NTU E-Tendance System

[Project Plan]
Version 1.2

By: Simon El Nahas Christensen, Li Shanlan, Zeng Jinpo, MN Shaanmugam, Cao Ngoc Thai and Akshaya Muthu

Revision History

Revision Number	Date	Primary Author(s)	Comments
1.0	Sep 23rd, 2019	Simon El Nahas Christensen, Li Shanlan, Zeng Jinpo, MN Shaanmugam, Cao Ngoc Thai, Akshaya Muthu	First Version
1.1	Sep 27th, 2019	Akshaya Muthu	Second Version
1.2	Oct 6th, 2019	MN Shaanmugam	Third Version

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1 Introduction

1.1 Project Overview

The E-Tendance is an online attendance taking system that leverages on existing facial Recognition technology. Attendance of students will be recorded when their faces are detected using the E-Tendance system. This method of attendance taking increases efficiency and reduces the possibility of fake attendance.

1.2 Project Description and Scope

The E-Tendance System is part of the campaign of NTU becoming the greenest and an eco-friendly campus. The main function of the E-Tendance system would be to record attendance of the students by recognising their faces. The E-Tendance system will be implemented across all schools in NTU.

E-Tendance is composed of the following main features:

- Login form for professors to enter the tutorial/lab index
- Main screen with webcam to capture students' attendance using facial recognition
- Main screen with lists of late, present and absent students
- Summary Report page which displays the final attendance

A detailed description of the E-Tendance application and its various functionalities can be found in the System Requirements Specification document.

2 Project Organization

2.1 Team Structure

The following is the list of roles

- Project Manager : Simon El Nahas Christensen
- Lead Developers : Li Shanlan , Simon El Nahas Christensen
- Backend Developers : Simon Christensen, MN Shaanmugam, Zeng Jinpo, Cao Ngoc Thai
- Frontend Developers : Li Shanlan, Akshaya Muthu
- Quality Assurance Manager : Cao Ngoc Thai
- Quality Engineers : Zeng Jinpo, Akshaya Muthu

2.2 Roles and Responsibilities

Project Manager: Simon El Nahas Christensen

- Oversees project progress
- Approves and executes project plan
- Assigns tasks and reports status of project to team members
- Manages and motivates team members
- Represents the team to the outside world

Lead Developers: Li Shanlan, Simon El Nahas Christensen

- Designs logical system based on requirements
- Translates logical design into detailed design
- Creates detailed design document

Front-end Developers: Akshaya Muthu, Li Shanlan

- Designs User Interface for Web application
- Ensures stability and response time of the system meet the requirements
- Creates user manual

Backend-Developers: Simon El Nahas Christensen, Zeng Jinpo, Cao Ngoc Thai, MN Shaanmugam

- Implements product based on detailed design document created by lead developers
- Integration of coded modules into functioning system
- Integration between Front-end and Back-end

Quality Assurance Manager: Cao Ngoc Thai

- Ensure the software and code quality adheres to established standards
- Draw up quality management plan and configuration plan for E-Tendance
- Creates and administers test plan

Quality Assurance Engineers: Zeng Jinpo, Akshaya Muthu

- Ensures acceptable software quality
- Designs testing strategies
- Manages test plan
- Verify software requirements
- Executes test procedure

2.3 Team Communication

TLA communication channels include the following:

- Weekly face-to-face meetings are held on Mondays in NTU
- Collaboration for documentation done using shared Google Drive
- Individual updates on tasks also reflected and updated using Trello board
- Group announcements, updates and other minor discussions are sent and carried through Whatsapp group chat
    - Group split into sub-groups to focus on specific tasks - communication within sub-groups is also done using Whatsapp

3 Process Definition

3.1 Lifecycle Model

The team intends to use the Incremental Development Model throughout the timeline of the E-Tendance project. This methodology is more flexible than the traditional Waterfall Software Development Life Cycle (SDLC) model since it allows repeated iterations involving design, coding, unit testing, integration and quality assurance. On the other hand, the Waterfall SDLC model will not be a good option due to the limited time available for the development of the project.

The team also considered other SDLC models such as the Spiral model, but decided not to proceed with it since the project will likely overshoot its critical schedule and the deadlines will not be met.

The team intends to deliver the first iteration of functionality on the System Delivery dates indicated in the Schedule section of this document. After further client interaction, further improvements can be made to the system as deemed necessary.

4 Schedule

4.1 Activity Dependencies and Schedule

Gantt Chart specifies individual tasks, their respective stages and duration of each task.

