Department of Computer Science and Engineering
The University of Texas at Arlington

Reflection

Echo – Voice Controlled Interactive Mirror

Team Members:
Jacob Fisher
Sumeet Kaur
Aisha Kulindwa
Sean Nesburg
Tanmaykumar Patel

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Document Revision History

Revision Number	Revision Date	Description	Rationale
0.1	October, 5th 2014	STP First Draft	Initial draft for STP
1.0	October, 16th 2014	STP After Review	Baseline Submission

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1. Introduction

1.1. Document Overview

The System Test Plan will introduces various testing procedures that Team Reflection will follow to ensure that the Echo will perform to specifications set forth in the System Requirements Specification. This document will outline the procedures team Reflection will use to all acceptance criteria set forth in previous documents. In addition, this document will expand on the testing guidelines set forth in the Detailed Design and will go into detail of the hardware, unit, component, integration, and system validation testing.

1.2. Product Overview

Echo is a Smart Mirror that displays applications from a user's phone to a mirror. The user will be able to choose which applications to display on the mirror and enlarge the application to see it in more detail. It achieves this using an ACA that communicates with and controls the Echo. Echo will give a better start to the day. The few minutes that you spend in front of the mirror looking at your reflection could be used more productively. While brushing your teeth you can inquire about weather, social updates, calendar events, emails, or even listen to music.

Echo is designed for the average consumer who wishes to view information more easily than on their phone. The ACA will allow the user to select various apps that are on their Android™ phone. The selected apps will be displayed on the mirror and will allow the user to see updated information, similar to normal locked screen updates.

An example is the busy student. They wake up, go to the bathroom to do their morning rituals, and they can see what their friends posted on Facebook, figure out how to get that perfect look for their presentation, play some upbeat music, and see what the weather is like, all while brushing their teeth and getting ready for the day.

1.3. Project Description

Echo will consist of two major components, the mirror and the ACA. The mirror will hold the display unit, speakers, microphone, and a motherboard. The display unit will be a LCD screen that will display user's requests. The speakers will send sound from the music application or from the "How-To" application to the user. The microphone will allow the user to interact with the ACA using voice commands. The motherboard will analyze the voice commands and send it to the ACA and receive information from the ACA and make it into a display for the screen. The mirror itself will be a mountable box that will keep all components inside, while keeping moisture out and allowing sound to come in and heat to dissipate.
The ACA will be the main interface between the applications and the user. It will take the commands, both voice and touch, and use it to interact with the applications. The ACA will also store the list of videos for the "How-To" application.

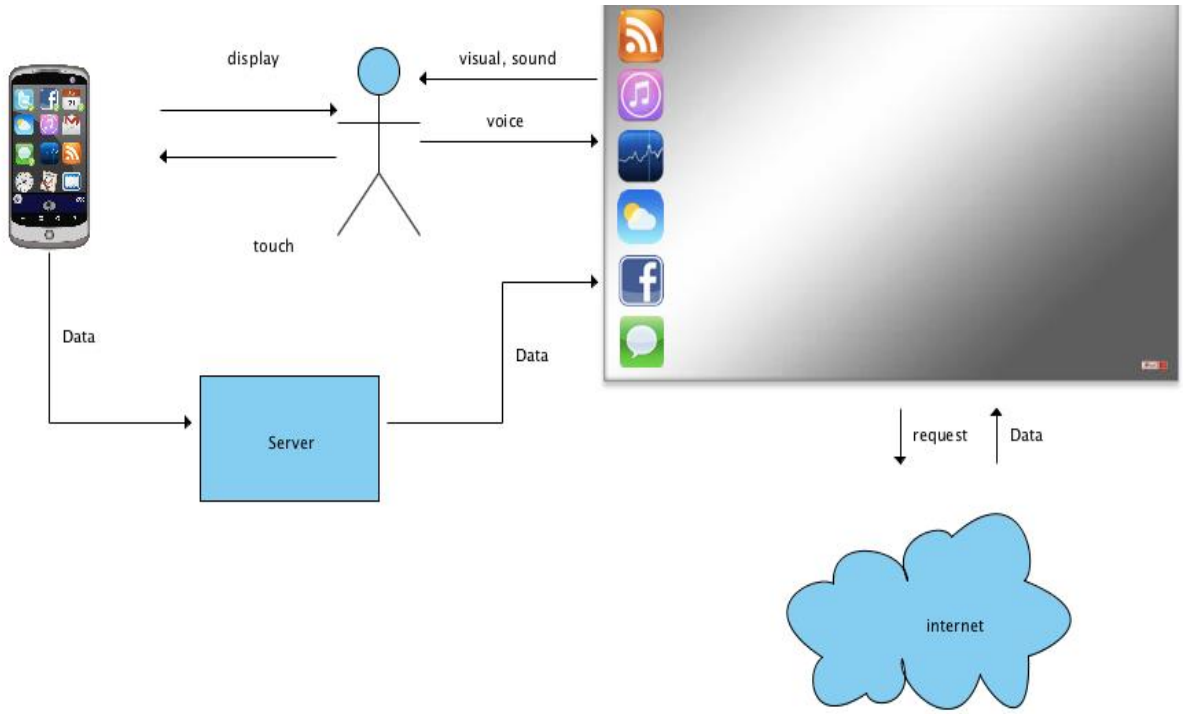

Figure 1-1 General System Diagram

2. Test References

The System Test Plan will be based on previous documents produced by team Reflection. These documents are the System Requirements Specification (SRS), Architecture Design Specification (ADS), and the Detailed Design Specification (DDS). The following sections and subsections will define for the reader our testing approach and will help the reader understand our system better.

