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Text To Learn: A Digital Training System for Global Social Enterprises

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Text To Learn: A Digital Training System for Global Social Enterprises

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Text To Learn: A Digital Training System for Global Social Enterprises

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ABSTRACT

Text to Learn is a training tool made with Social Enterprises in mind that uses SMS to distribute training materials and to test users on their learning. Our goal is to give social enterprises a way to train employees and customers digitally and remotely. We will create an online dashboard, using RapidSMS and a cloud storage service, for social enterprises to upload and send training materials, manage users, and create SMS-based quizzes to assess users progress.

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Chapter 1

Introduction

1.1 Background

Social enterprises are rising in prevalence in developing countries to help address issues related to social, economic, environmental, and other issues that these countries face. We worked with two different social enterprises in Nepal and India, respectively, and saw the life-changing work they do for extremely disadvantaged people. However, we also encountered some of the problems that these types of organizations face, especially concerning training of employees. Many factors contribute to the difficulty social enterprises have in providing proper and effective training for their employees, including fewer resources relative to other types of organizations and logistical barriers inherent to working in developing countries. Employee training is vital for social enterprises to succeed in both their social missions and business goals, and cannot be taken for granted in the context of the developing world.

Social enterprises take on various approaches to training their employees, but most of these approaches do not overcome the barriers described above. Anudip, the organization Melissa worked with in India, holds annual Training of Trainers events, where hundreds of trainers gather and receive formal lessons on how to teach new employees either English/workplace readiness or information technology (IT) skills. While this event is great for uniting all of the Anudip trainers and sharing ideas, it is not necessarily the most effective way to train employees. The training was impersonal due to such a large number of people, and many of the employees seemed unfamiliar with the material that they were supposed to teach to others.

Anudip also has informal training in each of its centers, which typically is conducted by having the trainer working at a computer and explaining the material to a group of employees crowded around her. Anudip, like many social enterprises, does not have the resources for designated classrooms, so training happens in the main workspace alongside other working employees. Additionally, this informal training, while very personal, can be fast-paced and overcrowded, making it hard for employees to learn the material effectively. Our senior design project addresses these

difficulties social enterprises face in trying to train employees.

Our solution to this issue of training in social enterprises is to use mobile phones, which are becoming increasingly popular in developing countries. We have developed Text to Learn as a system for trainers within social enterprises to upload digital training materials to a common repository. This information can then be sent as SMS text messages to the mobile phones of employees who are registered by the trainers. Text to Learn is interactive with the addition of quizzes created by the trainers. Registered employees can respond to these quizzes via SMS.

This product addresses the issue of lack of resources by utilizing a resource that nearly all people, even in developing countries, already have—the mobile phone. More specifically, we have developed the system to be used on feature phones, which are less advanced than smartphones and much more common in the developing world. Furthermore, this product overcomes the logistical barriers many social enterprises face by allowing training and learning of materials to be done on employees own time, at their own pace, and in their own space. Employees will have full access to training materials as they will be stored on their personal feature phones. They will also not be limited to training only at work where computers are available, but can learn from the materials on their phones at home as well.

Ultimately, Text to Learn is an affordable, adaptable, accessible, and appropriate solution for social enterprises to provide vital training to their customers and employees and continue producing social benefit for the developing world.

1.2 Project Overview

Our system is a website interface for social enterprises to upload and send training materials and quizzes, which are sent as SMS messages to trainees mobile phones. Through the website, trainers are also able to manage users, keep track of all messages sent and received, and monitor users' progress on training and quizzes. Text to Learn could be used in addition to or in place of other traditional training methods.

Chapter 2

System Requirements

2.1 Requirements

From discussions with a social entrepreneur, founder and CEO of Anudip Dr. Radha Basu, and by reflecting on our own experiences working abroad with social enterprises, we have compiled the following requirements for this project. Functional requirements are quantitative and describe the actual functions our system needs to be able to perform, while nonfunctional requirements are qualitative and describe the way in which the functional requirements are implemented.