	Task name	Duration	Start date	Finish date
1	***Complete Project Specification***	*91 days*	*26/8/2019*	*11/8/2019*
2	***Requirements Specification***	*47 days*	*26/8/2019*	*14/10/2019*
2.1	*Project Proposal*	*13 days*	*27/8/2019*	*8/9/2019*
2.2	Use Case Diagram and Description	9 days	30/8/2019	8/9/2019
2.3	System Requirement Specification	14 days	9/9/2019	22/9/2019
2.4	Quality Plan	7 days	16/9/2019	22/9/2019
2.5	Project Plan	16 days	26/9/2019	11/10/2019
2.6	Risk Management Plan	10 days	2/10/2019	11/10/2019
3	**Design**	7 days	9/9/2019	15/9/2019
3.1	UI Mockup Design	5 days	9/92019	13/9/2019
4	**Implementation**	28 days	16/9/2019	13/10/2019
4.1	Prototyping	21 days	16/9/2019	6/10/2019
4.2	Design Maintaniability Report	5 days	23/9/2019	28/9/2019
4.3	Configuration Management Plan	5 days	1/10/2019	5/10/2019
4.4	Change Management Plan	4 days	7/10/2019	10/10/2019
4.5	Release Plan	6 days	8/1/2019	13/10/2019
5	**Testing**	14 days	14/10/2019	27/10/2019
5.1	Test Plan	4 days	14/10/2019	17/10/2019
5.2	Test Cases and Requirements Test Coverage Report	5 days	18/10/2019	22/10/2019
5.3	Develop CMMI Level 2 Definition	5 days	23/10/2019	27/10/2019
6	**Deployment**	7 days	28/10/2019	3/11/2019
6.1	Upload and Deploy E-tendance Application	5 days	28/10/2019	1/11/2019
6.2	Sign-off Project	2 days	2/11/2019	3/11/2019

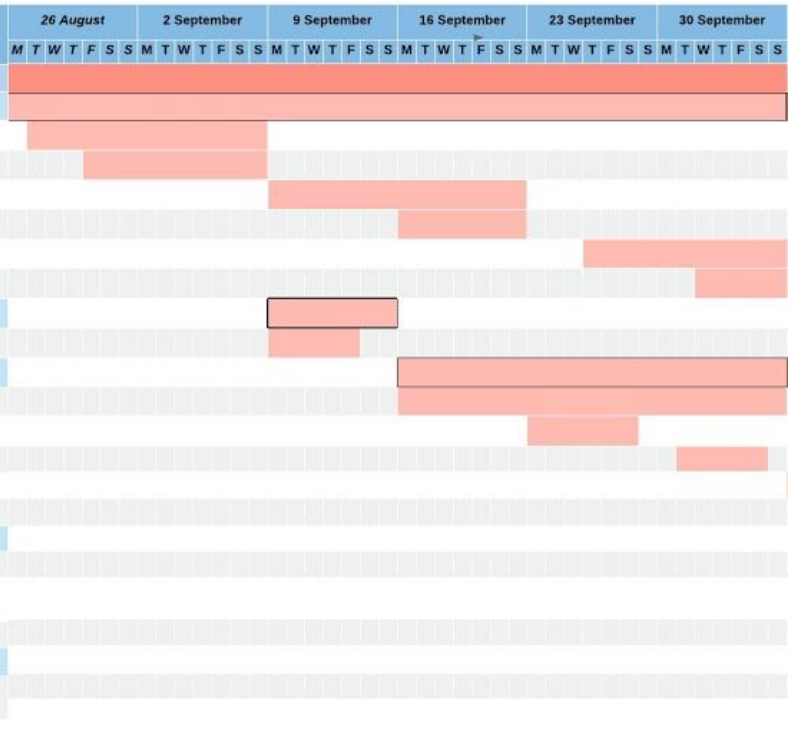

Figure 1: Project Management Gantt Chart from August to September

	Task name	Duration	Start date	Finish date
1	***Complete Project Specification***	*91 days*	*26/8/2019*	*11/8/2019*
2	***Requirements Specification***	*47 days*	*26/8/2019*	*14/10/2019*
2.1	*Project Proposal*	*13 days*	*27/8/2019*	*8/9/2019*
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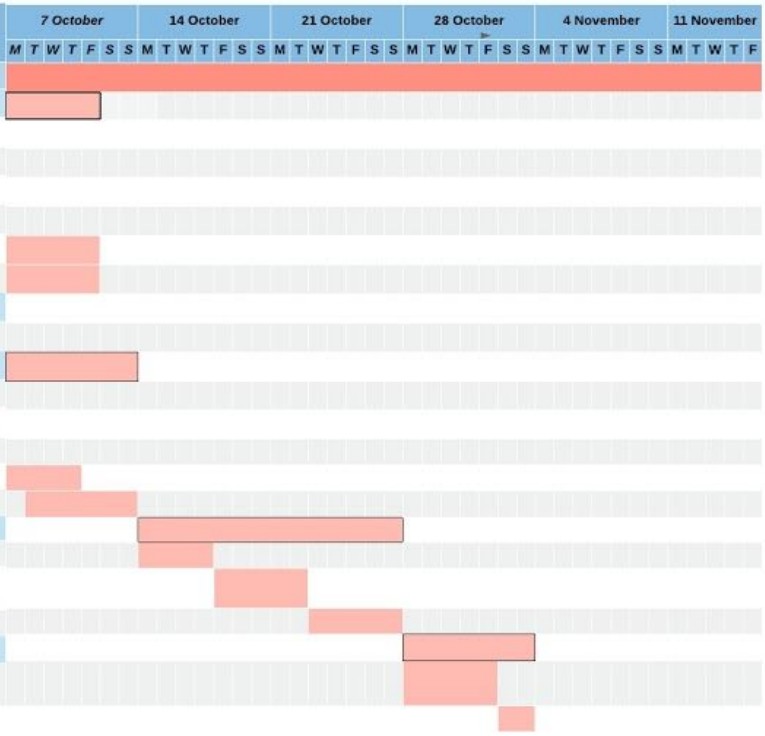

