goldFish
Technologies

15 February 2009

Patrick Leung
School of Engineering Science
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Re: ENSC 440 Functional Specifications for the De-Tech Reminding System

Dear Professor Leung:

The document included outlines the functional specifications for goldFish Technologies' D-Tech Reminding System. We are designing and implementing a device that will scan a person as they are leaving their home, check for important items that they have forgotten to bring with them, and alert them of these items.

Our functional specifications document describes the high level functional requirements for our device. The specified requirements will also be used by the members of the team to direct the design, development and testing efforts of our project.

goldFish Technologies is built of five motivated and skilled fifth year engineering science undergraduates: Owen Lin, Sami Nguyen, Sharika Salim, Jeremy So, and Christopher Yao. If you have any questions or concerns, please feel free to contact us at ensc-goldfish@sfu.ca.

Sincerely,

Sharika Salim
Chief Executive Officer
goldFish Technologies

# Functional Specifications:

RFID-Based Reminder System

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## Submitted to:
Mr. Patrick Leung
Mr. Steve Whitmore

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**Revision:** 1.0

# Executive Summary

*The Best Reminder Before Leaving Your Home*

As most people have experienced the inconvenience of forgetting something important while leaving for school, work, or even social events, the creation of a reminder system that integrates seamlessly into everyday routines would save time and even money. The recent advances in communication technology have created various opportunities for innovative designs and solutions. Taking advantage of this, we at goldFish Technologies are probing various possibilities to create products for the sake of easing the everyday lives of our customers. Our invention, D-Tech, seeks to integrate technology to create a reminder system that is able to scan and identify a household member as they leave their home. In the case that the family member leaves something of importance behind, the system would notify them. We hope this solution will bring ease of comfort to those who, due to various reasons, often forget items of importance.

The D-Tech system consists of two main components: the Central unit and the Detect-and-Scan unit. These two units are installed at the main household exit and serve the following functionalities:

- Detect and identify a user as they are leaving their home.
- Scan for tagged items on the user and notify them if any items are missing.
- Display relevant to-do tasks and notes to the user.
- Allow touch-based user interactions for task and item input.

In addition to these main components, a standalone accessory to the D-Tech system called the Anywhere Access Form, gives users an alternative method for item and task input to the D-Tech system database. It is a web-based application that can be accessed over the internet by the user's own computer.

This document presents the functional specifications of the D-Tech reminder system. While our main focus is to outline the functional specifications of the proof of concept prototype, we will also mention some future functionality that would possibility be added to the final commercial product.

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# List of Figures

# Glossary

RFID           Radio Frequency Identification
LCD             Liquid Crystal Display
AC              Alternating Current
GUI             Graphical User Interface

# 1. Introduction

The D-Tech system is an item and task reminding device which can be installed at the user's front door. Once items have been tagged with our SmartTags and entered into the system's database, the system will be able to scan and detect whether or not specific items are missing, as a person passes their front door. If there is a mismatch between the list of items the user wanted to bring, and the list of items that are on the user, the system will notify the user by displaying the missing objects on a touch-based liquid crystal display (LCD). In addition, the user can also specify tasks that they wish to be reminded of when they are leaving their home.

## 1.1. Scope

This document details the high-level requirements of the D-Tech system. It provides a detailed description of the required functionality for a proof of concept model and partially describes the required functionality for the production model. The listed requirements will guide design phases and will be highlighted in future design documentation.

## 1.2. Intended Audience

This document is to be used by all members of goldFish Technologies. The team lead will refer to it in order to track the group's progress, and the design engineers can use the specified requirements as design goals for the completed system. The requirements can aid the test engineers when they are designing system tests, and will help them verify the validity of the outputs.

## 1.3. Classification

The following convention will be used to differentiate between different classes of requirements:

[R#-I]     Applies only to the proof of concept prototype
[R#-II]    Applies to the proof of concept prototype and the final product
[R#-III]   Applies only to the final product

# 2. System Requirements

## 2.1. Understanding the User

The D-Tech system is intended for average busy households. In a family, generally each member has multiple personal commitments and belongings. Commonly, a calendar or to-do list is used to organize tasks and note personal reminders. The use of our product will facilitate family members in scheduling task and item reminders to a single electronic unit, and hence better organize their daily activities.