2.1. System Requirements Specification

The SRS is the original requirements documentation which were created by the members of team Reflection and the sponsor, Dr. Becker. This document introduced the product, specified in detail what was needed for the product to be considered complete, and the purpose of the product. These requirements will be covered in this subsection.

2.1.1 Customer Requirements

SRS No.	Requirement	Description	Priority
3.1	Android Control Application	It is an Android™ application that is used to control Echo system. It shall interact with other applications on the user's phone and fetch data from those applications to display on the mirror.	1-Critical
3.2	Display Multiple Application Icons	The Android™ Application and the mirror shall display multiple application icons on the main/opening screen. For example, Facebook, Weather, Calendar, Clock, Music and How-To app. The user can choose one of the available applications to open and display the large interface of the application on the mirror.	1-Critical
3.3	Switch between Applications	The Android™ Application shall allow user to switch between the Android™ applications by either using the touch screen from phone or using voice command.	1-Critical
3.4	Voice Recognition	The user can use voice commands to interact with Echo.	2-High
3.5	"How-To" Application	The Android™ application associated with Echo will have an applet that allows the user to watch "How-to" videos such as "*how to tie a tie"*. This will allow the user to mimic the video while being able to see him or herself. All of the how-to videos will be preselected.	1-Critical
3.6	Speakers Mounted on Echo	Echo shall have speakers mounted on to it. User shall be able to hear audio for videos and music.	1-Critical

3.7	Bluetooth Connectivity	Phone connects to mirror via Bluetooth. All the data transfer happens via Bluetooth.	1-Critical
3.8	Pill Reminder Applet	The Android™ application shall come with an applet that will let the user set reminders for pills and will allow the user to upload pictures of the pills. The user will be able to see the directions as well as the pictures of the pills they need to take that day.	4- Low
3.9	Resolution and Brightness	Echo will have a high enough resolution and be bright enough so that the user will be able to see all information displayed clearly.	2- High
3.10	Microphone	Echo will have a microphone built onto it. This will allow the user to interact with the ACA hands free.	1-Critical
3.11	Power Button	Echo will have an external power button to allow the user to conserve energy and to power down the system if desired	1-Critical

Table 2.1 Customer Requirements

2.1.2 Packaging Requirements

SRS No.	Requirement	Description	Priority
4.1	Mirror Housing	The components of Echo will be attached to the inside of the wooden housing to secure them in place. The housing will prevent any of the components from being exposed to the user. The housing will be rectangular in shape (wooden box). The housing will also have mount for the phone. The housing will keep moisture from entering Echo.	2-High
4.2	Mirror Size	Echo will be no larger than 44” x 24” x 8”.	3-Moderate
4.3	Mirror Weight	The weight of Echo will not exceed 50 lbs.	3-Moderate
4.4	Power Cable	The cable will be used as the source of power for the Echo. The power cable can be modular.	1-Critical

Table 2.2 Packaging Requirements

2.1.3 Performance Requirements

SRS No.	Requirement	Description	Priority
5.1	Smart Phone to Mirror Synchronization Delay	There will be a small delay of 1 to 2 seconds in the reaction of the screen synchronizing with the phone.	3-Moderate
5.2	Smart Phone Control Latency	There will exist a small delay of up to a second between the input controls and the corresponding action of the mirror due to processing delay.	2-High
5.3	Internet API Interface Latency	The apps displayed on the mirror will be retrieving real time data from multiple websites. There will be a standard web service delay of on average 50-200ms delay in data query and display.	4-Low
5.4	Speaker Quality	Echo speakers must have high quality so that the user can clearly hear the system.	2-High
5.5	Microphone Quality	The microphone mounted on Echo must be of high quality such that the voice commands are correctly interpreted by the system.	2-High

Table 2.3 Performance Requirements

2.1.4 Safety Requirements

SRS No.	Requirement	Description	Priority
6.1	Installation	The system shall include adequate anchors and screws such that it can be safely secured to the wall.	1-Critical
6.2	Packaging Safety	The system shall be packaged such that there will be no exposed circuitry to the user.	1-Critical
6.3	Heat Dissipation	The system shall be able to dissipate the heat generated by the components of the system.	2-High

Table 2.4 Safety Requirements

2.1.5 Maintenance and Support Requirements

SRS No.	Requirement	Description	Priority
7.1	User Manual	The user manual will include step-by-step instructions on how to initially install the system as well as the accompanying mobile application. It will also include directions on how to use all of the features of the system.	1-Critical
7.2	Troubleshooting Guide	The system will come with a troubleshooting guide to identify some of the problems and recommend possible solutions to both hardware and software aspects of the system.	1-Critical
7.3	Application Updates	The Android™ application accompanying Echo will receive updates to resolve bugs. The instructions will be included in the user manual.	2-High
7.4	System Software Updates	Echo system will receive updates directly via the accompanying Android™ application to resolve bugs. The instructions will be included in the user manual.	3-Moderate
7.5	Hardware Support & Maintenance	The user may change any of the hardware used in Echo. All the specifics of the hardware used in the system will be included in the user manual. The instructions on replacing the hardware will be included in the troubleshooting guide.	3-Moderate
7.6	Source Code & Documentation	Any code written or used by the development team and any documentation for the system will be readily available for everyone to see post production.	3-Moderate