Figure 2: Project Management Gantt Chart from October to November

4.2 Work Breakdown Structure

In the work breakdown structure, the project is first decomposed into the different stages of development then followed by smaller specific tasks. The activities specified in the work breakdown structure act as guidelines for the work packages to be carried out.

1. Initiating Project

- 1.1 Background Review
  - 1.1.1 Analysis of current methods of attendance-taking
  - 1.1.2 Stakeholder Analysis
- 1.2 Kick Off Meeting
  - 1.2.1 Assignment of Project Roles
  - 1.2.2 Discussion of Project Requirements
- 1.3 Develop Project Proposal

2. Requirement Elicitation

- 2.1 Develop System Specification and Requirements
  - 2.1.1 Develop Use Case Diagrams
  - 2.1.2 Develop Use Case Descriptions
  - 2.1.3 Develop User Interface Mockups
- 2.2 Develop Work Breakdown Structure
- 2.3 Determine Design Goals
- 2.4 Determine System Architecture
- 2.5 Determine Software Lifecycle Model
- 2.6 System Requirements Specification
- 2.7 Develop Project Management Plan

3. Implementation of E-Tendance

- 3.1 Create basic Prototype of E-Tendance
  - 3.1.1 Include important features
- 3.2 Build Source Code
- 3.3 Develop Design Maintainability Report
- 3.4 Develop the Configuration Management Plan
- 3.5 Develop Change Management Plan
- 3.6 Develop Risk Management Plan
- 3.7 Develop Release Plan
- 3.8 Prepare for Project Demonstration

4. Testing

- 4.1 Develop Test Plan
  - 4.1.1 Include Test Cases
  - 4.1.2 Include Black-box testing and unit testing
- 4.2 Develop Requirements Test Coverage Report
- 4.3 Conduct Testing

4.4 Develop CMMI Level 2 Definition

5. Deployment

5.1 Upload and Deploy E-Tendance Application
5.2 Project Presentation
5.3 Sign-off Project

4.3 Work Packages

The entire project work is broken down by the important phases of the software development life cycle. They include the following:

1. Project Plan
2. Requirement Specification
3. User Interface
4. Front-End Design
5. Back-End Design
6. Integration and Quality Assurance
7. System Testing

4.4 Activity Dependencies

The following table describes the dependencies of the deliverable work packages:

Work Package #	Work Package Description	Duration	Dependencies
X01	Project Proposal	13 days	--
X02	Kick-Off Meeting	1 day	--
X03	Use Case Diagrams and Descriptions	9 days	X01
X04	Work Breakdown Structure	2 days	X01,X03
X05	System Requirements Specification	14 days	X01,X03,X04
X06	Project Management Plan	16 days	X05
X07	Prototype and Source Code	21 days	X06
X08	Design Maintainability Report	5 days	X07
X09	Configuration Management Plan	5 days	X07,X08
X10	Change Management Plan	4 days	X09
X11	Risk Management Plan	10 days	X07, X10
X12	Release Plan	6 days	--
X13	Preparation for Project Demonstration	2 days	X07
X14	Test Plan	4 days	X07
X15	Requirements Test-Coverage Plan	5 days	X07,X14
X16	Conduct Testing	14 days	X07,X14,X15
X17	CMMI Level 2 Definition	5 days	X14,X16
X18	Upload and Deploy E-Tendance	5 days	X07,X16

X19	Project Presentation	1 day	--
X20	Sign-Off Project	2 days	--

4.5 Work Package Details

Work packages are listed below. A team member, indicated in bold, has been assigned as primarily responsible for each work package and will coordinate that package.

Project	E-Tendance Web Application
Work Package	**X01 - Project Proposal**
Assigned To	Simon El Nahas Christensen, Li Shanlan, Zeng Jinpo, MN Shaanmugam Cao Ngoc Thai, Akshaya Muthu
Effort	7 days
Start Date	27th August 2019
Purpose	To propose and detail the undertaking of the project E-Tendance and facilitate communication between relevant stakeholders with regards to information on the project.
Inputs	None
Activities	Identify the limitations of current attendance-taking methods in NTU. Come up with possible solutions to tackle the limitations. Identify assumptions and constraints for the possible solutions. Identify the primary and key stakeholders. Interview stakeholders to determine preliminary project requirements and cost. Establish technical goals and ways to achieve them.
Outputs	A written Project Proposal document.