Functional

Critical

- Trainers are able to make training materials available to trainees digitally.
- Trainers are able to test trainees knowledge of training materials.
- Trainers are able to view results of quizzes.
- Trainers are able to enable/disable quizzes.
- Trainers are able to register/unregister trainees for use of system.
- Trainees are able to access training materials.
- Trainees are able to receive training materials in small pieces.

Recommended

- Trainers are able to send notifications when new training materials are added.
- Trainees are able to automatically receive results from quiz.

- Trainees are able to view their progress.
- Trainees are able to access notifications/training materials multiple times.

Suggested

- Trainers are able to set a time limit on the completion of quizzes.

Non-Functional

Critical

- Compatible with basic/feature phones.
- Easy to read.
- Low distribution costs for social enterprises.
- Portable to different web and mobile platforms.
- Maintainable.

Recommended

- Scalable for more users.

Suggested

- Open source, extensible.
- Support for multiple languages.

2.2 Use Cases

For our implementation, we have come up with several key use cases for the two types of users of our system: trainers and trainees. The following figures visually describe the main functions for each type of user. The primary use cases are also described in greater detail below.

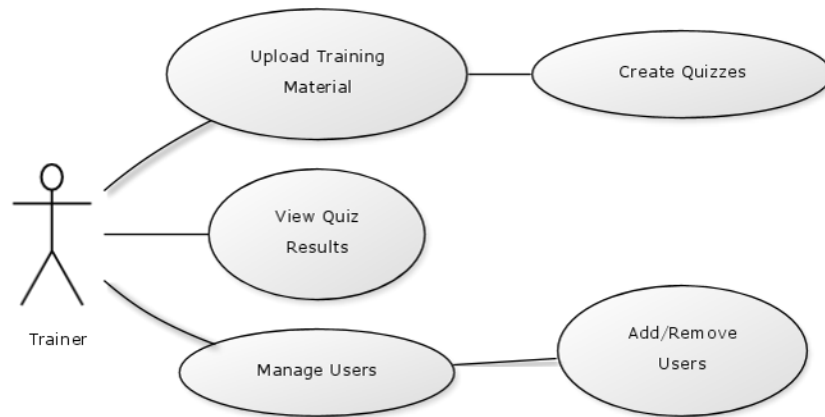


Figure 2.1: Use Case for Trainers

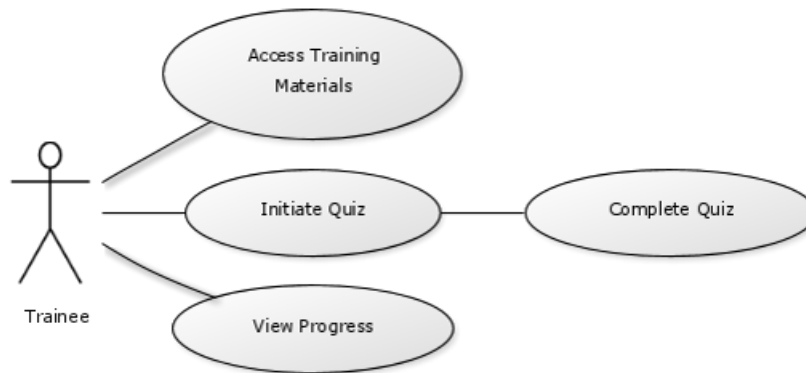


Figure 2.2: Use Case for Trainees

Case 1 - Upload Training Material

Actor: Trainer

Goal: Materials with related quiz are ready to distribute.

Preconditions: Have materials in a plaintext format, be a registered user, and internet connection.

Postconditions: Materials are uploaded and a quiz is created.

Scenario:

1. Navigate to the Add New Materials page.
2. Enter text of training materials into the box.
3. Write in the questions answers in the appropriate boxes.
4. Hit Submit.

Exceptions:

1. Text is too long to process.
2. Something on the site is broken.

Case 2 - Add User

Actor: Trainer

Goal: Grant access to training materials to their employees.

Preconditions: Be a registered user, know the phone-number the employee will be using.

Postconditions: A registered user can download training materials.

Scenario:

1. Navigate to the “Manage Users” page.
2. Select Add Contact from the action list.
3. Enter the new users name and mobile number.
4. Hit “Save” to store the number and send a verification text to the trainee.