Table 2.5 Maintenance and Support Requirements

2.1.6 Other Requirements

SRS No.	Requirement	Description	Priority
8.1	Security and Privacy	When communicating via Bluetooth™ the Android™ application should ensure the security and privacy of the user information.	4-Low
8.2	Bluetooth Range	The phone needs to be within the Bluetooth™ range of Echo. There should be a clear line of sight between Echo and the phone for the most stable connection.	2-High
8.3	Android™ Version Support	The Application shall be designed to run on all Android™ versions between 4.0.3 and 4.4.	1-Critical
8.4	Moisture Control	Echo will prevent moisture from damaging components within the system.	2-High

Table 2.6 Other Requirements

2.2. Architectural Design Specification

This subsection highlights the architecture outlined in the ADS. Providing details on the system's overall components and structure. This is a high level overview and the subsections following need to be thoroughly tested, as to show the system's architecture is working properly.

2.2.1 Layer Overview

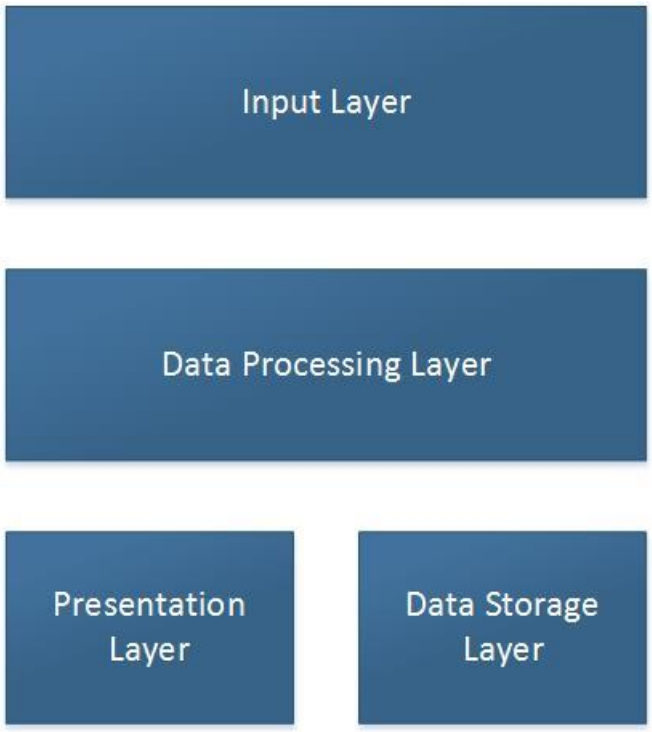

Figure 2-1: High Level Layer Definitions

Input Layer

The purpose of the Input Layer is to accept input from the user. The layer accepts input from the user through the phone's touch screen. This will serve as a secondary source of input from the user to the system. Information from the Android™ Control Application (ACA) is sent to this layer where it is initially processed and then formatted. Once the data has been formatted it is passed to the next layer to be further processed. The Hardware Sub-Layer accepts data from the mirror microphone and the power button. This will serve as the main source of input from the user into the system. This layer will listen for the key command words spoken by the user. The information will go through an event handler in order to distinguish what actions need to be taken with the given input (every word after the key word "Echo" is collected). After the speech recognition has been formatted it is converted to strings to be sent out for processing.

Data Processing Layer

The purpose of the Data Processing Layer is to accept data that has been gathered through the input layers and to trigger events that correspond with the needs of the user. This layer contains components to analyze the data that is being received from the other layers. After the data has been analyzed, it is sent to the app command processor, where the command is processed into a request and sent to the Internet and database. The appropriate action will be generated and sent to the presentation layer. This layer also contains a component to deal with API requests to the Internet as well as their responses.

Presentation Layer

The purpose of the Presentation Layer is to present information to the user. This could be via LCD Screen, the speakers, or the Android™ Control application on the phone. Data to be output is sent from the Data Processing Layer to the Presentation Layer and is then routed to the correct output formatter based on the data received. After the data has been formatted to the correct medium it is presented to the user via that channel.

Data Storage Layer

The purpose of the Data Storage Layer is to store or retrieve data for the Data Processing Layer. The components inside this layer will facilitate saving or retrieving data as necessary. Data can flow in or out of this layer. Data flowing in from the Data Processing Layer will be converted to a more suitable format for being saved on the file system. Data flowing out will be converted from its file format to a data structure that the Data Processing Layer can use.