Project	E-Tendance Web Application
Work Package	**X02 - Kick-Off Meeting**
Assigned To	Simon El Nahas Christensen, Li Shanlan, Zeng Jinpo, MN Shaanmugam Cao Ngoc Thai, Akshaya Muthu
Effort	1 day
Start Date	29th August 2019
Purpose	To officially sanction the project E-tendance by Nanyang Technological University and the project sponsors and to communicate the purpose and overview of the project to stakeholders.
Inputs	Project Proposal
Activities	Determine venue, time and invitation list for the meeting. Additionally, prepare an agenda for the meeting based on details from the project proposal. Agenda for the meeting would include, project objectives, budget and timeline.
Outputs	None

Project	E-Tendance Web Application
Work Package	**X03 - Use Case Diagrams and Descriptions**
Assigned To	MN Shaanmugam
Effort	3 days
Start Date	30th August 2019
Purpose	To identify the main use cases for the project so as to determine the main functionalities and users of the project. Use Case diagram to visualise the internal and external influences of the project.
Inputs	Project Proposal
Activities	Identify the main functionalities, actors and external factors in project. Draw a Use Case Diagram based on these. Write the Use Case Descriptions for the identified use cases to detail the initiating factors, detailed use case flow, alternative flows and exiting conditions.

Outputs	Use Case Diagram and Description Document

Project	E-Tendance Web Application
Work Package	**X04 - Work Breakdown Structure**
Assigned To	Akshaya Muthu
Effort	1 day
Start Date	2nd September 2019
Purpose	To breakdown the project into smaller sub-tasks based on the different software development life cycle stages. Breaking down into smaller tasks makes it more manageable and efficient to monitor the project progress. Include duration of each sub-task as well.
Inputs	Project Proposal, Use Case Diagram
Activities	Divide the project into the main stages such as initial, requirement elicitation, implementation, testing and deployment. For each stage, identify sub-tasks and their durations and the relevant dependencies.
Outputs	Gantt Chart

Project	E-Tendance Web Application
Work Package	**X05 - System Requirements Specification**
Assigned To	Zeng Jinpo, MN Shaanmugam, Cao Ngoc Thai
Effort	5 days
Start Date	9th September 2019
Purpose	The purpose of the System Requirements Specification is the document the operations and activities that a system must follow. It also explains the chosen System Architecture and chosen Lifecycle Model for the project .
Inputs	Project Proposal, Use Case Diagram, Work Breakdown Structure
Activities	Define project objective, problem statement, analysis methodology, constraints and requirements of project in SRS.
Outputs	System Requirements Specification Document

Project	E-Tendance Web Application
Work Package	**X06 - Project Management Plan**
Assigned To	Akshaya Muthu, MN Shaanmugam
Effort	12 days
Start Date	26th September 2019
Purpose	Document roles, processes and schedules to manage E-tendance's development. The Project Plan also outlines the responsibility and tasks assigned to each Member as work packages.
Inputs	Project Proposal, Work Breakdown Structure
Activities	Present an overview of the project. Define the project organisation structure, roles and responsibilities. Define the development lifecycle as well as establish managerial and technical processes. Additionally, design work packages using the Work Breakdown Structure, the assignees will identify tools and resources required. Furthermore, they will perform function points analysis and develop COCOMO model to estimate the overall budget for the project.
Outputs	Project Management Plan Document

Project	E-Tendance Web Application
Work Package	**X07 - Prototype and Source Code**
Assigned To	Simon El Nahas Christensen, Li Shanlan, Zeng Jinpo, MN Shaanmugam Cao Ngoc Thai, Akshaya Muthu
Effort	40 days
Start Date	16th September 2019
Purpose	To develop a working prototype of the E-tendance system including the main functionalities derived from the use case diagrams. Use this prototype to demonstrate the initial design of the E-Tendance web application.
Inputs	Project Proposal, Use Case Diagram and Descriptions
Activities	Backend Team work on backend components and develop source code using node.js. Frontend Team work on user interface mockups and design front-end

	user interface accordingly using ReactJS.
Outputs	Working Prototype of Project

Project	E-Tendance Web Application
Work Package	**X08 - Design Maintainability Report**
Assigned To	Cao Ngoc Thai
Effort	3 days
Start Date	23rd September 2019
Purpose	To establish metrics and practices to analyse the maintainability of the application. This will help analyse ways to allow fast and inexpensive changes to the software.
Inputs	System Requirements Specification , Prototype
Activities	Identify design strategies towards better maintainability. This is achieved by defining design patterns, frameworks and architecture that will be used in developing the application.
Outputs	Design Maintainability Report