Exceptions:

1. Incorrect mobile number.

Case 3 - Manage/Edit Training Materials

Actor: Trainer

Goal: Ability to view and edit all uploaded training materials, quizzes, and related SMS messages.

Preconditions: Be a registered user, have previously uploaded training materials, and internet connection.

Postconditions: Training materials can be edited.

Scenario:

1. Navigate to the “Training Materials” page.
2. To add a new training material, click on “Add new” within the Training Materials Panel.
3. To view or edit an existing training material, click on “List Training Materials” in the action list and then click on the title of the desired training material.
4. Once a training material has been saved, it can be previewed by clicking “Preview” at the bottom of its edit

page.

5. To assign and send a training material to users, select “Assign” next to the desired training material from the main “List Training Materials” page, check users to assign to, and click “Assign and Send Notification”.

Exceptions:

1. Cannot edit texts that have already been sent; must send new version.

Case 4 - Initiate and Take Quiz

Actor: Trainee

Goal: Respond to quizzes based on specific training materials.

Preconditions: Trainee is registered by trainer and has received and completed reading training materials on phone.

Postconditions: Trainee can submit responses to quiz.

Scenario:

1. Receive assignment notification text message with instructions on how to begin quiz.
2. Reply to message following the instructions to begin quiz.
3. Receive quiz questions one at a time on phone as SMS messages.
4. Answer questions by texting back answer along with appropriate tag.
5. Receive feedback and correct answer if applicable.
6. Quiz results are sent back to webpage to be parsed and stored in cloud.

Exceptions:

1. Quiz is not available.

Chapter 3

Design and Implementation

3.1 Trainer Interface: The Website

The following are screenshots of the website we designed and built for the trainers. These five images show the main pages of our website: Home, Add a User, Training Materials, Assign Training Material, and Message Log. The goal is a clean, simple interface that is intuitive and functional. Additional screenshots from the website are included in the Appendices.

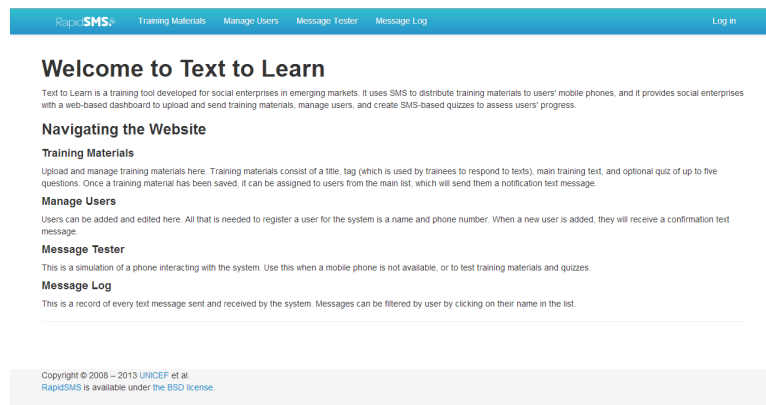


Figure 3.1: Home page

RapidSMS
Training Materials
Manage Users
Message Tester
Message Log
Admin
Log out admin

Manage Users

ACTIONS
[List Contacts](#)
[Add Contact](#)
[Bulk Add Contacts](#)

Add Contact

Name

Language

The language which this contact prefers to communicate in, as a W3C language tag. If this field is left blank, RapidSMS will default to: en-us

Backend

Identity

[Save Contact](#)
[Delete Contact](#)

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Figure 3.2: Add a User

RapidSMS
Training Materials
Manage Users
Message Tester
Message Log
Admin
Log out admin

Training Materials

ACTIONS
[List Training Materials](#)
[Add Training Material](#)

All Training Materials

Title	Date	Assign
Advanced XML	05/17/2014 10:50 p.m.	Assign
Intro to HTML	05/17/2014 10:50 p.m.	Assign
Mobile Phones Around the World	05/08/2014 5:42 p.m.	Assign
Our Project	05/08/2014 3:29 p.m.	Assign

[Prev](#)
[1](#)
[Next](#)

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Figure 3.3: Training Materials

RapidSMS
Training Materials
Manage Users
Message Tester
Message Log
Admin
Log out admin

Training Materials

ACTIONS
[List Training Materials](#)
[Add Training Material](#)

Assign Training Material

Assigned users

- ☐ Kate
- ☐ Chase
- ☐ Luzy
- ☐ Melissa
- ☐ Tester
- ☐ Leslie
- ☐ Mike

Title: Mobile Phones Around the World

Tag: MOBILE

Messages

According to a UN study of the world's 7 billion people, 6 billion have access to mobile phones, but only 4.5 billion have access to working -Reply NEXT MOBILE toilets!

