, password history so that passwords are not same as previous passwords etc.
17.	The system shall support Disaster recovery by replicating the data at remote locations

18.	The system shall support provide support for HTTP/SSL for secure data transfer
19.	The system shall provide an integration facility with another platform and shall support single sign-on
20.	The system shall support Extensive Audit-trails at document, Folder, and highest levels for each action done by a particular user with the user name, date, and time
21.	Support for rule and roles-based rights
22.	Support for rights on administrative reports
23.	Ability to generate security-related reports such as document uploading, downloading printing, etc.
24.	Ability to provide item-wise permission if required
25.	Ability to restrict document viewing, printing, downloading, etc.
26.	The system shall support web-based administration modules for the complete management of the system.
27.	The admin module shall provide easy to use interface for Index structure definition, that can be used by different users
28.	The admin module shall provide an interface for purging old audit trails and do selective logging i.e. select the system or application features for which the audit trails have to be generated.
29.	The solution should be able to manage the retention of the document base on the index
30.	The system should have the feature to restrict admin from unauthorized changes in the system. This feature needs to be flexible and can be enabled based on organization policy.
	Version Control
31.	Ability to manage version control of documents including check-in, check-out, view history, view the latest version, write version comments, etc.
	Book
32.	The system can process single or multiple zip file archives for indexing and assembling each flip book prepared by content vendors contracted by SRDL project.

33.	The web platform can show flipbooks online. For example https://www.mozaweb.com/mozabook The online book viewer is expected to dynamically show books as per the definition uploaded in requirement 1. The book viewer must be able to show the book images, 3d, video, audio, and other resources. The individual resources viewer must have standard features for controlling the resources.
34.	The web platform can index the flipbook content in such a way that it can later view in desktop and mobile apps natively(not as web view).
35.	The system can generate high, medium, and low-resolution versions of book pages
36.	The system can index the flip book digital content using metadata for searching and inserting in the user teaching screen by the app
37.	The system will check for viruses or security threats before publishing the contents using CalmAV demon

3.1.2 User Application

The user can access the content platform contents with a native application installed on the user's device. In the application, users e.g. general users, student users, teacher users, and moderators will have the same functionality as in the web portal stated in 3.1.1. In addition, the user will have features to use content offline for teaching as well as studying. The application will be native-built and compiled e.g. exe for Windows. The vendor may develop cross-platform desktop and mobile apps using a single code base (for example .net multi-platform framework). The app will be developed for Android, IoS, Windows, Mac, and Linux.

In addition to user functions stated in 3.1.1 web platform, the following are the functions and features of the user application:

- Download contents
    - User Can make a download queue
        - Add or remove from the queue
        - Remove from the file system
    - The User can set download priority and auto-update
    - The User can select an individual or list of contents
- Teaching
    - painting
        - The user can paint on an empty canvas
        - The user can create a canvas for painting over the content and move to new content
        - Users can take snapshots of the onscreen and paint over the image
        - The user can type on screen in an overly-text-box

- Users can draw and manipulate vector shapes like rectangles, circles, polygons, straight lines, bezier curves, bezier curve shapes, etc.
- User can convert vector shape to pixels
- Users can Erase, delete, select, multiple object color change, set transparency, select different brush styles and sizes, insert different shapes, insert different icons from a library.
- Users can select different brushes and transparency for both drawing and erasing.
- Object selection should be including but not be limited to color key, drawing free selection boundary, drawing selection shapes like circles or rectangles or polygons, clicking on an object, progressive
- Move and resize the color shapes, icons, and painted objects
- Users can clone pixel and vector shapes, icons, and painted objects
- Users can apply common photo filters like grayscale, blur, contrast, brightness, and saturation to selected pixels
- Users can type and manipulate text
    - Users can do common typographic formatting tasks such as bold, italic, underline, color, font, font size, etc.
    - Users can convert text to pixels
- Users can put any pixels and vector shape in different layers
- Users can align pixel objects and vector shapes like left, right, middle, vertical, horizontal, equal space, etc.
- Users can insert choose a variable number of image objects, shapes, and icons between two or more points
- Users can variable number of repeated copy pixels or vector shapes between two or more points
- Users can undo and redo their actions
- Users can keep/save personal painted canvas
    - The user can make the saved personal paintings public or private

o Textbook

- page turn animation.
- Users can move forward and back pages or chapters
- Users can go back to the index page and move to any items from the index
- Users can go to any page number
- Users can print pages
- Users can click on linked items to open and view digital content
    - An interactive image, video, audio, 3d scene, web technology-based simulations (HTML, CSS, javascript)
    - The linked item should be indicated
- Users can select single or multiple text items on a page and zoom into the items
- Users can draw bounding shapes to indicate items to be selected on the page.
    - Users can zoom into the area of the selected item all at once
    - Users can arrange the selected items to the edge of the screen and click one by one to zoom in on the center or on empty space.
- Users can click and drag items to the screen edge or somewhere on the screen.

The system should automatically fill pixels in the void.
- Users can select image items and zoom into the items
- Users can paint with all paint features on the page and zoomed items
- Users can view, play and interact with digital content embedded in the book page
    - An interactive image, video, audio, 3d scene, web technology-based simulations (HTML, CSS, javascript)
- On every book, page user can bookmark, keep notes, keep additional digital assets/content, keep painted screens or images
    - Additional assets can be linked or offline
    - Users can generate personal indexes based on bookmarks, notes, assets, personal images
- The user can animate into details if available and

- Other requirements:
    - The system can understand touchscreen gestures such as zoom-in, zoom-out, move, remove, etc.
    - The system can utilize any graphics tablet's standard abilities.
    - The system can do Filip animation for turning pages.
    - All animation has to be smooth and antialiased
    - The user can have multiple devices and set sync settings that include but are not limited to personal paintings, bookmarks,

Note: the administrative functions are not a requirement for apps.

3.1.3 System Requirements Description

The vendor is requested to submit a **"System Requirements Description (Ref. Doc-1)"** covering the detailed functional scope to be covered in this project. In the proposal, the vendor may add other relevant functionally described features if they find it relevant.

Apart from this, the interested vendor should analyze the other scopes which are relevant to the areas covered above and should propose the best possible and comprehensive ICT solutions in their technical proposal. The ultimate modules and features of the proposed system will be finalized at the requirement study and analysis phase of SDLC based on the client's actual requirement, acceptance, and vendor's best proposal/solutions relevant to the above-mentioned area and scope.

3.1. Solution Architecture

Solution architecture plays a useful role in the initial stage of understanding the solution ideation, solution design, and solution implementation plan. Here the solution architecture is expected to establish a complete understanding of the business context .i.e Service delivery and receiving process in digital form, the vision, objectives, and ultimate requirements of this

solution for the proposed application.

This architecture should define the process of developing and documenting covering the context of the proposed system solution including all impactful and applicable architecture domains such as the Micro-Service approach, accessibility, business, data, application, technology, integration, cross-cutting issues like security, management operation, etc. The solution architecture will elaborate and further decompose the target architecture into architecture deliverables for each architecture domain. The vendor shall submit a **"Comprehensive Solution Architecture (Ref. Doc- 2)"** in their technical proposal which may include business architecture, information architecture, application architecture, and technology architecture focusing on the scope mentioned in this TOR.

Understanding the context, objective, and functional scope of this proposed system. The vendor is expected to submit a comprehensive "**System User Management Plan (Ref. Doc-3)"** in the technical proposal which should include or cover categorization of major users, accessibility, authentication, authorization, and overall management for the solution.

Vendors should submit a comprehensive plan and approach covering different types of users and their roles providing accessibility, privacy, confidentiality, and transparency based on the given statics. Also, have to mention the user-friendliness login system.

4. SDLC Approaches & Methodology

Considering the current context of digital government implementation of Bangladesh, we've proposed hereunder a tailored SDLC methodology for the development of this eService solution. Under the scope of this SDLC methodology, for effective, efficient, timely and fruitful development of this system and achieving early release as a tangible result, the scope of this project can be divided into multiple packages (components & modules) based on priority and dependency of the modules and features to be developed and released. At the project inception phase, the package components/modules will be defined by the concerned authority (implementing agency) discussing with the vendor.