Project	E-Tendance Web Application
Work Package	**X09 - Configuration Management Plan**
Assigned To	Simon El Nahas Christensen, Li Shanlan
Effort	3 days
Start Date	1st October 2019
Purpose	To establish guidelines and controls for managing the configuration of the application. This is used to maintain consistency and support the overall change management efforts.
Inputs	System Requirements Specification, Prototype
Activities	Define and configuration items identification rules. Identify configuration items. Establish policies for configuration management measurements and activities. Define the configuration tools and best practices. Finally, establish configuration support activities

Outputs	Configuration Management Plan

Project	E-Tendance Web Application
Work Package	**X10 - Change Management Plan**
Assigned To	Simon El Nahas Christensen, Li Shanlan
Effort	3 days
Start Date	7th October 2019
Purpose	To establish guidelines and controls for managing the configuration of the application. This is used to maintain consistency and support the overall change management efforts.
Inputs	System Requirements Specification, Prototype
Activities	Define and configuration items identification rules. Identify configuration items. Establish policies for configuration management measurements and activities. Define the configuration tools and best practices. Finally, establish configuration support activities
Outputs	Configuration Management Plan

Project	E-Tendance Web Application
Work Package	**X11 - Risk Management Plan**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	2nd October 2019
Purpose	To establish guidelines and controls for managing the configuration of the application. This is used to maintain consistency and support the overall change management efforts.
Inputs	System Requirements Specification, Prototype
Activities	Define and configuration items identification rules. Identify configuration items. Establish policies for configuration management measurements and activities. Define the configuration tools and best practices. Finally, establish configuration support activities

Outputs	Configuration Management Plan

Project	E-Tendance Web Application
Work Package	**X12 - Release Plan**
Assigned To	Simon El Nahas Christensen, Li Shanlan
Effort	2 days
Start Date	8th October 2019
Purpose	Establish processes to ensure smooth initial release of E-Tendance as well as any subsequent software revisions and patches.
Inputs	Prototype
Activities	Identify release assumptions, constraints and risks. Next, define release approach and strategies.
Outputs	Release Plan

Project	E-Tendance Web Application
Work Package	**X13 - Preparation of Project Demonstration**
Assigned To	Simon El Nahas Christensen, MN Shaanmugam, Li Shanlan, Zeng Jinpo, Cao Ngoc Thai, Akshaya Muthu
Effort	3 days
Start Date	10th October 2019
Purpose	To prepare for the project demonstration, complete main functionalities of prototype and other necessary demonstration materials.
Inputs	Prototype
Activities	Complete development of prototype which includes the main functionalities of the product. Also, create powerpoint slides for explanation of system architecture choice and technical choices.
Outputs	Powerpoint Slides

Project	E-Tendance Web Application
Work Package	**X14 - Test Plan**
Assigned To	Zeng Jinpo, Akshaya Muthu
Effort	2 days
Start Date	14th October 2019
Purpose	Document and formalise the testing processes, including functional tests, non-Functional tests, system tests and user acceptance tests.
Inputs	Prototype
Activities	Identify test areas and test features in application. Define testing strategies and the appropriate completion criteria. Establish testing schedules and responsibilities.
Outputs	Test Plan

Project	E-Tendance Web Application
Work Package	**X15 - Requirements Test-Coverage Plan**
Assigned To	Zeng Jinpo,
Effort	1 days
Start Date	18th October 2019
Purpose	To compile and analyse findings from application testing.
Inputs	Test Plan
Activities	Prepare test cases and response sheet for testers. Schedule testing with users and relevant stakeholders. Once testings are over, collate and analyse user feedback to prepare test coverage report. Obtain users sign-off on the reports.
Outputs	Configuration Management Plan

Project	E-Tendance Web Application
Work Package	**X16 - Conduct Testing**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	22th October 2019
Purpose	To establish guidelines and controls for managing the configuration of the application. This is used to maintain consistency and support the overall change management efforts.
Inputs	Prototype
Activities	Define and configuration items identification rules. Identify configuration items. Establish policies for configuration management measurements and activities. Define the configuration tools and best practices. Finally, establish configuration support activities
Outputs	--

Project	E-Tendance Web Application
Work Package	**X17 - CMMI Level 2 Definition**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	23rd October 2019
Purpose	Define the maturity level of the development process and guide improvements.
Inputs	System Requirements Specifications, Software Quality Assurance Plan, Project Management Plan, Change Management Plan
Activities	Utilise the model framework and perform appraisal.
Outputs	CMMI Level 2 Definition

Project	E-Tendance Web Application
Work Package	**X18 - Upload and Deploy Project**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	28th October 2019
Purpose	To make the E-tendance web application available for use in all schools in NTU.
Inputs	Source Code
Activities	Initiate transition from development to operation environment. Establish target date to make application available and inform customers and users of the launch date.
Outputs	--

Project	E-Tendance Web Application
Work Package	**X19 - Project Presentation**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	28th October 2019
Purpose	To present the end-product to the project sponsor and relevant stakeholders and obtain feedback.
Inputs	Prototype
Activities	Schedule project presentation with project sponsor and relevant stakeholders. Prepare presentation slides and application demo. Hold the project presentation and obtain project sponsor's sign-off.
Outputs	A project presentation for project sponsor and key stakeholders. Approval by the project sponsor to go ahead with the release.