Basic cell phones have been used around the world to read books, access bank accounts, and coordinate initiatives such as respon -Reply NEXT MOBILE ties to natural disasters and human trafficking -Reply QUIZ MOBILE

Quiz

Question 1 What percentage of the world is using mobile phones? A Over 80% B Around 50% C Less than 25% choose A, B or C

Answer A

[Assign and Send Notification](#)

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Figure 3.4: Assign Training Material to Users

RapidSMS

Training Materials

Manage Users

Message Tester

Message Log

Admin

Log out admin

Message Log

Contact	Connection	Direction	Date	Text
Lizzy	17083077099 via my-tropo-backend	Outgoing	05/08/2014 5:24 p.m.	You have not started this training material
Lizzy	17083077099 via my-tropo-backend	Incoming	05/08/2014 5:24 p.m.	Next Minute
Lizzy	17083077099 via my-tropo-backend	Outgoing	05/08/2014 5:24 p.m.	ses to natural disasters and human trafficking -Reply QUIZ MOBILE
Lizzy	17083077099 via my-tropo-backend	Incoming	05/08/2014 5:24 p.m.	Next mobile
Lizzy	17083077099 via my-tropo-backend	Outgoing	05/08/2014 5:23 p.m.	toilets! Basic cell phones have been used around the world to read books, access bank accounts, and coordinate initial
Lizzy	17083077099 via my-tropo-backend	Incoming	05/08/2014 5:23 p.m.	next mobile
Lizzy	17083077099 via my-tropo-backend	Outgoing	05/08/2014 5:23 p.m.	According to a UN study of the world's 7 billion people, 6 billion have access to mobile phones, but only 4.5 billion have
Lizzy	17083077099 via my-tropo-backend	Incoming	05/08/2014 5:23 p.m.	Start mobile
Lizzy	17083077099 via my-tropo-backend	Outgoing	05/08/2014 5:22 p.m.	You have been assigned Mobile Phones Around the World. To begin, reply with START MOBILE.
Mike	17082635465 via my-tropo-backend	Outgoing	05/08/2014 4:40 p.m.	Correct. (quiz complete)
Mike	17082635465 via my-tropo-backend	Incoming	05/08/2014 4:40 p.m.	Ans a
Leslie	17088333971 via my-tropo-backend	Outgoing	05/08/2014 4:40 p.m.	Correct. (quiz complete)

Prev

1

2

3

...

72

73

Next

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Figure 3.5: Message Log

3.2 Trainee Interaction: The Phone

Trainees, or the users that are registered for Text to Learn, interact with the system through their mobile phones via SMS text messaging. Once their phone number has been registered by a trainer, they are able to text the Text to Learn phone number. At any time, a user can get help for using our system using the *HELP* command. The help commands are listed in the table below:

Table 3.1: Help messages

Text Sent by Trainee	Text Received by Trainee in Response
HELP	Reply HELP TRAINING or HELP QUIZ for instructions.
HELP TRAINING	To start, reply START TAG. Example, START INTRO. To continue, reply NEXT TAG.
HELP QUIZ	To start, reply QUIZ TAG. Example, QUIZ INTRO. To continue, reply ANS youranswer.