2.2.2 Subsystem Overview

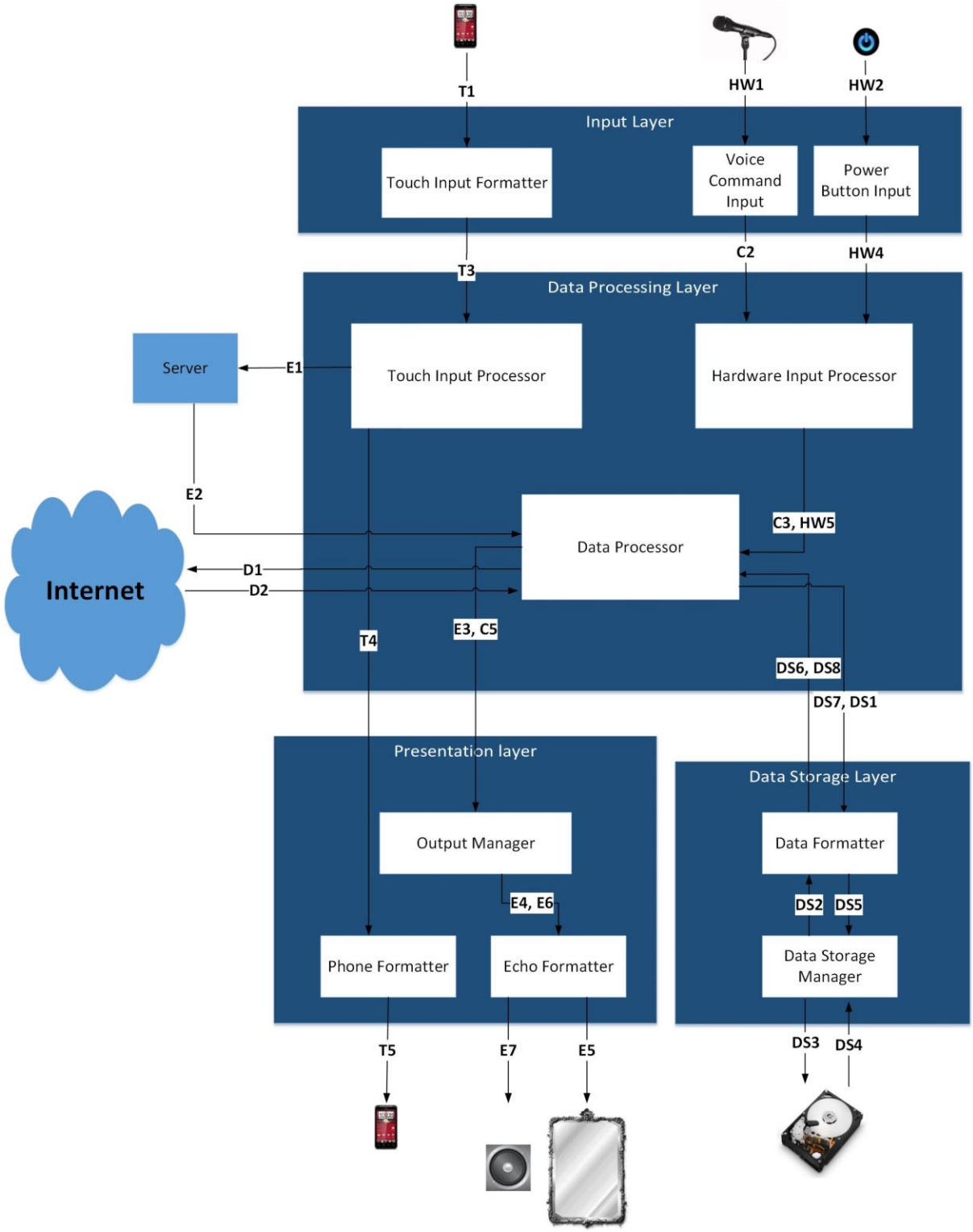

Figure 2-2 : Architecture Design Diagram

2.2.3 Requirements Mapping

Requirement Number	Requirement Name	Input Layer	Data Processing Layer	Data Storage	Presentation Layer
3.1	Android™ Control Application	✓			✓
3.2	Display Multiple Application Icons	✓			✓
3.3	Switch between Applications	✓			✓
3.4	Voice Recognition		✓		
3.5	"How-To" Application	✓		✓	✓
3.6	Speakers Mounted on Echo				✓
3.7	Bluetooth Connectivity		✓		
3.8	Resolution and Brightness				✓
3.9	Microphone	✓			
3.10	Power Button	✓			
3.11	Pill Reminder Applet	✓		✓	✓