## 2.2. System Overview
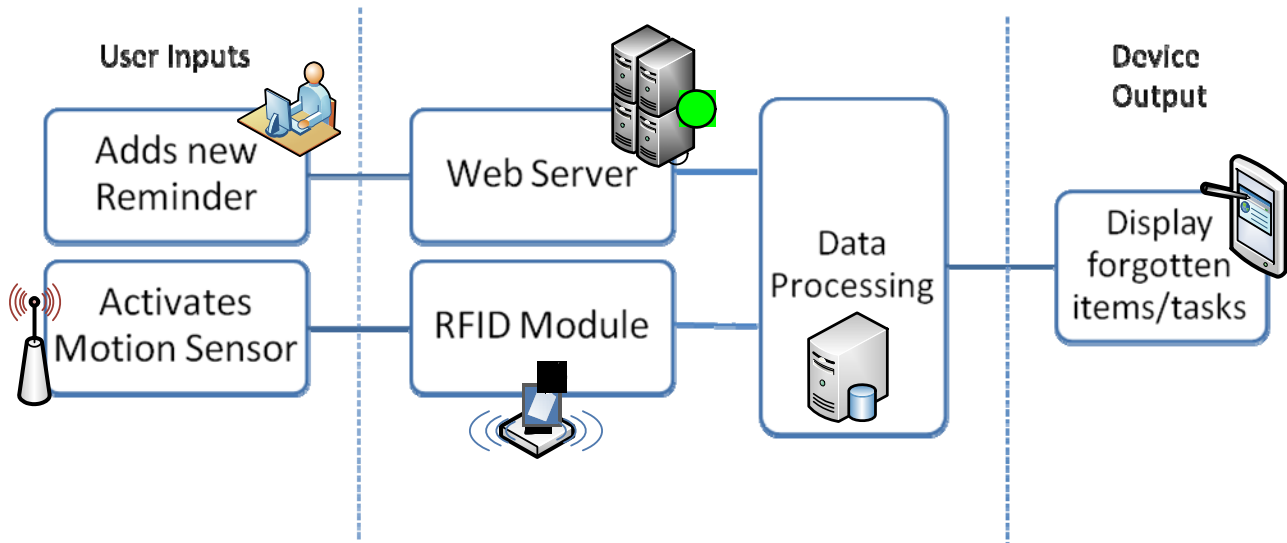


**Figure 1: High Level Functional Block Diagram**

The D-Tech system consists of two essential subcomponents: the Detect-and-Scan module or radio frequency identification (RFID) module, which detects the SmartTags on the user; and the central D-Tech System Door Unit, which takes care of the data processing and output display functionalities. Essentially all items can be added at the central unit. However, in order to increase usability, items can also be added through an internet form. Thus our product integrates the user's own personal computer into the system's functional design.

The functionality of each unit is as described:

1.  The Personal Computer and online form: *The Anywhere Access Form*
    *   As it might become inconvenient for users to have to go to the door every time they want to add a new reminder item, a personal computer can be used instead.  Additionally, the user can specify the dates that reminders need to occur on. In this case, the central unit will access a web server in order to download information from the server database and acquire the list of added items.

2.  The RFID Module: *The Detect-and-Scan Module*
    *   The RFID module is always on stand-by until a user walks by. When the user walks by the door, a sensor activates the module to scan the user to record all items that are on the person. The detected items are then sent to the central unit for comparison and display.

3.  The Central Unit: *The D-Tech System Door Unit*
    *   The central unit is used to determine the identity of the user, and display reminders pertaining to this user. This component compares information from the item reminder list and the detected SmartTag list to display possible missing items to the user. This component is crucial to the system's functionality as it is the only subsystem that communicates with the user.

The D-Tech system is separated into two stages during use. The input stage requires the user to manually enter a list of important items that are tagged with SmartTags. These entered items are what the user wishes to be reminded of, should the user leave the household without them. The remind stage does not require any user control and the system will automatically scan the user anytime he/she is leaving the household. During this stage, in the case that the user forgets to bring any tagged items, the system will alert the user via an audio indication and specify the items that were forgotten.