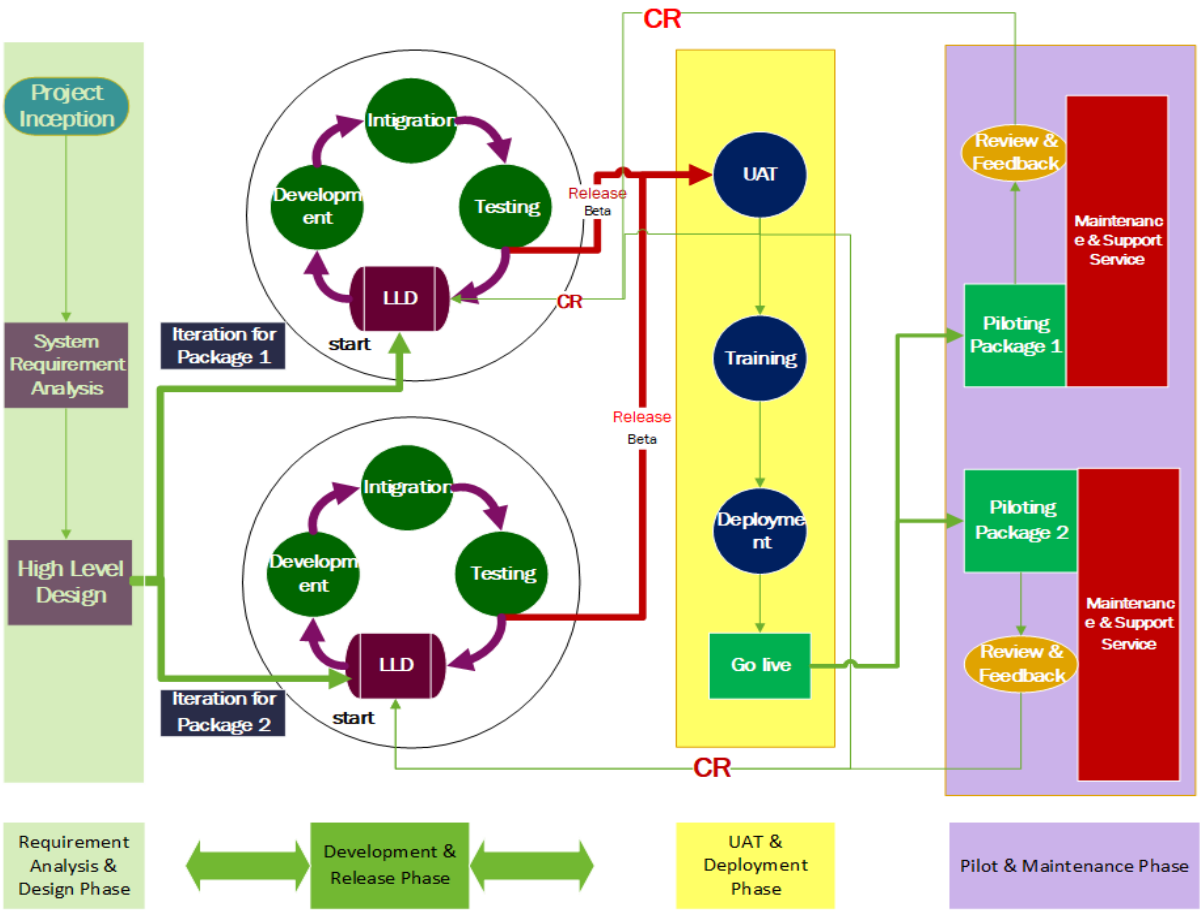


Figure: Hybrid SDLC Methodology

The methodology covers the following phases:

4.1. Phase-1: System Analysis & Design

4.1.1. Project Inception:

The SDLC process will be started from this phase. The project will be initiated with a kick-off meeting between the vendor, implementing agency & relevant stakeholders. At this phase, the entire project scope mentioned in TOR will be briefed and discussed extensively, the package boundaries will be defined, preliminary project implementation timeline, project management plan format & content structure will be discussed. At the end of this phase, the vendor will submit a comprehensive and detailed project management plan for the client's approval with a PowerPoint presentation and submit a hard copy of the documents. On receipt of approval of the project management plan, only the phase will move to **Phase 2**.

Deliverables: Approved Project Management Plan

4.1.2. System Requirement Analysis:

The vendor will initiate the project with this phase which includes requirement finalization for the entire (all the packages) project scope from a functional aspect.

Proposed system requirement study, analysis and finalization is a very important phase in the entire SDLC. It is expected that the selected vendor will carry out a detailed requirement study and analysis on every scope of the system that is mentioned in the TOR. Under this scope of work, the selected vendor has to analyze the detailed functions, processes, documents, actors, service delivery sites, and infrastructure of the relevant services precisely of the concerned organization. At this phase, the vendor's ultimate objective will be the finalization of the system requirements in detail under the scope of TOR and receiving approval from the concerned organizational authority. Here vendor is requested to propose and submit a software requirement analysis plan which should cover the relevant activities to be performed, the required timeline, specific deliverables to be produced, and determine dependencies and resources to be used.

Deliverables: Software Requirement Specification (SRS) and UI-based non-functional prototype/ Mock.

4.1.3. High-level System Design (HLD):

The phase-2 is entirely dependent on phase-1 deliverables which will only be initiated after the completion of Phase 1.

The scope of the high-level design phase will be based on the entire project's (all packages) approved SRS. However, the HLD document (if required) can be updated based on the changes of SRS i.e. version changed of SRS on received CR.

Here, a high-level design will ensure the architecture that would be used for developing this system solution. The architecture diagram will provide an overview of an entire system, identifying the main components that would be developed for the system and their interfaces.

The ultimate deliverables of this design will be a high-level design document or HLDD which adds the necessary details to the current project description to represent a standard model for coding. This document includes a high-level architecture diagram depicting the structure of the system, such as the database architecture, application architecture (layers), application flow (navigation), security architecture, technology architecture, and integration blueprint.

Deliverables: High-level design document or HLDD.

4.2. Phase-2: Development & Release:

Based on the priority, importance, and dependency, the project scope will be divided into multiple Packages as per organizational consideration and decision. Each Package will be completed through an iteration. The iteration process may follow the scrum process with several sprints of Agile Methodology. The iteration includes several steps such as LLD (Low

Level Design), Development, Integration, Testing, Review and Release. For detailed clarification the "Iteration 1" steps for Package 1 are described below:

4.2.1. Iteration 1 for Package 1:

Low-level design (LLD) is a component-level design process in which the actual software components, modules, and functional requirements are designed. This process can be used for designing data structures, required software architecture, source code, and ultimately performance algorithms. The vendor will have to submit a report on LLD based on which development will be started.

Deliverables: Package1 LLDD version 1.0

4.2.2. Development:

At the development stage based on the LLDD, a development team will be mobilized that will start the coding process following the standard code convention, code level documentation, header of each file, algorithms, interfaces, code compression, and APIs should be supplied with proper description within the given schedule as per the plan. The team will strictly follow the standard procedure of version control of the codebase, database, and related files using stable version control tools. The vendor will use standard project management tools to manage and track issues as well as monitor development progress. The client (Govt.) or client-nominated representative/product owners need to have access and control to the version control system and project management tools to manage and monitor the development process.

Deliverables: Developed features/modules/components/applications, code documentation, algorithm & interface related documents, development & versioning report, Test-driven development (TDD) approach should be included at this stage to ensure smooth development etc.

4.2.3. Integration

Considering the Integration requirements and scopes defined in the SRS, HLDD & LLDD for this application, the vendor must perform the planned integration activities. At this stage, the vendor will perform all necessary above-mentioned tasks & follow guidelines regarding integration to make the system application interoperable.

Deliverables: Integration testing reports, Integration activity report

4.2.4. Testing

The software testing process is one of the most vital phases through which it will be expected to evaluate every functionality of the proposed software application with an intent

to find whether the developed application's functional features meet the specified requirements or not.