While the trainee is reading a training material or taking a quiz, there are three text commands that can be used (in addition to *HELP*, which can be used at any time): *START*, *NEXT*, and *QUIZ*. These are each followed by the unique tag associated with the current training material. The training material and quiz text commands are described in the table below:

Table 3.2: Text messages used during training materials and quizzes

Status	Text Received by Trainee
Once assigned a training material	You have been assigned <training material title>. To begin, reply with START <tag>.
After starting a training material	...training material text -Reply NEXT <tag>
At final message of training material with a quiz	...training material text -Reply QUIZ <tag>
At final message of training material without a quiz	...training material text (end)
At final message of quiz	...final quiz question feedback (quiz complete)

If any other command that is not listed above is sent to the Text to Learn phone number, then a default message will be sent back as a response:

Table 3.3: Default text message for invalid commands

Status	Default Text Received by Trainee
If an invalid message is received by Text to Learn	Invalid message. Reply HELP TRAINING or HELP QUIZ for instructions.

3.3 System Design

The following diagrams show our design visually by specifying the three main components of our system (webpage, cloud storage, and SMS service), the main functionality of each component, and how they interact with each other.

Our system is designed around three main components: a website, SMS, and cloud storage. The website is the way trainers or distributors interact with the system. Through the website, trainers can login to the office of their choosing and manage users, add new training materials and quizzes, and view, edit, and manage previously uploaded training materials and quizzes. To add users, the trainer simply needs to know the trainee's phone number and add it into the system. Adding new training materials and quizzes requires trainers to have these in plain text format and then copy and paste them into the appropriate text fields. From there, the materials can be assigned and sent to trainees via SMS. Through the website's message log, the trainers are able to view every message sent and received by the system, and filter this by user to see a particular user's responses to a quiz.

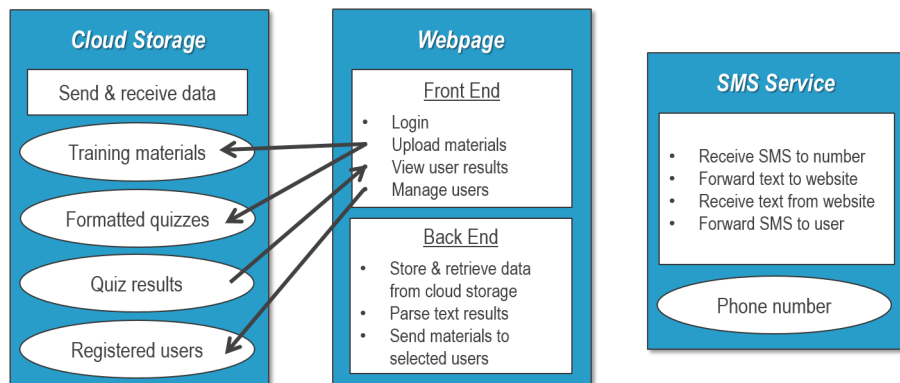


Figure 3.6: System Diagram for Trainer

Trainees will interact with the system through SMS. ...