Table 2-1: Architectural Requirements Mapping Table

2.3. Detailed Design Specification

2.3.1 Module Overview

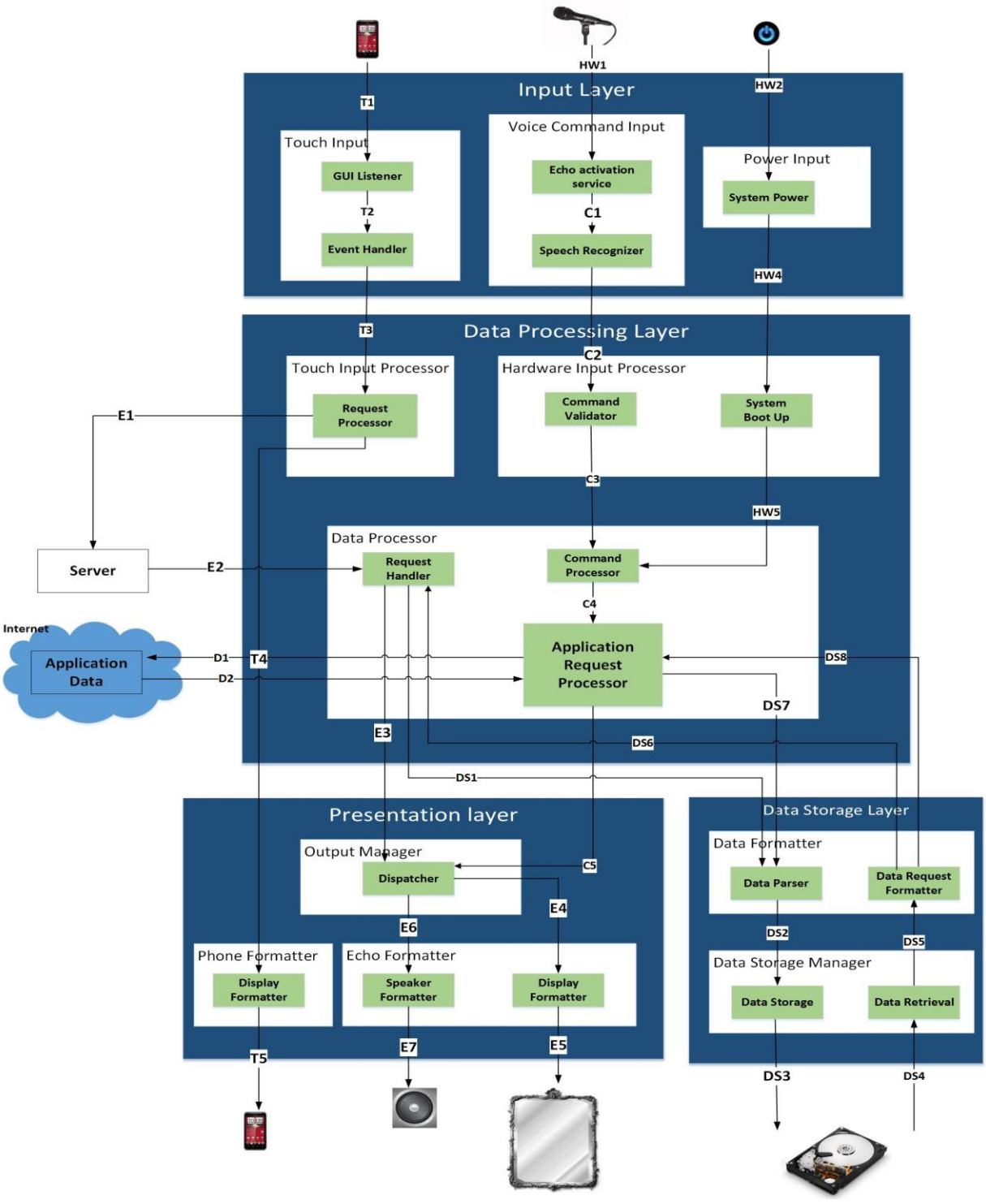

Figure 2-3 : Detail Design Diagram

2.3.2 Requirements Traceability

Input Layer

Requirement Number	Requirement Name	GUI Listener	Event Handler	Echo Activation Service	Speech Recognizer	System Power
3.1	Android™ Control Application	✓				
3.2	Display Multiple Application Icons	✓				
3.3	Switch between Applications	✓	✓			
3.4	Voice Recognition			✓	✓	
3.5	"How-To" Application	✓	✓	✓	✓	
3.6	Speakers Mounted on Echo					
3.7	Server Connectivity					
3.8	Resolution and Brightness					
3.9	Microphone			✓	✓	
3.10	Power Button					✓
3.11	Pill Reminder Applet	✓				

Table 2-2 : Requirements Mapping For Input Layer

Data Processing Layer

Requirement Number	Requirement Name	Request Processor	Command Validation	Command Processor	Request Handler	App Request Processor
3.1	Android™ Control Application	✓				
3.2	Display Multiple Application Icons	✓			✓	✓
3.3	Switch between Applications	✓	✓	✓		✓
3.4	Voice Recognition		✓			✓
3.5	"How-To" Application	✓	✓			✓
3.6	Speakers Mounted on Echo					
3.7	Server Connectivity				✓	
3.8	Resolution and Brightness					
3.9	Microphone		✓			✓
3.10	Power Button				✓	
3.11	Pill Reminder Applet	✓			✓	✓

Table 2-3: Requirements mapping for Data Processing Layer

Presentation Layer

Requirement Number	Requirement Name	Dispatcher	Phone Formatter	Speaker Formatter	Echo Formatter
3.1	Android™ Control Application		✓		✓
3.2	Display Multiple Application Icons	✓	✓		✓
3.3	Switch between Applications	✓			✓
3.4	Voice Recognition				
3.5	"How-To" Application	✓		✓	✓
3.6	Speakers Mounted on Echo	✓		✓	
3.7	Server Connectivity				
3.8	Resolution and Brightness		✓		✓
3.9	Microphone				
3.10	Power Button				
3.11	Pill Reminder Applet	✓	✓		✓

Table 2-4: Requirements mapping for Presentation Layer

Data Storage Layer

Requirement Number	Requirement Name	Data Parser	Data Request Formatter	Data Retrieval	Data Storage
3.1	Android™ Control Application				
3.2	Display Multiple Application Icons			✓	✓
3.3	Switch between Applications			✓	✓
3.4	Voice Recognition	✓	✓		✓
3.5	"How-To" Application	✓	✓	✓	✓
3.6	Speakers Mounted on Echo				
3.7	Server Connectivity				
3.8	Resolution and Brightness				
3.9	Microphone				
3.10	Power Button				
3.11	Pill Reminder Applet	✓	✓	✓	✓

Table 2-5: Requirements Mapping for Data Storage Layer

3. Test Items

This section details the separate subsystems of the Echo Mirror system and their tests. Each table with show their unique test ID, the component or module being tested, the input that will take, the expected output when that input is used, and how to test that specific module or component. The tests will be composed of different tests, including unit tests for each module, hardware tests for the systems physical components, integration tests for system interfaces, and system validation tests to ensure the system performs correctly.