The vendor should prepare an extensive testing plan so that any functional failure can be detected and corrected timely and proper. The scope of the software testing should include the examination of code as well as the execution of the code in various environments and conditions as well as examining the aspects of the code; does it do what is required?

The vendor must propose a comprehensive testing plan in their technical proposal for these applications starting from development to deployment that is covered in the full test life cycle. This testing plan should cover all the standard testing approaches applicable for this system solution which may include phase-wise testing activities like test scripting, test cases, testing tools, testing process, test log, result and report formats i.e. expected test deliverables. The vendor should submit testing plan which may include standard test approaches. Some are mentioned below as examples for reference.

1. Unit Test
2. Installation testing
3. Compatibility testing
4. Smoke and sanity testing
5. Regression testing
6. Stress Testing
7. Acceptance testing
8. Alpha testing
9. Beta testing
10. Functional vs. non-functional testing
11. Continuous testing
12. Destructive testing
13. Software performance testing
14. Usability testing
15. Accessibility testing
16. Security testing
17. Concurrent testing
18. System testing
19. Integration testing
20. Performance testing.

The Vendor must use automated Static Application Security Testing (SAST) and clean code tools beginning from the development phase. The vendor must resolved every issue raised by the tools. However, regarding the false positive by the SAST and clean code tool the vendor must provide a report with a detailed explanation. The project authority will use the tool report to the vendor's compliance with quality and security requirements.

The vendor must use AI-enabled testing tools for testing development from the early stages of development.

Deliverables: Test Plan, Test Scripts, Test Logs, Test Reports, Feedback.

Note: Based on the Test reports and received feedback (Change Request) the LLD, version, and developed application may be changed accordingly.

4.2.5. Release:

After the successful completion of "iteration 1" which is predefined, successive steps will be executed properly with expected quality, the developed application will be released as a Beta version considered to be deliverable of this iteration. In case of unsatisfactory testing reports, the iteration will be continued accordingly without any release.

The vendor must use the Dynamic application security testing (DAST) tool before and after the beta release.

Deliverables: Released application (Package 1) with versioning

4.2.6. Next Iteration:

For another package i.e. another same iteration may be started based on the mobilized team's availability and mobilization plan.

4.3. Phase-3: UAT & System Deployment

As soon as one iteration releases any developed application after completing the predefined steps and processes, this released version will be entered into this immediate phase i.e. UAT and System Deployment. The basic objective of this phase is to receive user feedback, adjust them, take final consent or acceptance of the user, and ensure system testing for deployment, training, and taking final deployment actions to GO LIVE. Here to be noted that before entering this phase no iteration release should contain any flags and issues raised by SAST, clean code, or DAST tools.

There may be 3 major steps involved in this phase which are described hereunder:

4.3.1. User Acceptance Test (UAT):

Just after the release from an iteration as BETA version, developed application will enter into this UAT Process. At this step, the system will be tested by the users of different levels extensively to receive their precise feedback and review. Based on the received feedback and review, the process may lead to the previous state i.e. may enter into the previous iteration again with a defined CR to adjust. Finally, when the user's valuable feedback and review will be addressed, this application will be ready for User Acceptance. This step will end with the user acceptance for the BETA version to move forward.

Deliverable: Accepted application (With version) and UAT Report

4.3.2. User Training:

After completion of the UAT, at this step, User training will be required to be provided as per a predefined project management plan and timeline. User training has to be very extensive and detailed so that users of each level will receive this training and will be capable to operate and run this system without any major technical dependencies.

Deliverables**:** Training Manual, Training Plan, Training Feedback, Training Report

4.3.3. Deployment

Deployment is a very important step in the SDLC before going LIVE where different types of necessary and standardized activities should be performed as per predefined plan. The deployment plan should be prepared in a comprehensive manner choosing the appropriate deployment method and the right deployment checklist. Automating the deployment process as much as possible is a wise decision at this step. Adopting continuous delivery and using an integration server is necessary. Deployment preparation also may include another code deploying entering version release notes, checking that the required server is running smoothly, and configuring the staging environment properly. At this step, various testing processes should be performed as a part of the obvious process. The deployment test plan and method should be chosen well ahead. This may include deploying the update to the test environment, running each test code/script and reviewing results. Finally, this deployment process may continue with copying the updates to the production environment, running any necessary scripts, setting changes for live and testing on the live server before going LIVE.

4.3.4. Go Live:

Successful deployment of any developed and tested application will lead finally to the "GO LIVE" state. The inauguration of the application may take place immediately when it enters into this stage. As inauguration is the formal session to expose or open the application to the end users/citizen, therefore proper consent of the concerned implementation Organization/Agency is required before going LIVE.

4.4. Phase-4: Piloting & Maintenance

It may be stated that the pilot phase will be started immediately with the starting of "GO LIVE" which should last a maximum of 3-6 months based on the decision of the

implementing Agency/Organization and predefined accepted pilot implementation plan. The vendor will provide all necessary support to ensure smooth operation in the pilot phase. It may be mentioned here that, some change requests (CR) based on the end users' review and feedback at this piloting stage may be required to be accepted and CRs will be adjusted through a predefined development cycle. Obviously, at this stage, those CRs must be considered aligned to the Terms of Reference (ToR) of the assignment avoiding major functional changes that may create alternation in architecture, database structure, and development complexity. In this case, CRs related to UI and UX, frontend scripting, and content presentation level may be accepted. In this piloting phase, technical support, continuous training, timely reporting, receiving end-user feedback, and measuring the overall performance of the application are the important factors that should be taken care of by the vendor at this stage.

4.4.1. Maintenance & Support:

The maintenance phase will be started in this SDLC methodology. This phase is very important because the actual maintenance support service will be started by the vendor and the implementing organization will also take measures for scale-up implementation of this software based on the result of the pilot. Those two important issues of this methodology are described hereunder:

In the case of software implementation, especially for the e-government, maintenance support service plays a very vital role. The vendor needs to provide this maintenance support service as per the predefined plan and action which will be approved by the implementing organization at the inception phase under the project management plan. During this maintenance phase, the main objective will be ensuring this application operation is running smoothly, uninterruptedly, and without any hassle or complexity. Some factors mentioned below are very important at the time of maintenance support service by the vendor.

1. The developed and deployed application should run smoothly and bug freely.
2. In case of any technical problem or support requirement, the vendor’s response for the solution has to be very prompt.
3. Based on the type of technical complexity and support requirement, the response and problem solution plan has to be predefined and precise through a signed SLA.
4. The vendor must consider a contingency plan to manage and solve sudden complexity, technical problems that arose, and support requests.
5. The help desk remote support should be comprehensive, strong, standard, and adequate.
6. Improving user engagement, user training, and receiving user reviews & feedback should be considered in the maintenance support plan.
7. Communication, software performance evaluation, continuous improvement for user satisfaction, and right-time reporting to the concerned authority should be planned well ahead and executed at the same time as standard service.

Based on the analysis of the impact of piloting phases and adjusting the plan, scale-up implementation has to be done. In this case, the vendor will provide proper guidelines and different kinds of planning support to the organization so that the implementing organization can complete the scale-up successfully

Deliverables: Support and Maintenance Plan, SLA, Running Digital Service

Note: The above-mentioned hybrid methodology is proposed based on the e-Government Application/Digital Service implementation context, priorities, dependencies and challenges. This hybrid methodology has been proposed here customizing a few popular SDLC methodologies like Agile Scrum, etc. Understanding the scope of the project and other important context and factors, the vendor may follow this proposed hybrid methodology, or may customize it as per necessity, or may propose any other different SDLC methodology with proper justifications in their technical proposal. The project implementation time plan /schedule should be proposed in the technical proposal completely based on the chosen SDLC methodology by the vendor.