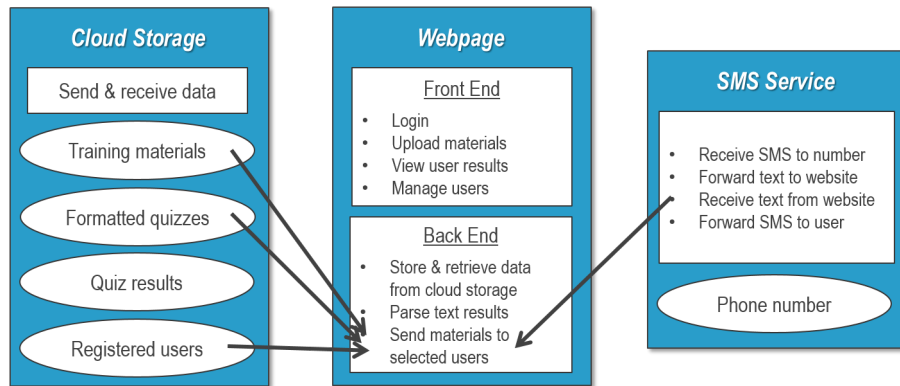


Figure 3.7: System Diagram for Trainee Request

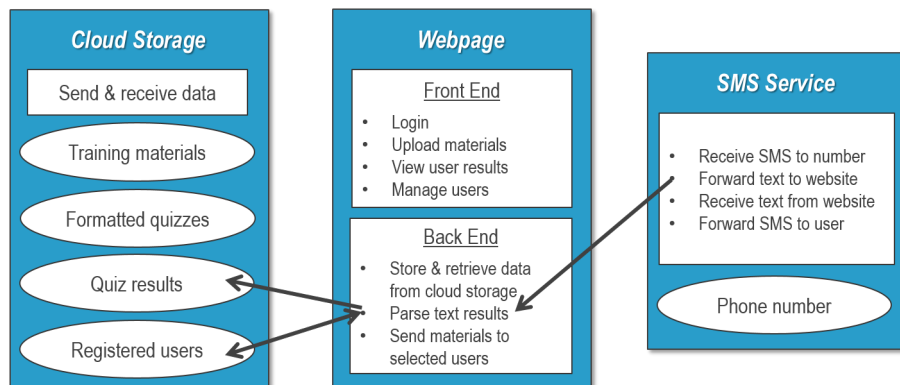


Figure 3.8: System Diagram for Trainee

3.4 Technologies Used

RapidSMS a recent UNICEF project built to integrate SMS services with the Django web-framework

Django a web-framework that lends itself to form collections

Python the primary programming language used in Django

dotCloud a cloud web-hosting service that hosts our website in a Python web server and our data in a PostgreSQL database

Tropo a web-based SMS service that generates a phone number and API to connect to websites

GitHub version control system

3.5 Design Rationale

We chose to use a cloud service for storage rather than a local server. The cloud service holds all of the information that is sent and received between trainers and trainees, including training documents, formatted quizzes, quiz results, and registered users. Storing information in the cloud means that it can be accessed by other people directly through the internet, so trainers have access to this information from any computer with internet connection, whether at the office or at home. The cloud offers storage for large amounts of data, so trainers will not be limited by storage space when uploading training materials. The alternative to using cloud storage would be to have all of the training materials stored on a server belonging to the individual social enterprise. We decided against this option because cloud computing is the technology of the future. Although all social enterprises may not have the capability to use cloud services at their offices currently, cloud computing is growing rapidly in popularity and is sure to be utilized by more social enterprises eventually.

We considered building our system as a native phone apps, however we saw more barriers to this approach versus an SMS-based system. Since our target audience will often have the most basic phones, their phones may not be able to support even Java applications that are available on most feature phones, and would require use of the internet which again is often not supported. Even if these problems were not a barrier, the application would need to be installed on the phone, and not all phones have a way to install applications via the Web and may require the phone owner to go to their office to install the application. Essentially, using SMS has virtually no startup costs, and it will reach the broadest audience possible in emerging markets.

The system will also be using a paid SMS service to manage incoming and outgoing texts. While we could have written scripts to send texts from an email address for free, we would have needed to know the users service provider, and that service provider must have an email domain which may not be extensible to developing countries. There are open source models that work by plugging a gsm modem with a sim card into a computer to receive texts, but these are often difficult to work with and hard to scale. For these reasons, we made the decision to use a paid SMS service rather than using an email address to handle text messaging.

Chapter 4

Testing and Documentation

4.1 Testing

4.2 Documentation

Chapter 5

Project Management

5.1 Project Schedule

Our development timeline for completing various portions of the project is defined in the Gantt charts (see **Appendix A**). There is one chart per quarter, each displaying the actual weekly timeline for the work Lizzy and Melissa accomplished. Since they worked together on all aspects of the project, there is no distinction between their work on the charts.

5.2 Risk Management

In addition to creating a schedule of when to complete different tasks for our project, we also compiled a list of potential risks to our project in the fall, including their probability of occurring, severity, and total impact. This risk analysis includes mitigation strategies for each risk so that if a risk were to occur, we would be prepared for it. These are defined in the following risk analysis chart, Table 1:

At the completion of our project, we re-evaluated our risk analysis and made changes to reflect the actual risks, severities, and impacts. This updated risk chart is defined in **Appendix A**.