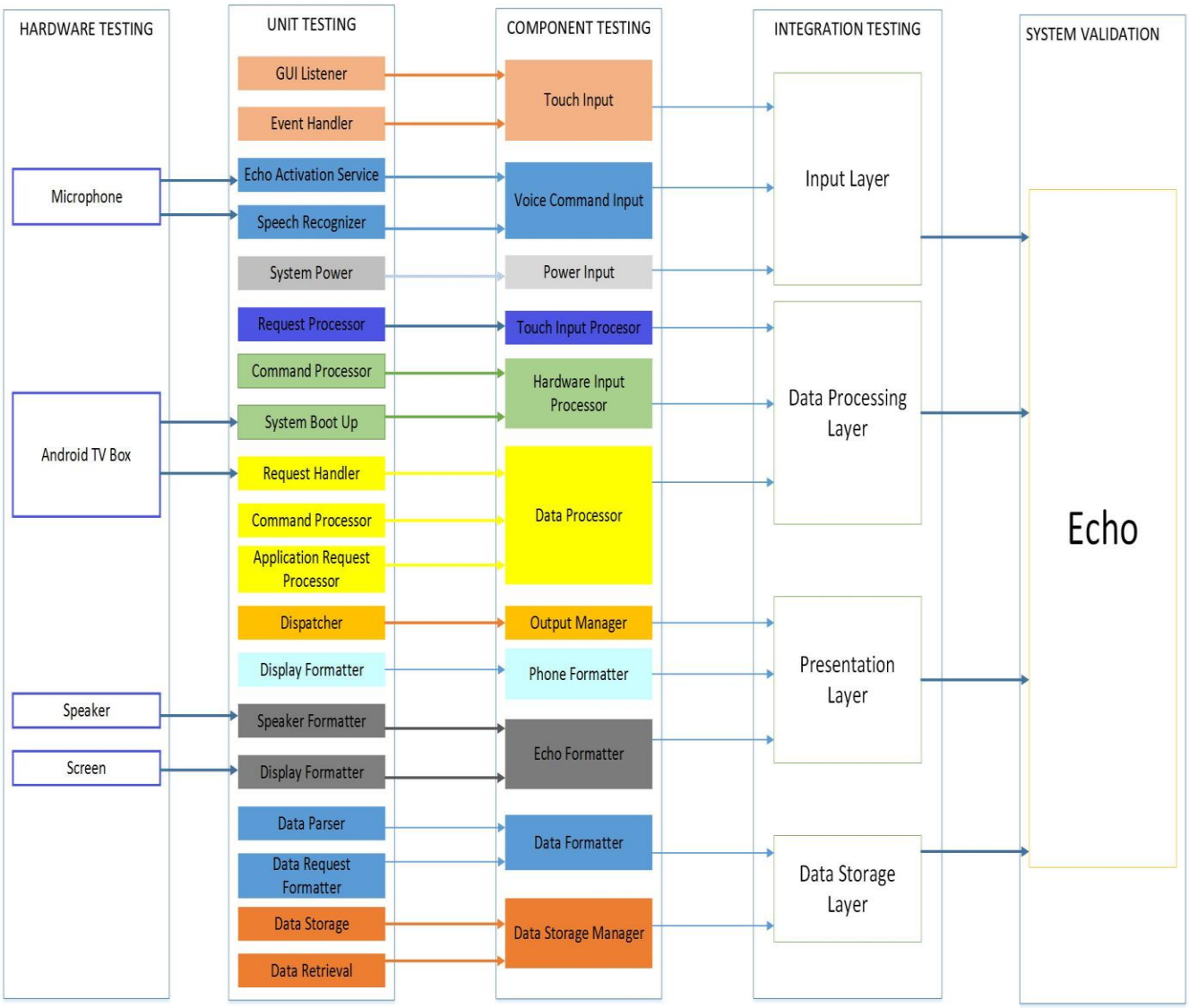

Figure 3-1: Relational Diagram

3.1. Hardware Tests

Test ID	Test Component	Input	Expected Output	Test	Requirements Satisfied
HW1	Microphone	The user speaks into the microphone.	The microphone accepts and records the words the user says.	Test the microphones output by checking the output log of the microphone and ensure it is recording the words being said.	3.4, 3.10
HW2	Speaker	The user brings up music on the Echo system.	The system should play the music through the speakers.	Test the speakers by telling the Echo system to play music, and ensure it plays the music appropriately.	3.3, 3.6
HW3	Screen	The user will press the power button on the Echo system.	The system will turn the screen on and display the home screen of the ACA	Test the screen by pressing the power button on the side of the Echo system to ensure it turns on and off.	3.2, 3.9, 3.11
HW4	Android TV Box	The user will press the power button on the Echo system.	The system will turn the Android TV box on and start the ACA	Test the screen by pressing the power button on the Echo System to ensure it turns on and off.	3.1

Table 3-1: Hardware Tests

3.2. Unit Tests

3.2.1 Touch Input Subsystem

Test ID	Module	Input	Expected Output	Test	Priority
UTI1	GUI Listener	User touch screen input.	Identified touch screen action.	Test the GUI listener by typing, tapping, or sliding on the screen, ensuring it correctly identifies each action.	Critical
UTI2	Event Handler	Application Check lists, sync button status	List of selected applications and a sync button activation call.	Test the Event Handler by selecting applications from the home screen list and pressing the sync button, ensuring the correct applications are displayed on the screen.	Critical

Table 3-2: Touch Input Unit Tests

3.2.2 Voice Input Subsystem

Test ID	Module	Input	Expected Output	Test	Priority
UVI1	Echo Activation Service	User says Echo	Speech Recognition activation signal and audio beep to confirm Echo was recognized.	Test the Echo Activation Service by saying the word “Echo” while the system is on.	Critical
UVI2	Speech Recognizer	User says command	Tokenized voice input in the form of a text string matching users vocal command.	Test after “Echo” has been said by speaking any command.	Critical