Project	E-Tendance Web Application
Work Package	**X20 - Sign-Off Project**
Assigned To	Zeng Jinpo,
Effort	3 days
Start Date	2nd November 2019
Purpose	To officially mark the end of the project and perform handovers.
Inputs	--
Activities	Close outstanding contracts and perform handover to the team maintaining the application and system.
Outputs	--

5 Project Estimates

5.1 Code Size Estimation using Function Points

The team calculated the unadjusted function points based on the complexity of functions provided by the E-Tendance system. Code size was then estimated by considering the adjusted function points.

5.1.1 Unadjusted Function Points

E-Tendance supports the following proposed functions

Student:

- Automatically recognize faces of students entering the classroom
- Automatically marks their attendance for the lesson
- Automatically differentiate students who are late from those who are not
- Manually retake photos of unrecognized students and store it in the database
- Automatically generates the class attendance list at the end of the lesson

Professor:

- Starts the attendance-taking session with appropriate course code and index
- Sends an e-mail to absent students

The measure of unadjusted function points is based on five primary component elements of these functions: Inputs, Outputs, Inquiries, Logical Files, and Interfaces. Each element ranges from Low Complexity, Medium Complexity to High Complexity. The detailed evaluation of the complexity is as follows:

Rating Inputs:

- Appropriate course code and index
- Live video feed for attendance-taking

Files Type Referenced (FTR)	**Data Elements**		
	1 - 4	5 - 15	Greater than 15
Less than 2	Low (3)	Low (3)	Medium (4)
2	Low (3)	Medium (4)	High (6)
Greater than 2	Medium (4)	High (6)	High (6)

Rating Outputs:

- View real-time attendance of students
- View full attendance list for the class
- Generate e-mail for absent students

Files Type Referenced (FTR)	Data Elements		
	1 - 5	6 - 19	Greater than 19
Less than 2	Low (4)	Low (4)	Medium (5)
2 or 3	Low (4)	Medium (5)	High (7)
Greater than 3	Medium (5)	High (7)	High (7)

Rating Inquiries:

- Professor changing the attendance of students if necessary

Files Type Referenced (FTR)	Data Elements		
	1 - 5	6 - 19	Greater than 19
Less than 2	Low (3)	Low (3)	Medium (4)
2 or 3	Low (3)	Medium (4)	High (6)
Greater than 3	Medium (4)	High (6)	High (6)

Rating Logical Files:

- Attendance List
- Database of Course Indexes

Files Type Referenced (FTR)	Data Elements		
	1 to 19	20 to 50	51 or more
1 RET	Low (7)	Low (7)	Medium (10)
2 to 5 RET	Low (7)	Medium (10)	High (15)
6 or more RET	Medium (10)	High (15)	High (15)

Rating Interfaces:

- Amazon Rekognition API

Files Type Referenced (FTR)	Data Elements		
	1 to 19	20 to 50	51 or more
1 RET	Low (7)	Low (7)	Medium (10)
2 to 5 RET	Low (7)	Medium (10)	High (15)
6 or more RET	Medium (10)	High (15)	High (15)

Summary of above analysis:

Element	Complexity	Detail
Inputs	Low	Appropriate course code and index
	Medium	Live video feed for attendance-taking
Outputs	Medium	View real-time attendance of students
	Low	View full attendance list for the class
	Medium	Generate e-mail for absent students
Inquiries	Low	Professor changing the attendance of students if necessary
Logical Files	Low	Attendance List
	Medium	Database of Course Indexes
Interfaces	High	Amazon Rekognition API

Calculation of Unadjusted Function Points:

Characteristic	Low		Medium		High	
Inputs	1	× 3	1	× 4	0	× 6
Outputs	1	× 4	2	× 5	0	× 7
Inquiries	1	× 3	0	× 4	0	× 6
Logical Files	1	× 7	1	× 10	0	× 15
Interfaces	0	× 5	0	× 7	1	× 10
Unadjusted FP	17		24		10	
Total = L + M + H	51					

5.1.2 Adjusted Function Points

Scoring	Meaning
0	No Influence
1	Insignificant Influence
2	Moderate Influence
3	Average Influence
4	Significant Influence
5	Strong Influence