But the vendor is requested to describe the **"SDLC Methodology (Ref. Doc- 4)"** for this project in detail in their technical proposal covering the following

1. Diagrammatic representation of the proposed SDLC showing the phases, methods, processes, flow, steps, deliverables, etc.
2. Proper justification/rationality for choosing the SDLC and context/factors considered in choosing the same. The advantages of this SDLC should be stated very clearly and precisely in respective of this project scope/context.
3. Detailed activities/tasks and description of every phase /step which will be performed under the scope of this SDLC for this project like Inception, Requirement analysis, Design, Testing, Development, Deployment, etc. This description of each phase/step should also include the purpose, deliverables/documentation, and dependencies of this SDLC.
4. The probable risk, challenges, and threats of this SDLC that the vendor is assuming

5. Non-Functional Requirements

5.1. Application Compliance Requirements

- The vendor must use standard design patterns for architecture and developing code.

5.2. Web Application

1. The application which is a web-based solution, should be hosted in a centralized Web-server
2. The application should be developed following Service Oriented Architecture (SOA)

3. The application should support the MVC framework.
4. Considering the operating/client environment at different levels of this application, it should be developed in such a way that it requires low bandwidth to run.
5. The web-based application should support cross-browser platforms (popular web-browsers such Mozilla Firefox, Opera, Chrome, Internet Explorer, Safari etc.)
6. The application should have the ability to seamless integration with future module/components / applications
7. The application should be lightweight and rich client-side scripting
8. UI should be developed based on the analysis of UX.
9. Any web interface of this application should be fully responsive
10. The database has to be pluggable into MySQL, SQL server, and Oracle, with factory pattern.
11. The vendor must use layered architecture for separating data access, business logic, and presentation.

5.3. Mobile and desktop Application Requirements

1. The user application has to be developed for native compilation for android, iOS, mac, windows, and Linux.
2. A single code base for multiple OS is preferred for example .net multiframework. However, the developer may agree with the project PIU for multiple codebases for technical reasons.
3. The applications should be integrated tightly with the web platform through REST API. However, the applications must be able to function when no internet connection is available to the user.
4. There should be an option to auto-synchronize with the web platform with the app's local data on the availability of Internet connectivity.

5.4. Coding Conventions

The vendor must follow the standard coding styles to produce high-quality code for further usage of the code in terms of reusability, refactoring, task automation, language factors etc. The vendor should submit a standard coding convention approach, which may include different conventions like commenting, indent style, naming etc. following the best coding practices.

- The vendor must use a clean code tool integrated with development IDE from the early stages of development.

Note: A comprehensive "**List of Standards (Ref. Doc- 05)"** based on the latest technology to be complied with for web and mobile platforms regarding this eService solution development and operation will be preferred in the vendor's technical proposal.

5.5. Integration Requirements

As a government system or system application, integration with the required and other prescribed national systems is very important and essential. Only by proper integration and interoperability, a system application can drive the ultimate citizen benefits with the optimum use of technology from manual to digital transformation. Here, the vendor should come up with an integration plan in their technical proposal considering and understanding the scope of the system application as per this TOR. The possible integration scopes of this system application are mentioned below as a reference for the vendor

SL	Name of System to be Integrated/Scope of Integration	Purpose of Integration	Organization
01.	SMS Gateway Integration	Notification to Authorized Users.	Telecom Operator

To establish an integrated digital government and ensure interoperability among the e-government/eServices of Bangladesh, integration is one of the key factors which should be considered as a topmost priority. The proposed eService solution must comply with all national e-Government standards which are prescribed by the BNDA (Bangladesh National Digital Architecture) or any relevant and authorized government authority. Only an integrated and interoperable e-government/eService solution can fulfill the ultimate objectives of digitalization with the optimum use of the latest and standard ICT.

The vendor can follow standard integration mechanism such as exposing standard Restful APIs for the service process in different components so that any component or service can exchange data and related resources it is required by satisfying the Govt. Agency's business purposes. The digital services should be able to exchange data with other digital systems within the particular Govt. agency as well as with inter-agency solutions. So, the vendor will develop a standard API manager following international standard so that the data sharing can happen efficiently and standard securities will be maintained smoothly. The digital solution must address the stated interoperability and integration issues of the agency for systems' sustainability and end-to-end digitalization issues which is the ultimate goal of digital transformation.

Based on the consent and approval of implementing organization (concerned authority) at system requirement analysis phase of software development, vendor may follow customized integration framework complying BNDA guidelines, published e-

government policies & acts and international standards/conventions for minimizing system's operational dependencies and strengthening sustainability.

The vendor is requested to submit an **"Integration Plan (Ref. Doc- 06)"** in their technical proposal for this eService solution covering the functional, technological, business, strategic, implementation, dependencies and activity related aspects.

5.6. Hosting Requirements

The vendor will arrange a hosting environment for the system. The vendor must arrange an appropriate number of hosting servers, resources, load balancers, caching, enterprise database servers, and storage for the smooth delivery of the service to the user. The vendor must get hosting service from a market leader in cloud hosting according to Gartner magic quadrant or Forrester Wave leader as of the latest report

However, during the service time, the vendor must provide the following minimum but not limited to at any given time:

- Hosting Service with Domain
- SSL Certificate
- Minimum 3 vm with 8 vcpu and 28 gb ram.
- Minimum 5TB blob storage
- Enterprise Database server

5.7. Security and Privacy Requirements

The vendor should submit an extensive **"Security and Privacy Plan (Ref. Doc- 08)"** including comprehensive security architectures in their technical proposal for this proposed system application considering the following issues:

1. Project technical scopes
2. Functional and nonfunctional requirements and ultimate objectives
3. Concerned service provider organization's operational environments and capacity
4. User roles - Accessibility, Authentication, Authorization and Accountability
5. Importance of data management & data privacy
6. Strength of technologies to be used for development, operate & maintenance
7. Deployment & hosting
8. Service recipients and providers' security, confidentiality, and privacy
9. A checklist of security measures to be taken for this solution
10. Overall security standards should apply to an e-government system.

Apart from these, the vendor should keep in account the following considerations as well as vendor should provide a checklist based on system and hosting security plan (i.e. fraud, hacking, money laundering etc.) & the test report of that checklist.

5.7.1. System Security Requirements (But not limited to)

1. The following vulnerabilities must be checked and ensured security found in CWE (common weakness enumeration) database.
2. The vendor must use automated SAST and DAST tools for checking and resolving security vulnerabilities in all stages of development. The automated tools report will be critical for evaluating applications security by project PIU.
3. The vendor should follow any of the industry standards secured development methodologies such as (but not limited to) Comprehensive Lightweight Application Security Process (CLASP) by OWASP etc.
4. The vendor should consider (but not limited to) common vulnerabilities such as SQL Injection, Cross Site Scripting (XSS) etc.
5. Vendor will undertake responsibility for Input Validation Controls, Authorization/Authentication Controls and other security controls in place in both the testing and production environment of the application.
6. The following vulnerabilities must be checked and ensured security:
    a. Cross Site Request Forgery (CRSF)
    b. Cross Site Scripting (XSS)
    c. Session hi-jacking
    d. Session Fixation
    e. SQL Injection and Code Injection
    f. Input Validation/Filtering
    g. Output Escaping
    h. Secure File Access
7. The vendor shall minimally provide Access control, Authentication and accountability security mechanisms for backend operations of the System.
8. The proposed security solution shall be scalable and should not affect the performance by creating a bottleneck or single point of failure to the overall system.
9. The system should provide tamper-proof audit trails and logs for administrator or auditor to check for the actions committed by users. The audit trails shall consist of following details but not limited to:
    a. Login and logout
    b. Attempts to access unauthorized resources
    c. User profile changes
    d. Past audit events.
    e. Track all actions performed on documents attached/uploaded.
    f. The system should have provision to assign the access rights of other resources on need basis to authorized users.
    g. Information in the System that is deemed to be sensitive shall be encrypted and protected from accidental and/or unauthorized modification.
    h. The System shall provide automatic session disconnection for inactive user after session time [Proposed best practice session time] is over.
    i. The system shall protect the audit trails from being modified by unauthorized personnel or privileged users.