## 2.3.  General Requirements

[R1-II]    The system shall detect the identity of the user and provide information related to this user.

[R2-II]    The system shall activate when signal from Detect-and-Scan unit is detected.

[R3-II]    The system shall acquire a list of items detected on user.

[R4-II]    The systems shall list and display items missing on the user.

[R5-II]    The system shall access the internet.

[R6-II]    The system shall display the to-do list for the current day.

[R7-II]    The system shall have touch screen functionality to obtain user inputs.


## 2.4.  Physical Requirements

[R8-II]    The system shall have an LCD display.

[R9-II]    The system shall be wall mountable.

[R10-II]   The system shall be compact and attractive.

[R11-II]   The system shall have a speaker system with adjustable volume to alert the user of forgotten items.

[R12-III]  The system shall be as compact as possible.

[R13-III]  The system shall be enclosed in a hard case.


## 2.5.  Electrical Requirements

### 2.5.1.  Data Transfer Requirements

[R14-I]    Internet access shall be provided through an Ethernet cable.

[R15-II]   Detect-and-Scan data shall be transferred to the Central unit via a physical cable.

[R16-III]  Internet access shall be wireless.


### 2.5.2.  Power Requirements

[R17-II]   Power to the system shall be provided through an alternating current (AC) wall plug (110V, 60Hz).

[R18-II]   Power consumption shall be as low as possible.


## 2.6.  Environmental Requirements

[R19-II]   The system will only be operated indoors.

[R20-II]   The system will be operable in relative humidity up to 90%.

[R21-II]   The system will be operable in temperatures ranging from -20-40˚C.

[R22-II]   The system will produce virtually no noise while active or inactive except for the audio system that alerts the user of missing items.

## 2.7. Standards
[R23-II]   The system will comply with the following standard: IEC 62369-1 [1].

## 2.8. Reliability and Durability
[R24-II]   The system should last a minimum of 5 years.
[R25-III]  The system shall not overheat with continuous usage (twenty four hours a day, year round).
[R26-III]  The system should not crash from general use.
[R27-III]  The system should be able to withstand shock from falls from up to 50 centimeters.
[R28-II]   System performance shall not degrade from normal use.

## 2.9. Safety Requirements
[R29-II]   The system should not provide any static shock when touched.
[R30-II]   The display and user interface shall not be a strain to the eyes of the majority of users.
[R31-II]   Signal emissions from the system shall not interfere with other electronics.
[R32-III]  All cable and wire connections shall be enclosed with proper shielding.
[R33-III]  The system should provide clear indication in case of a crash.
[R34-II]   The system audio component shall not exceed 85 decibels.
           **Reason:** At 85 decibels, risk of permanent hearing damage occurs.
[R35-II]   The system should not explode or combust spontaneously.

## 2.10. Performance Requirements
[R36-II]   The system shall not take more than 0.5 seconds to scan user and display an alert.
[R37-II]   The system shall become active within 0.5 seconds of detecting a user.
[R38-II]   Lag time of the user interface shall not exceed 0.5 seconds.

## 2.11. Usability Requirements
[R39-II]   The learning curve of the device should be no more than a few minutes on average.
[R40-II]   The system will be intuitive to use.
[R41-II]   The module will facilitate easy access to the user interface.
[R42-II]   The system should integrate into a user's daily life relatively seamlessly.

## 2.12. Luxury Functions

[R43-III]   The system should enhance the aesthetics of the location where it is placed.

[R44-III]   The system exterior should be customizable.

[R45-III]   The system should be upgradable with new, and easily obtainable (internet download) functionality.

[R46-III]   The system should be expandable with user generated content.

# 3. Anywhere Access Form

The D-Tech System Anywhere Access Form is an available online portal for users to add tagged item and tasks to their Central unit database. This web application will act similarly to a survey or questionnaire, asking the users for relevant information. Performing as an accessory to the D-Tech system, the home system is able to work without the Anywhere Access Form. However, with the extended functionality of the form, D-Tech system's usability and flexibility is greatly improved.