Table 3-3: Voice Input Unit Tests

3.2.3 Power Button Subsystem

Test ID	Module	Input	Expected Output	Test	Priority
UPB1	System Power	User presses the external system power button.	If the system is off, the screen turns on and the ACA starts.	Test the power button subsystem by pressing the power button, ensuring the system turns on and off.	Critical

Table 3-4: Power Button Unit Tests

3.2.4 Touch Input Processor Subsystem

ID	Module	Input	Output	Test Method	Priority
UTIP1	Request Processor	List of Applications	JSON Object	We will provide the module with a List of Applications and verify if the module outputs a JSON object.	Critical
UTIP2	Request Processor	List of Applications	App Icons	We will provide the module with a list of selected applications and verify if it displays the application icons on the next screen on the phone.	Medium

Table 3-5: Touch Input Processor Interfaces

3.2.5 Hardware Input Processor Subsystem

ID	Module	Input	Output	Test Method	Priority
UHIP1	Command Validator	String	Parsed String	We will provide the Module with a string command and verify if is parses the string by picking the key commands.	Critical
UHIP2	System Boot up	Digital Signal	Android OS call	We will provide the Module with a digital signal and verify if it starts ACA on Boot up.	Critical

Table 3-6: Hardware Input Interfaces

3.2.6 Data Processor Subsystem

ID	Module	Input	Output	Test Method	Priority
UDP1	Server	JSON Object	JSON Object	We will provide the module with a JSON object and verify if it outputs the other JSON object on ACA of mirror.	Critical
UDP2	Request Handler	JSON Object	Array List of Apps with package Info	We will provide the module with JSON object that has list of apps to pull the information and we will verify if the module pulls the package info for the requested Apps.	Critical
UDP3	Request Handler	Table	Request	We will provide this module with Table of favorite Apps and will verify that it shows the Icons to the user.	Critical
UDP4	Command Processor	String	String	We will provide this module with a valid string and verify that it sends the string to Application request processor to perform the action.	

UDP5	Command Processor	String	None	We will provide the module with a valid command and verify if it discards the command since it will be invalid for the situation.	Medium
UDP6	Application Request Processor	Android OS Call	ACA interface	The Module will be provided with Android OS call to open ACA and we will verify if it opens the App on boot up.	Critical
UDP7	Application Request Processor	Request	Application Data	We will provide the module with Voice Command in form of String and verify if performs the requested action.	Critical
UDP8	Application Request Processor	AppMessage Object	InterfaceRequest Object	We will provide the Module with AppMessage (“Next Page”) object and verify the module returns the data requested.	Critical

Table 3-7: Data Processor Interfaces

3.2.7 Output Manager

Test ID	Model	Input	Excepted Results	Test Description	Priority
UOM1	Dispatcher	Application data	Application interface	We will provide the method with application interface and verify if it displays it on screen	High

Table 3-8: Output Manager Unit Test

3.2.8 Echo Formatter

Test ID	Model	Input	Excepted Results	Test Description	Priority
UEF1	Speaker Formatter	Audio File path	Sound data	We will provide the method with a test audio path and see if it will play the audio file.	High
UEF2	Display Formatter	Application data to display	Display data	We will provide the method with a test string of display data and see if it will correctly display data passed	High

Table 3-9: Echo Formatter Unit Test

3.2.9 Phone Formatter

Test ID	Model	Input	Excepted Results	Test Description	Priority
UPF1	Display Formatter	Application data to display	Display data	We will provide the method with a test string of display data and see if it will correctly display data passed	High

Table 3-10: Phone Formatter Unit Test

3.2.10 Data Formatter

Test ID	Model	Input	Excepted Results	Test Description	Priority
UDF1	Data Parser	String	String request	We will provide the subsystem with a string and see if the request is properly sent to the data storage manager	High
UDRF3	Data Request Formatter	Strings	Application Data	We will provide the subsystem with test strings and see if it combines it correctly and sends it to the correct module	High

Table 3-11: Data Formatter Unit Tests

3.2.11 Data Storage

Test ID	Model	Input	Excepted Results	Test Description	Priority
UDS1	Data Storage	String	String from database	We will send requests to the data base to retrieve data	High
UDS2	Data Storage	Strings	Strings into database	We will provide the subsystem with a test string and see if it stores the information in the right location	High
UDS3	Data Retrieval	String	String from database	We will receive data from the database from dummy requests	High

Table 3-12: Data Storage Unit Tests

3.3. Component Test

3.3.1 Input Layer

Test ID	Subsystem	Input	Expected Output	Test	Priority
CIL1	Touch Input	Phone touch screen input.	Touch screen commands, application selection lists, and sync command.	Test the touch input subsystem by testing various touch screen inputs on the screen (such as tapping and sliding), ensuring the correct buttons and commands are registered.	Critical
CIL2	Voice Command	User voice input.	System command in the form of a text string.	Test the voice command subsystem by activating it with the “Echo” keyword, then saying a system command.	Critical
CIL3	Power Button	Pressing the external power button.	The Echo screen and Android TV box both turn on.	Test the power button subsystem by pressing the power button and ensuring the system turns on.	Critical