5.8. Sizing, Performance and Scalability Requirements

1. The system shall be capable of handling online functionalities for a database of service recipients from 30% of all school teachers and students within Bangladesh.
2. The system processing shall be scalable to support the volume estimates for a period of 10 years at a 20% annual growth rate.
3. The system shall be designed to handle an estimated Medium Scale: 500, simultaneous connections (online users) when it is ultimately rolled out.
4. The vendor must conduct an extensive load testing task considering the above factors and submit load testing results.
5. The database architecture should be such that the system is available to users 24x7x365 days a year without any unapproved downtime.
6. Page load time, login response time, and on-click load time for the web application should be less than 3 seconds while this is accessed over the intranet.
7. Average transaction response time, on-submit response-time, or any other database access/ search time should be less than 5 seconds when the system solution is accessed over the intranet.
8. Considering the network infrastructure challenges in Bangladesh, the solution must support low bandwidth conditions for the services defined in the functional requirements.
9. In the case of mobile applications also, this should support very low bandwidth even in 2G network provided internet bandwidth.
10. The proposed solution should be highly scalable to accommodate current and future requirements within the scope of the scope mentioned in the TOR
11. Analyze the requirements of whether both horizontal scaling (scale-up) and vertical scaling (scale-up) will be required for this system application or not.
12. The system application should be provided with an appropriate caching mechanism to handle very high-traffic scalability
13. The vendor may propose here other relevant measures for the system application scalability.

Note: The vendor should submit a **"Strategic & Action Plan for System Optimization (Ref. Doc- 09)"** including the method of sizing, mechanism and measures that will be taken for ensuring the standard of performance mentioning proposed system's functional process and completion of standard time and scalability of this eService solution

5.9. Interoperability and Data Exchange

The selected vendor must develop this system system following all the standards and protocols of interoperability, integration and data exchange with other systems. It is expected

that the system will be based on open architecture and will be fully interoperable with current and future systems.

The following are the key expectations on interoperability requirements:

1. The system should be designed for interoperability using industry standard protocols.
2. System must expose data by Advanced Message Queuing Protocol and REST via TLS
3. All imported data must undergo data validation to ensure full integrity.
4. Data exchange within the system at different levels via the internet shall be encrypted.
5. The system should have functionality to exchange data with other own systems or external institute systems.
6. The system shall have functionality to export/import files based on the standard template defined through web services and/or API

Full API documentation must be provided so that third party integrators can integrate their system with this system.

5.10. UI/UX.

The vendor must propose a **"UI/ UX Plan (Ref.Doc-10)"** containing UI designing method and tools, UI design Activity plan, prototype or Mock Up design for both web & mobile, expected result & their finalizing process of that UI/UX design. Apart from this, the vendor should consider the following issues as requirement at the time of UI/UX plan.

1. The system interfaces should be highly user friendly, easy to navigate and ensure fast loading.
2. The UI shall be designed by using well-established, supported and lightweight UI framework so that it follows widely used industry flow patterns
3. UI shall be easily configurable if any changes are needed
4. Menu, content and navigation shall be based on the user entitlements, roles and permissions.
5. Vendor is requested to include five important features considering service recipient five UI for each platform i.e. mobile, web. Those UI should be design professionally & hardcopy color page so that UI design capacity & standard will be able to measure.

5.11. Digital Service Toolkit and Guide

A 360 degree guide of service using updated technologies will create a significant impact in case of using the implemented digital service by the system user (service providers& recipient).This toolkit & guide service may be implemented in different modalities as mentioned below:

5.11.1. Digital service receiving guide:

Digital service receiving guide: In both of the platform of web & mobile applications, the service recipient who are not even tech literate should be able to find an easy way to make them easily oriented for the digital service they would like to receive from application. Both the platform (Web & mobile) with few clicks should have easy content read & multimedia/ animated/video which is easy to view & understand receiving process, guideline & examples. The content can be focused on service receiving eligibility, requirements & step by step service receiving process for each & every service.

5.11.2. Smart guide for Digital features:

Smart guide for Digital features. In both the platform mobile apps & web in case of receiving any digital service in each interface of digital feature, the service recipient will find a default "guide/help link" by clicking on this meaning. Instance guide service can be availed like step by step pictorial action flow or video/multimedia content to use this feature & other relevant smart or interactive contents to receive instant support.

5.11.3. Digital user manual:

For all types of usage, vendor must prepare easy accessible & focused training manual which will also be available in mobile apps & web application also. The user manual should be smart enough so that the target users can receive the training by himself or herself without a trainer intervention also. The content should not be prepared only based on text but also the info graphic, pictures, animation, diagrammatic presentation, multimedia should be used smartly. The digital training guide or manual may be hosted into the e-learning platform of a2i, ICT division named Muktopath for larger promotion, advertisement, accessibility & cost effectiveness. The digital training can be provided by using Muktopath e-learning features easily in this regard

Vendor is requested to provide a comprehensive "**Digital Service Toolkit & Guide plan** (**Ref**.**doc-11**)" for all the service to be digitalize.

1. User (service recipient/ provider) will use this system in a very simple, fast and interactive way.
2. Vendor should plan properly during content designing & development so that it will be easier for non-technical & non tech savvy users.
3. This digital guide has to be implemented for each & every service of this system for each platform i.e. web, mobile.
4. All the digital content guidelines must be interactive so user can navigate the system by hearing, listening & reading.
5. Content creation methodology, activity & standard should be included in the plan.
6. Vendor's innovative & future context plan of this digital toolkit & guideline considering all the users will be appreciated

5.12. Language Support

System's default language will be Bangla. The system system should support multilingual option i.e. Bangla and English for both the Web version and Mobile Apps. All the user interfaces will be able to display and input controls can take input both in Bangla and English. System/App users can choose and set his/her preferred language in profile setting for the system interfaces. The system should support Unicode for the Bangla Language.

5.13. Accessibility

Vendor must develop this system application ensuring access for the citizens (Service Recipients) with disabilities in different standardized accessible formats. System application should be developed in "universal design" and "assistive technologies". Accepting and facilitating the use of sign languages, augmentative and alternative inputs and all other accessible means, modes and formats for inputs and outputs as per their choice by "Service Recipients" with disabilities; all system features (Web application or Mobile Application) should be usable with the help of screen reading software by the service recipients with disability.

5.13.1. Internet and Web-based Content Accessibility Checklist

Accessibility Checklist		
SL.	**Items to Check**	**Details**
1.	For anything on a web page that is not text, is there a text equivalent for that item?	• Anything that is not text on a web page usually includes, but is not limited to, an image, graphic, audio clip, applets (small application running within a web browser, i.e. text chat window, etc.), tickers, or other feature that conveys meaning through a picture or sound. Examples include buttons, check boxes, pictures and embedded or streaming audio or video. • Providing a text equivalent means that words are being used to describe what an item (that does not physically consist of text) actually is, why it is there, and any information being communicated by the use of that item or the item itself. • Check that all images have accurate and meaningful text equivalents. Images mostly use an "alt-tag" or "longdesc" attribute as part of the object. To check, mouse users can roll their cursor over an image. If a text label or window pops up, then it has a text equivalent. Screen reader users can listen to see if an image is identified and described. It is also acceptable to simply include a text description above or below the image. For example, "The picture below shows…" • Ascertain that images of text, graphical text (pictures of text), or text that is part of an image have a text

		equivalent. Be sure that the text equivalent correctly describes the image or communicates any information as part of the image. For example, if the image itself contains words, be sure the exact wording from the image is used within the text equivalent. • Ensure any audio has a text equivalent, such as a text transcript.
2.	Is captioning, audio descriptions, or other equivalent provided for presentations that utilize both audio and video at the same time? Is captioning, descriptions, or other alternatives synchronized with the presentation?	• Determine that all audios have been captioned for the deaf and hard of hearing, and all videos have audio descriptions for blind and visually impaired. • Ascertain that captions and audio descriptions are synchronized correctly with the audio and video. For example, synchronized captions allow someone to read captions and also watch the speaker's relevant body language. • Remember that this only applies to multimedia presentations, i.e., those presentations utilizing both audio and video at the same time. For example, the audio and video web cast of a program would need to be synchronized. An audio web cast would require a text transcript. A silent (no audio) web slide show would require a text equivalent for any images.
3.	If color was removed, would it inhibit use of the web site?	To check, view the page using a monochrome monitor (ex. black and white monitor, etc.) or by printing a page to a black and white printer.
4.	Is color being used to emphasize text or indicate an action?	If so, an alternate method needs to be included so users can identify what is being emphasized by the use of the colored text or action. For example, if all links on a web page are blue, than underlining the links is an acceptable method for identifying blue colored links. Another example, if users are prompted to press a green start button, than a text label above the green button saying "press green start button" is an acceptable method.
5.	Do web pages ignore user defined style sheets?	Style sheets are formatting instructions on how a page should be displayed (can also include how it is printed and presented). For example, a user specifies that they want their browser to view pages with extra-large font with white characters on a black background. These preferences are set up for all pages viewed.