## 3.1.   General Requirements

[R47-II]   The form website shall be accessible by any computer with internet capabilities.

[R48-II]   The form shall provide an alternative method for users to input data to their home database.

[R49-II]   The form shall provide security by allowing access only when correct log-in credentials are confirmed.

[R50-II]   The form shall allow users to enter data for a single tagged item to the server at a time. **Reason:** Allowing data entry for only one item at a time allows the form to be more compact. Since many data fields are required for one item, it can get confusing for the user to see so many data entry fields on the same page.

[R51-II]   The form shall provide a method for users to take a photo of their tagged item via a webcam, provided that a webcam is available on their computer.

[R52-II]   The form shall allow users to enter up to three tasks at a time. **Reason:** Again, limiting the number of fields on the page, increases usability. Task entry requires fewer fields and therefore, more than one task entry is possible at a time.

[R53-II]   The form shall allow users to specify when the D-Tech system should remind the user of the item or tasks by providing fields for date entry.

## 3.2. Standards

[R54-II]  The form shall meet required web language coding standards in order to be properly viewed across all common web browsers, mainly Windows Explorer and Firefox.

## 3.3. Reliability and Durability

[R55-II]   The form shall be error free.

[R56-II]   The form shall be maintained by goldFish Technologies' technicians.

[R57-III]  The form database shall be maintained on its own servers to allow a high capacity of users to be online at a time, thus minimizing server downtime.

## 3.4. Performance Requirements

[R58- II]  The form should allow multiple users to log in simultaneously to submit data.

[R59- III] The form database should be able to store an unlimited amount of item and task data.

## 3.5. Usability Requirements

[R60- II]  The form should inform the user when fields are not entered correctly or if data is missing.

[R61- II]  The form should confirm with the user the tasks and items that were added.

[R62- II]  The form shall provide built in instructions and examples.

[R63- II]  The form shall be intuitive enough that no additional user manual is required.

[R64- II]  The form shall be compact and attractive.

## 3.6. Luxury Functions

[R65- III] The form shall allow users to set up multiple accounts to their D-Tech system to allow other people outside the household to enter items and tasks.

[R66- III] The form shall accessible with mobiles phones and compatible with their web browsers.

# 4. User Interface

The D-Tech System user interface allows users to access, view, and edit their items and tasks database. Also, the interface will notify users about missing tagged items and daily scheduled tasks.

## 4.1 General Requirements

[R67-II]  The user interface shall be operational at any time.
[R68-II]  The primary method of user inputs shall be through a LCD touch-screen.
[R69-II]  The user interface shall notify user when tagged items are missing.
[R70-II]  The user interface shall remind users of schedules tasks.
[R71-II]  The user interface shall allow user to add and edit items and tasks on the database.
[R72-II]  The user interface shall provide the user with up-to-date database information.

## 4.2 Graphical User Interface

[R73-II]  The visual display shall have sufficient resolution to clearly display database information and pictures.
[R74-III]  The user interface shall allow users to select various graphical customizations.
[R75-III]  The graphical user interface shall provide animations to promote user interactions.

## 4.3 Usability Requirements

[R76-II]  The user interface's functions should be intuitive and easy to use, requiring minimal user manual usage.
[R77-II]  The user interface should have large button for navigation and selection.
[R78-II]  The graphical user interface should contain intuitive button placement for easy navigation.

## 4.4 Reliability Requirements

[R79-II]  The user interface should not have fatal errors resulting in system crashes.
[R80-II]  The user interface should be fool-proof and prevent any unsuitable inputs that might cause system errors.
[R81-III]  The user interface should have instant access to the system database when information is requested by user.

# 5. The Detect-and-Scan Unit

This unit will be used to detect and scan whenever a person walks within the vicinity of the door where the central unit is placed. This system will also be able to distinguish between a person leaving their home and a person just doing tasks in the vicinity of the doorway. In this way, power can be conserved as the power requirement of the detection component is much less than that of the scanning component. In addition, the scanning component will detect any tagged items carried by the user and distinguish between different items. The scanner should be in power-saving mode at all times unless triggered by the detection unit, to conserve power. New SmartTags purchased should be identified by the scanner first so the tags can be properly detected at later times.