Chapter 6

Societal Issues

Ethical

Our project's goal is to aid social enterprises by utilizing a widely accessible platform, mobile phones, to distribute information, particularly training materials. Information can be difficult to distribute in the developing world due to poor infrastructure. Getting new information to customers and employees of social enterprises far from centralized offices is crucial, but difficult. After each of our two team members worked with social enterprises over the past summer, we both recognized the importance of effective and accessible training within this type of organization. Applications of our project more generally could aid in education by giving anyone with a mobile phone the ability to learn from the materials.

Several ethical concerns could arise from the use of our product by both employers who distribute materials and employees who access the information. From the distributor end, employers could potentially misuse our system to distribute false information. Furthermore, employers could give access to others to our system to upload information. If our security is poor, others could gain access without the permission from the organization, which could affect the authenticity of uploaded training materials. Additionally, since our product is also meant to be used as an evaluation tool through the SMS quiz feature, there is potential for unethical usage from the trainee end as well. If training is being used by a social enterprise to certify employees on certain training information rather than simple reinforcement of material, the trainees could cheat much more easily than by more traditional evaluation methods. We will need to consider implementing authentication and security features into our system to address these concerns about the ethics of using our product.

Social

Since we are building a product meant to be used in the developing world, specific ethical concerns arise related to social responsibility and appropriateness. Our customer base has very different requirements than a customer from a developed country would have. It is important for us to be culturally aware of our customers and potential users of the product. We will be able to do this by keeping in communication with these potential users, which will be possible for us after working and making contacts with people from developing countries over the summer. We will make sure that our technology is appropriate, usable, and affordable for the specific clients we are working with, in addition to meeting the specific functional and nonfunctional requirements they have asked for.

Political

Economic

Health and Safety

Manufacturability

Sustainability

Environmental Impact

Usability

Distributor End

What the distributor, or trainer, sees is the part of the product we have the most control over. They will upload training materials and quizzes through a website. On this website they will manage their user base by adding phone numbers of employees they wish to register to receive their uploaded documents. They can also view results of quizzes and materials accessed by their trainees.

Since our product is meant to be used by social enterprises in the developing world, the technical level of the user may vary greatly, and as a consequence we designed our product with this in mind. The website includes easy-to-use forms to cut and paste in training materials for the trainees to read. Navigating the website is intuitive and simple through clearly named and well-placed buttons and links. Since this could be used in many different countries, it is important to consider easy ways to change language content in our design to make the website as accessible as possible.

Receiver End

The receiver end of our product consists of SMS messages containing the text of uploaded documents from distributors. The main aesthetic goal for the receivers is simplicity, as we intend for our system to be usable on the simplest type of mobile phones. The text messages will have to comply with basic SMS message lengths, which is typically around 140-160 characters. Because most training documents will be longer than this, we will implement functionality for receivers to easily continue receiving text messages until they have received the entire document. This function will likely be implemented by having the receiver press 1 to receive the next text message. If there are any quizzes accompanying the training documents, they can press 2 to receive to receive the quiz in a separate text message. All of these instructions will be included concisely at the end of each message to ensure that users will always receive entire training documents.