Influence Factors	Score	Detail
Data Communications	5	Application requires active communication with Amazon Rekognition services
Distributed Functions	4	Distributed processing and data transfer occurs online and in both directions frequently
Performance	5	Response time is extremely critical since it is a real-time application
Heavily Used	4	Used multiple times by different Professors daily
Transaction Rate	4	Daily peak transaction period is anticipated.
On-Line Data Entry	1	Manual data entry is rarely anticipated since the application is mostly automated
End-User Efficiency	3	It needs to run smoothly on the school computers
On-Line Data Update	3	Attendance lists are updated online
Complex Processing	4	Complex processing required due to real-time facial recognition system
Reusability	4	The application is meant to be reused many times within NTU, and possibly in other institutions as well
Installation Ease	0	Installation is not required
Operational Ease	1	The application is mostly automated and hence, interaction with the application is kept to a minimum
Multiple Sites	4	Different Professors will be running the application at the same time during lesson hours
Facilitate Change	3	Unrecognized students will update the database with a new set of photos and the application is expected to recognize the students with the new pictures uploaded
Total Score	45	

Influence Multiplier =
Total Score × 0.01 + 0.65 = 45 × 0.01 + 0.65 = 1.10
Adjusted FP =
Unadjusted FP × Influence Multiplier = 51 × 1.10 = 56.10

5.1.3 Lines of Code

According to Quantitative Software Management (QSM), each Function Point requires 47 lines of code in JavaScript on average.

Therefore, **E-Tendance: Lines of Code** = 56.10 FP × 47 LOC/FP = **2637 LOC**

5.2 Efforts, Duration and Team Size Estimation

To estimate the effort and duration required for the project, we use function points as the basis to calculate Effort, Duration, Team size and finally the schedule. The estimates are expanded to account for project management and extra contingency time to obtain the total average effort estimates. From these averages, the duration of each work package in working days is estimated based on the following calculations.

- Number of Working Days in a Week = 5 Days
- **Effort** = Size / Production Rate = (2637 LOC) / (33 LOC/PD)[1] = **80 Person-Days**
- **Duration** = 3 * (Effort)$^{1/3}$ = 3 * (80 PD)$^{1/3}$ = **13 Days**
- **Initial Schedule** = (13 Days) / (5 Days/Week) = **2.6 Weeks**
- **Team Size** = 80 PD / 13 Days = **6 People**
- Working Hours in a Day = 8 Hours
- **Total Person-Hours (PH)** = 80 PD * 8 Hours = **640 Person-Hours**

[1] M. Sanjay, 'Information Theory and Best Practices in the IT Industry' (2003). Springer Science & Business Media, 2012.

5.2.1 Distribution of Effort

Work Package	Distribution	Estimation (PH)
Requirements Specification	46%	294.4
Design	7%	44.8
Implementation	26%	166.4
Testing	14%	89.6
Deployment	7%	44.8
Extrapolated Total Effort (PH)		**640**
Project Management	2%	12.8
Contingency	3%	19.2
Total Effort (PH)		**672**

These duration estimates are based on the assumption that each team member works an equal amount on any given work package.

5.3 Cost Estimates

Hardware:

Developer Workstations (already owned):

HP z4 G4 Workstation	
Intel Xeon W-2123 (3.6 GHz with Turbo Boost up to 3.9GHz, 4C8T, 8.25 MB Cache)	
16GB (2 x 8GB) DDR4-2666MHz DIMM ECC Reg	
M.2 256GB SSD & 1TB 7200rpm SATA 3.5" 2nd HDD	**Total** **$0.00**

Software:

License-based Software:

Node.js	**$0.00**
Amazon Web Services (AWS)	For the first 1 million images processed per month, Price per 1,000 Images Processed : $1.00 **Total** = (1,000,000 / 1,000) * $1.00 = **$1,000**

Software Licenses already owned:

Microsoft Office 2016	**$0.00**

Other Resources:

Staff Salary = 672 PH with $18.00/hr = **$12,096**

Logistics (Stationeries, Paper, and other Miscellaneous Costs) = **$300**

Total: $1,000 + $12,096 + $300 = **$13,396**

6 Product Checklist

The items listed below will be delivered on the stated deadlines according to the plan.

Project Deliverable	Estimated Deadline
Project Proposal	Sep 9th, 2019
Use Case Model	Sep 9th, 2019
System Requirement Specification	Sep 23th, 2019
Quality Plan	Sep 23th, 2019
Project Plan	Oct 14th, 2019
Risk Management Plan	Oct 14th, 2019
Prototype	Oct 14th, 2019
Test Plan	Oct 28th, 2019
Test Cases & Requirements Test Coverage Report	Oct 28th, 2019
Design Report on Software Maintainability	Oct 28th, 2019
Configuration Management Plan	Oct 28th, 2019
Change Management Plan	Oct 28th, 2019
Release Management Plan	Oct 28th, 2019