6.	Does a web page override or ignore user settings?	To check, disable style sheets within the browser (Check browser's help menu for instructions) or try changing the font size or background colors through the browser's settings.
7.	If a link is embedded in an image, is there an equivalent text link?	• Frequently, a web designer will use an image map which contains a link or set of links. • Check to see if the image has any text links or labels. In some cases, you may have to move the mouse around the image to see if different text labels appear over different portions of the image. Screen readers will announce "image map link…" when a link is detected. These text labels alert users that by clicking or selecting the link in this particular region of the image, it will retrieve a specific web page. This is an example of a client-side image map which can be quite accommodating to people with disabilities and those using assistive technology. • On the other hand, there are image maps that do not indicate to the user which specific web page will be retrieved when a particular region of the image is selected. These are called server-side image maps, because the computer or server hosting the web page determines which page is sent based on portion of the image selected. These are not accessible image maps, requiring a redundant text link on the same page retrieving the same pages as those links used in the image map.
8.	If information is displayed using a table(s), can columns and rows be identified by screen readers?	Using a screen reader, listen to how the table is read aloud.
9.	If frames are used, are they accurately text labeled?	Frames are used to visually separate information on a web page.
10.	Does anything on the page blink or flicker?	Ask if the web designers can prove whether any blinking or flashing elements have a frequency greater than 2 Hz and lower than 55 Hz. This requirement is necessary because some individuals with photosensitive epilepsy can have a seizure triggered by displays that flicker or flash, particularly if the flash has a high intensity and is within certain frequency ranges.

11.	Do web sites not conforming to acceptable and approved accessibility standards offer a text only equivalent of their web site?	• The World Wide Web Consortium's (W3C) Web Accessibility Initiative Guidelines and Section 508 are the two widely accepted authorities on Web accessibility and design. • Web sites that cannot adhere to the accessibility guidelines set forth by W3C and Section 508 can offer a text only equivalent for all the information displayed and all functions available.
12.	If scripting is used, such as JAVA, etc., is there a text equivalent so assistive technology, like screen readers, can read the information?	An example of scripting could be a stock ticker on a web page that is animated, refreshing, and displaying information. Another example is using an image, that when a mouse cursor rolls over the image, additional information pops open on the screen, and then disappears when the mouse cursor rolls off.
13.	If online forms are used, can people using adaptive technology fill in and submit all the required information?	• Can a keyboard be used to access all the form fields? • Are text labels used either inside or near form fields to identify what information users should be entering? • Can a screen reader identify the form(s)? • Do the forms follow a logical order? For example, if a user hears "Last Name" is the corresponding form the area where they would enter their last name?
14.	Is there a way for users, especially those using screen readers to skip repetitive navigational links?	Navigational links are a set of routine navigation links frequently used to move users to pages within a web site, usually located on the top or side of each web page. For example, "Help," "Contact Us," etc. links that all appear on the same page within a web site in exactly the same way and location.
15.	If users are given a certain amount of time for an action or response, is there any indication how much time they have left or an option to request more time?	Some web pages may expire or time out after a certain amount of time, and refresh the entire page, for example those requesting personal information.
16.	Unicode character set for Bangla	Use of Unicode character set for Bangla - Interspersing Bangla and English in the same page should be avoided until such time that there is a screen reader which can handle

		multiple languages.
17.	Accessible documents on web pages	Where it is not possible to make a document accessible, then an alternative, accessible format should be downloadable along with the original image file.
18.	Navigation mark-up	Use of heading level 1-6, in addition to navigation links like 'skip to main content'.
19.	HTML validation	HTML is the simplest programming language used for website development and is accessible on all browsers — desktop browser or a mobile browser. All web pages should have HTML validation.
20.	CSS validation	Content presented with CSS errors may lead to serious problems such as overlapping of content, making it almost impossible to read. CSS errors may also prevent some users from successfully carrying out custom CSS processing to set the preference of color and size of text and object to suit their vision requirement.
21.	Color adjustment option	High contrast and font customization options should be available
22.	Labeling of Links	Labeling links correctly rather than just 'click here'- i.e., descriptions should be accurate. 1. The web page has a descriptive and informative page title. 2. A sign language video is provided for all media content that contains audio. 3. The page is readable and functional when the text size is doubled. 4. All page functionality is available using the keyboard

5.14. Tools and Technologies to be used

Vendor is recommended to choose the appropriate tools and technologies (Open Source is preferable) to be used for the development and implementation of the system application. The selected vendor has to consult with the project PIU to finalize the tools, technologies, framework and platform with the approval of same authorities consent.

The main components of the software will be web based applications. It should be run in Windows/Linux/OSx operating system at user's end and should be compatible with all major browsers such as – Internet Explorer, Firefox, Google Chrome, Opera etc.

The System UI should be compatible with Tab & Smart Phone browsers.

Understanding the details scope of this project, vendor is requested to submit a detail **"Tools & Technology plan (Ref.Doc-12)"** in their technical proposal following the table format mentioned below

Issues/Phases/Purpose	Used Technology/ Tools	Justification for use	Alternative Tool/ Technology
Project Management			
Version Control			
System Requirement Analysis			
System Design			
Development (Client end)			
Development (Server end)			
API/Web services			
Apps			
Testing			
Integration			
Hosting & Deployment			
Documentation			
QA			
Helpdesk/Support			
Reporting			
Communication			

6. Project Management

6.1. Implementation Timeline

Vendor must complete the project within a stipulated timeline based on the proposed SDLC methodology. The project timeline can be divided in four below phases that is – Requirement Analysis & Design, Development & Release, UAT & Deployment, Piloting & Maintenance.

"Project Implementation Timeline/Schedule (Ref.Doc.13)"

The project is divided into 4 phases. The entire assignment is divided as following phases:

The assignment is to be completed within 42 (Forty-Two) Months from the date of contract signing.

STEP-I: Requirement Analysis & Design -

Step	Duration
1	01(One) Month

STEP-II: Development & Beta Version Release –

Step	Duration
2	03 (Three) Months

STEP-III: Stable Version Release –

Step	Duration
3	01 (One) Months

STEP-IV: UAT & Piloting –

Step	Duration
4	15(Fifteen) Days

STEP-V: Go Live-, Implementation

Step	Duration
5	15(Fifteen) Days

STEP-VI: Support Service & Maintenance -

Step	Duration
6	36 (Thirty-Six) Months

6.2. Pilot Implementation Requirements

The selected vendor has to conduct package wise (as per priority and readiness) pilot implementation of the system software solution in pilot areas which will be decided by implementing agency. Vendor will submit the detailed **"Pilot Implementation Plan (Ref.Doc.14)"** in the technical proposal in which the following may be considered to incorporate:

1. Vendor will be required to provide on-site support in pilot phase to ensure smooth operation.
2. Vendor must provide extensive, premium and time-bound support at the pilot phase. The detailed support modality, methods, standard and relevant activities should be mentioned in the proposed plan.
3. Vendor will submit a performance assessment report at the end of the pilot phase covering pilot result/output, impact/outcome, scalability, stability and sustainability for full-scale implementation.
4. The criteria/key factors based on which the pilot evaluation will be conducted should be mentioned in the proposed plan.