## 5.1. General Requirements

[R82-II]   The unit shall be powered-off until activated by user movement in the vicinity of the system.

[R83-II]   The unit shall detect and identify SmartTags within a 10 centimeter range.

[R84-II]   The unit shall detect new SmartTags and register them.

[R85-II]   The unit's detection component shall consume considerably less power than the scanning component.

[R86-II]   The unit's detection component shall be on at all times.

[R87-II]   The unit shall detect a moving person within 0.5 meters of the door.

## 5.2. Reliability Requirements

[R88-II]   The unit should correctly differentiate between unique SmartTags.

[R89-II]   The unit should activate and scan the user in a timely manner.

[R90-II]   The unit shall not overheat or run the risk of failure when operating continuously.

[R91-III]  The unit shall be guaranteed to work for at least 5 years.

## 5.3. Physical Requirements

[R92-II]   The unit shall be hidden from the user and protected from environmental hazards.

[R93-II]   The unit shall be small and unobtrusive to home aesthetics.

[R94-III]  The unit shall be easy to install in any home doorway.

[R95-II]   The SmartTags should be small enough to tag to various sized objects.

# 6. The Computer System Requirements

[R96-II]  The server system should be intuitive to use.
[R97-II]  The scanner system should be in power-saving mode when not in use.

# 7. The Documentation

[R98-III]  The user documentation should consist of a user manual as well as a setup guide.
[R99-III]  Both the user manual and the setup guide will be available on the company website.
[R100-III]All documentation shall be available in English, French and Spanish.
[R101-III]All documentation will be written for an audience with minimal technical knowledge.

# 8. System Test Plan

The following section will describe functionality tests for the proof of concept D-Tech system prototype.  These guidelines will contribute to the basic framework of commercial product tests.  The preliminary stage of the prototype testing will be performed by the team members of goldFish Technologies. After the development cycle, the prototype will be tested by potential users. Their feedbacks on product appearance, functionality, and usability will be taken into consideration for alternative design solutions.

**Performance of database:**
-   Determine the time required to access entries in database.
-   Determine the time required to edit entries in database.
-   Observe whether the database will contribute to a possible information leak.

**Quality of touch-screen:**
-   Observe the intensity and clarity of the touch screen LCD display.
-   Determine the resolution of the touch-screen with respect to graphical user interface (GUI) button size.

**Performance of Detect-and-Scan Unit:**
- Determine the scanning range of RFID scanner.
- Determine the accuracy and sensitivity of the detection sensor.

**Usability:**
- Determine whether the navigation of the GUI is intuitive enough for users.
- Determine the ease-of-use for accessing and editing data in the database.
- Determine the ease-of-use for data input to the Anywhere Access Form.

**Safety:**
- Determine whether the RFID scanner will interrupt other radio-frequency dependent appliances.
- Determine whether the RFID scanner signal complies with Canadian Radio-Frequency Interference Regulations Guide.

**Power consumption:**
- Measure the power consumption of the Detect-and-Scan unit.
- Measure the power consumption of the D-Tech System Door Unit.

**Efficiency:**
- Determine efficiency by measuring the time delay from input (items scanned) to preliminary output (write to database).
- Determine efficiency by measuring the time delay from the preliminary output (items on database) to output (notification to user).

**Reliability:**
- Determination of software reliability by measuring the probability of error.
- Measure the maximum length of usage.

# 9. Conclusion

This functional specification clearly illustrates the capabilities and features included in the D-Tech reminder system. The product development is divided into two distinctive phases. The proof-of-concept model is being developed at this time, while strictly following the specifications outlined above. It is expected that all functional requirements described in this document (marked with either I or II) will be completed by the target date of April 15, 2009.

# 10. References

[1]     "RFID: Update on Standards and Regulatory Initiatives" Association for
        Automatic Identification and Mobility. [Online]. Available:
        http://www.aimglobal.org/members/news/templates/template.aspx?articleid=3
        302&zoneid=42 [Accessed: February 16, 2009]