7 Best Practice Checklist

No	Practice
1	All paperwork must be documented properly from the start so that the work produced will be organised and neat.
2	The requirement specification for the project must not be rushed. It should be clear and concise so that everyone in the team has a clear goal in their minds.
3	The implementation of the project must be kept as simple as possible. This is to reduce the complexity of the overall development process and thus, making it much easier to change a feature or add new ones.
4	The team should communicate with one another regularly and update each other's progress. This is to make sure that everyone knows what is already done and what is required of them to do next.
5	The code developed should be reviewed by one another to ensure that everyone understands what is going on. This can also improve the overall performance of the application since more skilled developers can come up with better algorithms as required during discussion. Furthermore, the possibility of developers not following common coding practices is greatly reduced, thus making the code much cleaner.
6	The time and effort spent by the team members should be consistent. The work should not be underestimated and team members should not wait till the last minute to accomplish the given tasks. This will prevent the application from being too inefficient in performing its functions.
7	The code developed should be regularly updated in a Version Control System. This is a safeguard measure in the event that the application being developed suddenly ceases to function as it used to. The team can then easily revert back to a point in time when the application was working perfectly, and continue to work from there.
8	Sufficient time must be allocated to the testing of the software so as to reveal unlikely bugs and improve the performance of the application.

8 Risk Management

The following risks have been identified for the E-Tendance system:

- **Cost exceeds**

  Impact Severity: High

  Probability: 10%

  Impacts: The AWS Licensing is such that you pay for what you use. Therefore, if the application is used too frequently, the cost of using the AWS services will rise.

  Risk Reduction: Unnecessary costs should be minimized for general logistics. If the Amazon Rekognition services turns out to be too costly, another alternative method should be considered for facial recognition such as Microsoft Azure services.

- **Underestimation of work**

  Impact Severity: Moderate

  Probability: 25%

  Impacts: Team members might neglect the work given to them until the very last minute. This will either result in them not meeting the deadlines, or a reduction in the quality of the work Produced.

  Risk Reduction: Closely follow the Project Management schedule to have a good estimate of how much time should be spent on each phase of the software development. If work is still felt to be too rushed, they should edit the Gantt Chart accordingly in advance and try to keep up with the new schedule.

- **Conflicts within team members**

  Impact Severity: Moderate

  Probability: 20%

  Impacts: Misunderstanding between team members will cause tension among them, resulting in a further decrease in productivity.

  Risk Reduction: Team members should be open to ideas from others and should be able to receive criticism. After regular meetings, they can spend some time together to bond outside working hours.

- **Important staff are unavailable**

  Impact Severity: Moderate

  Probability: 15%

  Impacts: Team members may be busy with other projects and hence, could not spend too much time on this project alone. This will eventually delay the project deliverables.

  Risk Reduction: Each component is assigned to multiple team members so that the team members can depend on one another and complete their given tasks.

9 Quality Assurance

The project will achieve the quality assurance following the standards set in the Quality Plan.

The E-Tendance system shall make use of two testing methodologies:

- Unit Testing involves testing system components individually
- In-Place Testing involves testing the whole system as a unit

The implementation of the quality assurance is the responsibility of the Quality Assurance Manager (QAM). The QAM provides Project Management with visibility into the process being used by the software development teams and the quality of the products being built. The QAM maintains a level of independence from the project and the software developers. In support of software quality assurance activities, the QAM has assigned and secured Software Quality (SQ) personnel from the pool of available SQ trainees to coordinate and conduct the SQ activities for the project and report back results and issues.

The following product assessments will be conducted by the SQ personnel:

- Identifying the core functionalities of the E-Tendance system and its special features
- Quality check on the code written
- Check the core functionalities of the initial prototype
- Check on the improvements to existing features of the prototype and also the supplementary functionalities of the application in the subsequent prototypes
- Check all the functionalities of the finalized product and make sure it is in a working condition and ready to be shipped

The following process assessments will be conducted by the SQ personnel:

- Ensure that the project requirements are implemented and the product does not deviate from the original design
- Ensure that the libraries or technology used to develop the system are in conformance with the contract
- Ensure that there is a quantitative way to measure the progress of the development of the project, and review it regularly as progress is made

10 Monitoring & Control

Many procedures are required in order to be able to successfully monitor the progress of a software project. Some of the most important are:

Quantitative Measurement of Resource Consumption: An estimation of the resource requirements, especially human resources, can provide a quantitative measurement of the project progress. The percentage estimates of each milestone's resource requirements allow to easily track the current progress of the project.

Identification of Major Project Risks: Early identification of major risks to the project allows for placement of preventative measures before problems can develop. Major risks have been identified in the Risk Management section of this document, along with the measures being taken to avoid them.

Regular Reviews of Project Progress: Throughout the duration of the E-Tendance project, the team will meet weekly to review the progress of all project tasks, including management, planning, analysis, development, and testing. The outcomes of the meetings will be recorded in a separate Meeting Minutes document.

Timeline Planning and Task Decomposition: This document outlines an estimated timeline for the project. A reasonably accurate timeline can be assembled by hierarchically decomposing tasks into measurable subcomponents and estimating requirements for each. At the same time, this decomposition can assist in task assignment and balancing. Throughout the implementation phase, these subcomponents can allow for fine-grained measurement of progress. Project subcomponents and timeline estimates are included in the Estimates and Work Breakdown Structure sections of this document.