6.3. Documentation

Detailed and proper documentation of such ICT based project like system application development and implementation for the Government is vital. Documentation is required for any such project as a reference, knowledge transfer, analysis of development and implementation history, baseline information for any modification or change, guidance etc. In this issue, Vender should show the highest-level of professionalism for delivering the standardized documentation approach at each phase of system development and implementation project. Vendor should include an extensive **"Documentation Plan (Ref.Doc-15)"** of this project in their technical proposal.

6.4. Work Distribution and Team Composition

The vendor is expected to provide work distribution and team composition plan based on the project scope, their proposed SDLC methodology and work and project implementation plan. The interested applicant (Vendor) should provide a **"Work Distribution & Team Composition Plan (Ref.Doc-16)"** in their technical proposal describing the different teams with required HR positions that will be allocated at various phases or steps of proposed SDLC and project implementation. In the case of running multiple phases or steps or activities, the team allocation plan mentioning the number of HR positions should be planned and described precisely. In the team allocation plan, each HR position should also be described with the roles, amount of involvement (man-day/man-month), expected deliverables and required skill and expertise. However, for proper execution of the project i.e. system application development, the vendor shall include at least the following HR positions as minimum project team requirements:

SN	Name of Position	Number of Person
1.	Project Manager	1
2.	Business Analyst	1
3.	System Analyst	2
4.	Software Architect	1
5.	Database Administrator (DBA)	1
6.	Senior Software Engineer	2
7.	Software Engineer	4
8.	Mobile Apps Developer /Programmer	2
9.	QA Expert & Test Engineer	2
10.	Deployment Expert	1
11.	Technical Document Writer	2
12.	UI Designer	1
13.	UX Expert	1
14.	Training Expert	1
15.	Implementation Engineer	5
16.	Support and Maintenance Engineer	2

For Maintenance Service & Support:

	Key IT Personnel	No.
1.	Service Manager	1
2.	Helpdesk Support Executive	2
3.	Software Maintenance & Support Engineer	3
4.	Developer/Programmer (On Demand)	2
	Totals	8

Note: Please consider, the above-mentioned project team composition has been proposed here mentioning the minimum size of the team with required HR positions for evaluation only. Vendor may propose any additional HR positions as per their SDLC methodology and work plan in the technical proposal as their plan.

Conditions:

- The vendor proposed Hr plan has to be reflected in git and git activity.
- The proposed HR must have appropriate educational qualifications/experience/vendor certifications.

6.5. Quality Attributes and Assurance

The Quality attributes and Assurance plan will describe the standards, processes and procedures in this system application development life cycle which will be used to support the consistent delivery of high-quality, professional standard system application and services

provided in the support of an automated environment. The quality assurance process will be concerned with establishing the authority of the QA function, quality assurance standards, procedures, policies, and monitoring, and evaluation processes to determine quality in relation to established standards. Quality assurance activities will concentrate on the prevention of problems through the continuous improvement of processes.

In order to provide high-quality products and services, each support team will adhere to processes, procedures, and standards. Quality Assurance (QA) is a process used to monitor and evaluate adherence to processes, procedures, and standards to determine potential product and service quality. It will involve reviewing and auditing the products and activities to verify that they comply with the applicable procedures and standards, and will assure the appropriate visibility for the results of the reviews and audits. In the quality assurance plan, the vendor must comply with the following conditions:

- The vendor must use automated SAST, ai-enabled test automation, and a clean code tool integrated into ci/cd pipeline. All the tests for quality and security must be carried out using the automated during and before release and resolved if any problems are found.
- Must provide the required number of users for the department of ICT for checking the reports and logs in the tools. The tools report and logs must be accessible over the web.

The vendor is requested to provide an extensive "**Quality Assurance Plan "Ref.Doc.17"** with measurable attributes for each phase of this system development life cycle in their technical proposal.

6.6. Data Management and Migration of Legacy Data

Under the process of service to system transformation, during system activation or deployment, it might be necessary to move the legacy data of prevailing services. In that case, the vendor may require to perform different relevant activities that may include data collection, softcopy conversion, data filter, data cleansing, data verification, data processing, data entry, data migration and overall data management. Here, it is expected that, the vendor will propose their detailed **"Data Management and Data Migration Plan (Ref.Doc.-18)"** for this system application considering the estimation of legacy data mentioned below which will be required to migrate into the developed application.

Data About	Description	No of Pages	Current Status	Amount of Data	Dependency

The plan may cover amount of data to be migrated, activities to be performed, the amount of resources to be used, required time for different data migration phases

for different activities (data collection, hardcopy to softcopy conversion, data entry, data transformation from soft copy, data filtration, data cleaning, data verification) etc.

6.7. System Audit

This system system will maintain an audit trail of any changes or updates made in any information that are considered as vital and should maintain the audit log with information such as

1. Log the users who are accessing the system
2. Log the parts of the application that are being accessed
3. Log the fields that are being modified
4. Log the results of these modifications
5. Log the attempted breaches of access
6. Log the attempted breaches of modification rights
7. Timestamp.

It should be ensured that an audit trail is kept for all transactions and all audit transactions logged are kept on the trail file or trail database from where system can generate different audit reports as and when required.

Vendor is requested to submit their proposed "**Audit Plan (Ref. Doc- 19)"** including strategy & standard measures in their technical proposal.

6.8. Training Plan

In the case of eGovernment/digital service's successful implementation, user training plays one of the most vital roles in the entire implementation cycle. Vendor must consider government culture, convenience of government officials & staff and ICT literacy & expertise at the time of designing user training plan for the eGovernment/digital service implementation. Based on the requirements, target prospective participants and implementation scope, vendor may plan for user training in 4 different modality; i.e., 1) Direct User Training, 2) TOT, 3) Refresher Training, 4) e-Learning Platform (Muktopaath) based training. The vendor is requested here to submit a detailed **"Training Plan (Ref.Doc-20)"** in their technical proposal considering the following:

1. Training Schedule & program details
2. Methods & modalities of user training
3. No. of targeted user groups and participants
4. Strategy of ensuring training standards
5. Methodology for evaluating performance
6. Ensuring smart training with latest tools & technologies
7. Innovative, user friendly, & multimedia training materials
8. Team composition, skill and expertise as training provider

Please **note** that, the training infrastructure like venue will be provided by the implementation organization.

6.9. End User Engagement

End user engagement is very important for e-government implementation especially for the citizen centric digital service delivery. Vendor should measure involvement of end users during development and the constant incorporation of feedback to provide high-quality end-user experience satisfying usability test. Based on different types end-user group, vendor may require to consider the following at the time of preparing **"End-User Engagement Plan (Ref.Doc-21)"** which is required to be submitted with the technical proposal,

1. Purpose of end-user engagement.
2. For ensuring end-user behavior, proposed method & activity.
3. Define indicators & factors of the outcome for end-user engagement.
4. Determining area & boundary of end-user's Engagement & there degree of involvement.
5. Mentioning vendors & implementing organization's roles in engaging end-users for large scale implementation.

6.10. Risk Management

Software development is an activity that uses a variety of technological advancements and requires high levels of knowledge because every software development project contains elements of uncertainty. This is known as project risk. The success of a software development project depends quite heavily on the amount of risk that corresponds to each project activity. As a project manager, it's not enough to merely be aware of the risks. To achieve a successful outcome, they must identify, assess, prioritize, and manage all of the major risks. A standard risk management process includes the following steps:

1. ***Identify*** risks and their triggers
2. ***Classify*** and prioritize all risks
3. Craft a ***plan*** that links each risk to a mitigation
4. ***Monitor*** for risk triggered during the project
5. Implement the ***mitigating action*** if any risk materializes
6. ***Communicate*** risk status throughout project

The vendor should submit a **"Risk Management Plan (Ref.Doc.-22)"** addressing all types of risks including above mentioned steps following standard risk management principles and their mitigation plan

6.11. Expected Deliverables

Considering the scope of services and work of this project and based on the proposed project development & implementation methodology (SDLC), the vendor is requested to submit a comprehensive **"Project Deliverables Plan (Ref.Doc.-23)"** in their technical proposal describing the SDLC phase/steps/action wise timeline based deliverables mentioning different formats and types.