Lifelong Learning

Compassion

Chapter 7

Conclusions

7.1 Summary

7.2 Lessons Learned

7.3 Future Improvements

Chapter 8

Appendices

8.1 Project Schedule

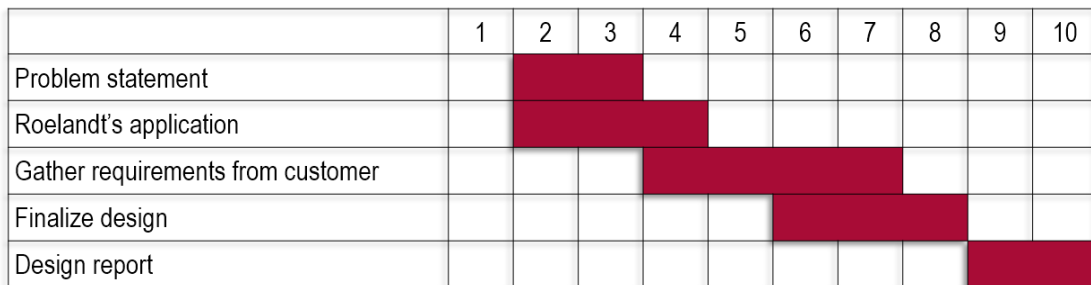


Figure 8.1: Gantt Chart for Fall Quarter

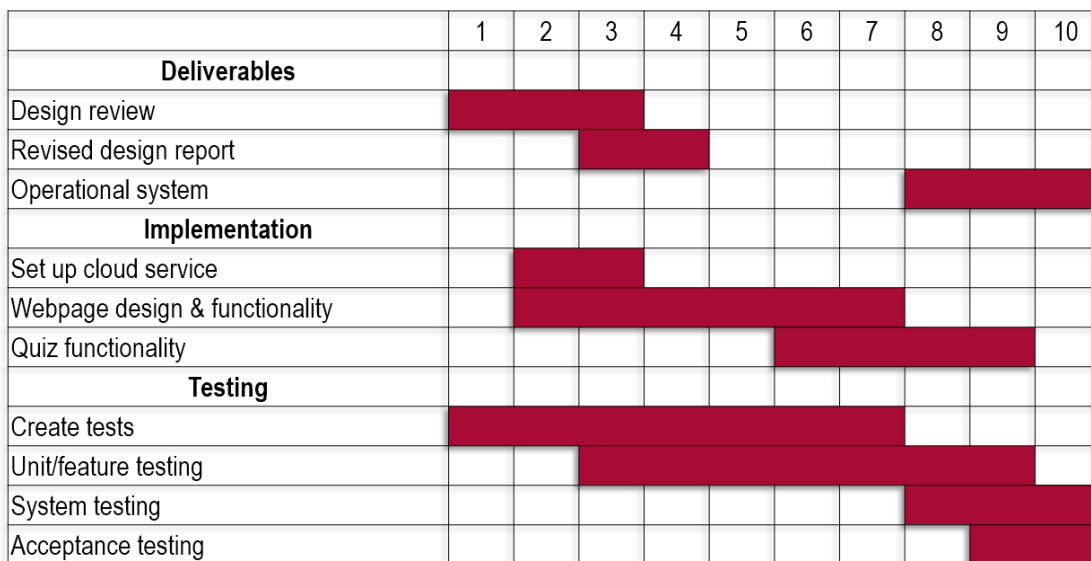


Figure 8.2: Gantt Chart for Winter Quarter

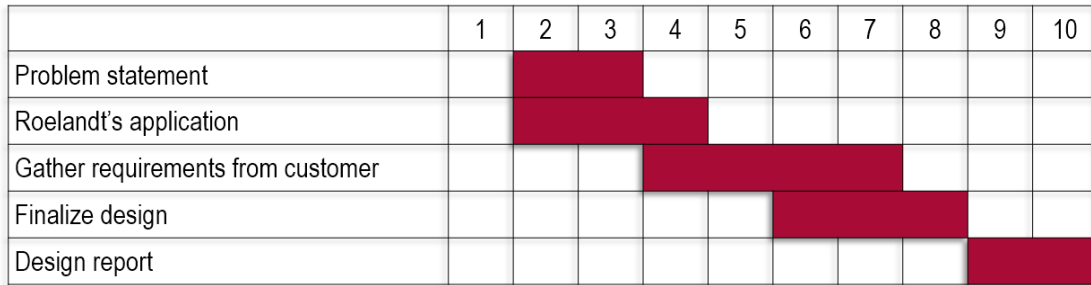


Figure 8.3: Gantt Chart for Spring Quarter

Table 8.1: Risk Analysis

Risk	Consequence	P	S	I	Mitigation Strategy
Scope of project larger than anticipated	Delayed completion	1.0	5	5.0	- Prioritize features and cut those with lowest priority if necessary. - Follow Gantt chart .
Team members do not complete their tasks	Missed deadlines	0.5	6	3.0	- Ensure both team members fully understand every component of the project.
Problems with RapidSMS	Delayed completion, restructuring of project	0.3	8	2.4	- Learn RapidSMS before starting.
Data loss	Lost work, delayed completion	0.1	5	0.5	- Keep backups . - Be careful with version control .

8.2 Setup and Installation

8.3 User Manual

8.4 Source Code