For better clarification, some of the deliverables examples are mentioned below:

1. Project inception report
2. Project management plan
3. System requirement specification (SRS)
4. System design document (HLD and LLD as SDD)
5. Complete source code with documentation
6. Test plan with testing reports
7. Integration plan and reports
8. Mobile and Desktop Applications (Android, iOS, Mac, windows, linux)
9. Web application
10. SLA

6.12. Copyright

Department of Information and Communication Technology (DoICT) shall be entitled to all proprietary rights including but not limited to patents, copyrights and trademarks, with regard to many Vendor.

All kinds of source codes including code documentation and other approved documents (all versions trail, products, developed applications, documents and all kinds of deliverables) which bear a direct relation to or are made in consequence of the services provided by the vendor under this scope of this TOR will be owned by Department of Information and Communication Technology (DoICT).

At the request of the Department of Information and Communication Technology (DoICT)), the vendor shall assist in securing such property rights and transferring them in compliance with the requirement of the applicable law. After the completion of the project, such rights will be handed over to the Department of Information and Communication Technology (DoICT) that will be produced at the time of entire system development and implementation life cycle under the scope of this TOR and will be owned by Department of Information and Communication Technology (DoICT).

The vendor should properly deliver the entire approved source codes and other deliverables to the Department of Information and Communication Technology (DoICT). The vendor cannot claim any royalty or authority of any sort in case of replicating the source code or database or any other deliverables under this TOR for any future use that Department of Information and Communication Technology (DoICT) and the Government of Bangladesh may see fit.

Any studies, documents, reports, graphics or other materials prepared by the vendor for this project under this TOR shall belong to and remain the property of Department of Information and Communication Technology (DoICT).

6.13. Maintenance and Support Service

The selected vendor will require to provide maintenance and support service for this developed, deployed, piloted eGovernment/digital service application. After the development and deployment phase as soon as the application goes Live, having consent and acceptance from the implementing organization, immediately the pilot implementation phase will be started including the maintenance and support service. Vendor will require to provide maintenance and support services plan for next **2 (Two) years**. If this project is divided into multiple packages (as planned), then maintenance phase will be started from the piloting independently for each package. Here it is expected that, the vendor must provide a detailed **"Maintenance and Support Service Plan (Ref. do-24)"** including proposed SLA in the technical proposal. The proposed SLA should include time bound service delivery layers, modality & compensation plan, which may also include the following:

1. A Proposed SLA plans
2. Support service types and mode of services
3. Help desk functionalities & facilities and capacity
4. Configuration management and Change management
5. Service layers for different types of support
6. Tools & technologies will be used for Support service management
7. Communication & report management
8. Incident & Problem management
9. Support Service Log Management
10. Support feedback & service evaluation methodology

Support & maintenance plan should be comprehensive and well elaborated to ensure proper support to the end users. Apart from above mentioned issues, if vendor thinks any other issue/method should be included in their plan which assures proper standard support & maintenance of this eGovernment/digital service application which is suitable for implementing organization, it would be considered as added value addition.

Out of this two year of maintenance period; after one year, vendor will require to submit a comprehensive managed service plan to implementing organization exploring each & every scope of switching operational modality from AMC to Managed service for ensuring easy manageable, hassle-free service delivery & minimized operational cost in operation. The proposed managed service plan will not only be cost effective & efficient in operation for quality service delivery for the implementing organization, should be also viable for the vendor i.e. more sustainable & win-win for both parties. The managed service plan will be a guideline & support for the implementing organization for important & crucial decision making regarding switching modality to AMC to Managed Service just after the expiration of two years maintenance & support period. For effective collaboration & proper decision

making, the implementing may consult with Access to Information Programme (a2i), ICT division in this regard. In this case the organization will require to take measures by maintaining the necessary legal formalities before the expiration of two years maintenance period for smooth switching towards managed service modality with proper knowledge transfer. At the time of preparing managed service plan after one year maintenance & support service period the vendor should consider the followings:

1. Business feasibility study.
2. Determining the cost of operation.
3. Infrastructure requirements.
4. HR requirements.
5. Service simplification & SOP.
6. Breakeven & ROI analysis
7. Risk & dependencies.
8. Stakeholders' roles & responsibilities.
9. Sustainability & business continuity
10. Technical operation & service delivery standard
11. Continuous improvement scope
12. Performance evaluation

Note: Please note that submitting the "The Managed Service" plan by the vendor will be one of the major deliverables of the 1st year maintenance plan before the expiration to the organization including extensive feasibility study. Here vendor is requested to add this as a deliverable in the **"Project Deliverables Plan (Ref.Doc.-23)"** Plan that is going to be submitted by the vendor with the technical proposal.

6.14. Performance Review

As per the predefined performance review plan of different stages of SDLC, the vendor will take necessary actions so that it will be possible to evaluate the performance at different levels of their activities and the deliverables based on indicators/factors precisely. Those indicators, standards and factors for performance evaluation have to be defined earlier at the time of project management plan. Here vendor is requested to submit a proposed **"Performance Review Plan (Ref.doc-25)"** for the entire design, development, and implementation cycle mentioning the indicators, measuring strategy and expected review scopes.

6.15. Knowledge Transfer

The Knowledge Transfer Plan should provide a comprehensive approach to transfer the responsibility for maintenance and operations from the vendor to implementing organization or their nominated agency. While designing a smooth, efficient and effective **"Knowledge Transfer Plan (Ref.doc-26)"** vendor should consider the following:

- Strategies, methods, milestones, schedules & their duration of accomplishing target.

- Vendor will propose required technical capacity, number of resources mentioning their roles & responsibilities from implementing agency to carry forward this plan.
- Vendor will need to identify the risks, craft a mitigation & contingency plan.
- Vendor needs to propose a method of evaluating & verification of the standard of the knowledge transfer plan.

7. Technical requirements

7.1. SAST, DAST, and Clean code tool license

Must have one or more license of automated SAST, DAST, and clean code tool from a market leader in SAST according to Gartner magic quadrant or Forrester Wave leader as of the latest report. The license must be enterprise-level. The tools have to be used at all levels of development.

7.2 AI Enabled test automation tool license

Must have one or more licenses of ai enabled software test automation tool from a market leader according to Gartner magic quadrant or Forrester Wave leader as in software test Automation market. The test automation tool must have a codeless natural language test generation feature, for example, AccelQ unified.

7.3 Condition of NOA

Must provide proof of valid license and coverage of the license for above clauses 7.2 and 7.3. If the bidder does not have such a license the bidder may provide a written declaration of intent to buy and integrate such license and tools in each stage of the development. The bidder must provide that they have purchased the license before signing NOA. Failure to do so will result in the automatic cancelation of NOA.

8. Conclusion

The ultimate expectation is to implement this system of Digital Content Repository System of Sheikh Russel Digital Lab (SRDL) to provide interactive digital content for Students & Teachers and to provide extensive virtual tutoring guidance for Teachers. For fulfilling the vision of Digital Bangladesh spearheaded by the Honorable Prime Minister, well-equipped modern computer laboratories in educational institutions at grass root level would contribute a lot to the expansion of ICT education in the country.

The ultimate expectation is to implement this system of Digital Content Repository System of Sheikh Russel Digital Lab (SRDL) for the Department of ICT to increase the quality of physical education instead of theoretical education. Increase the pass rate of examination, encourage more students to acquire quality education through spontaneous participation of students in education, and reduce the dropout rate. Create skilled human resources, introduce an international standard education system, increase the clarity of

content, decrease the tendency to memorize, increase the skills of teachers, active participation of teachers and students in education, and maximum use of information technology in education. Thus, to achieve the goal Project Authority intended to develop a Central Repository System.

Keeping the above in mind, here the vendor has to design, develop and implement end-to-end solutions named Digital Content Repository System of Sheikh Russel Digital Lab (SRDL) for the Department of ICT, where a comprehensive technical proposal will play a very important role to understand that, the vendor has fully visualized the system requirement, development requirement with tools and technologies, constraints and challenges of implementation and thus present the best solutions in their proposal.