Table 3-13: Input Layer Component Test

3.3.2 Data Processing Layer

ID	Subsystem	Input	Output	Test Method	Priority
CTIP1	Touch Input Processor	List of Applications	JSON Object	We will provide the subsystem with dummy data of array Lists and verify if the array list gets converted into the JSON object.	Critical
CHIP2	Hardware Input Processor	String voice or system startup command	String or Android system call	We will provide the subsystem with voice commands and verify if the commands are processed correctly. We will also test if on startup the system makes an android system call.	Critical
CDP3	Data Processor	JSON object	Application Icons	We will test and verify that the subsystem takes in the JSON object, performs the conversion and search and displays the application icons on the screen.	High
CDP4	Data Processor	String voice command	Third party Application Interface	We will test this subsystem by sending a string command like “open calendar” and verify if it opens the application and displays it on the screen.	Critical
CDP5	Data Processor	Android system call	ACA Application Interface	We will test this subsystem by providing startup command and verify if the subsystem opens the ACA on startup.	High

Table 3-14: Data Processor Layer Component Tests

3.3.3 Presentation Layer

Test ID	Subsystem	Input	Excepted Results	Test Method	Priority
CPL1	Output Manager	Application data	Application interface	We will provide the method with application interface and verify if it displays it on screen	High
CPL3	Echo Formatter	String of data to display	Display data	We will provide the subsystem with string of data and expect it to display the formatted data passed	High
CPL4	Echo Formatter	String of audio file path	Sound data	We will provide the subsystem with a string of file path and see if the right file will be played	High
CPL5	Phone Formatter	String of data to display	Display data	We will provide the subsystem with string of data and expect it to display the formatted data passed	High

Table 3-15: Presentation Layer Component Tests

3.3.4 Data Storage Layer

Test ID	Subsystem	Input	Excepted Results	Test Method	Priority
CDSL1	Data Storage Manager	String	String to the database	We will send data into the sub system and see if the data is stored into the database correctly	High
CDSL2	Data Formatter	Strings	Strings to Array List	We will see if the sub system will package the correct information together and send it correctly	High

Table 3-16: Data Storage Layer Component Tests

3.4. Integration Tests

Test ID	Layer	Input	Output	Test Method	Priority
I1	Input Layer	User interaction with ACA	Application Selection list in the form of an arrayList	The ACA will be tested through a variety of touch screen inputs, including sliding across and tapping the screen.	Critical
I2	Input Layer	User voice input	Parsed voice command string	Testing of the Echo systems voice input shall be through a variety of voice commands, both those known to the system and those that the system will not recognize.	Critical
I3	Input Layer	User interaction with external power button	Power to the screen and Android TV box	The external power button will be tested by confirming power to the screen and Android TV box is turned on and off by pressing the button.	Critical
I4	Data Processing Layer	Parsed Voice command	Application Interface	We will provide the Layer with parsed voice command and verify if the	Critical
I5	Data Processing Layer	JSON Object	Application Icons	We will provide the layer with JSON object and verify if it displays the Application Icons of the selected apps on the Screen	High
I6	Data Storage Layer	ArrayLists	None	We will send data to the layer and see if it properly stores it into the database	Critical
I7	Data Storage Layer	Request	Application Information	We will verify this by requesting data from the database and see if the layer packages it correctly and sends it to the proper location	Critical
I8	Presentation Layer	Application	Application Interface	We will provide the method with a test string of display data and see if it will correctly display data passed	High

Table 3-17: Integration Tests

4. Risk

4.1. Risk Overview

This section will go through the risks that we might encounter as we test the Echo. The table below will show specific risks that may affect testing and or the test outcome. It will also show impact assessment and management plan as it relates to these risks.

4.2. Risk Table

Risk ID	Description	Impact	Severity	Mitigation
R1	Trickle down error	It will make it very hard to detect where the fault is from.	Medium	To make sure the interfacing object requested are the same and catch the error early by doing unit testing, component testing and finally integrated test
R2	Failure of external software or third party application	This cannot be fixed by us the developers and it can also cause the test to give out undesired output	High	We are having the third party application to work independent of the rest of the system after they are called.
R3	Hardware Failure	This may cause the component test to not produce any outcome at all or produce undesired outcome.	High	We are testing the hardware separately to see if they work with other applications before we test it will our system.
R4	Server Connection error	This may cause settings not be sent to the echo from the phone	Medium	We will check if the server connection before we send the settings.

Table 4-1: Risk Table

5. Features not to be tested

This section details what requirements will not be tested and why. Largely, most requirements not being tested are simply those not being implemented, but to clarify each requirement will explain why it is not being tested.

5.1. Customer Requirements

5.1.1 Pill Reminder Applet

Description: The Android™ application shall come with an applet that will let the user set reminders for pills and will allow the user to upload pictures of the pills. The user will be able to see the directions as well as the pictures of the pills they need to take that day.

Reason: The pill reminder applet will not be implemented in the final product

5.2. Performance Requirements

5.2.1 Smart Phone to Mirror Synchronization Delay

Description: There will be a small delay of 1 to 2 seconds in the reaction of the screen synchronizing with the phone.

Reason: The synchronization action will not be taking place as frequently as other integral systems. The only thing when it comes to synchronizing the mirror and smart phone being tested is whether or not it is actually synchronizing.

5.2.2 Internet API Interface Latency

Description: The apps displayed on the mirror will be retrieving real time data from multiple websites. There will be a standard web service delay of on average 50-200ms delay in data query and display

Reason: This will be irrelevant to test, as internet service will differ depending on where the system is installed.

5.3. Packaging Requirements

5.3.1 User Manual

Description: There will be user manual provided with the system, with installation instructions.

Reason: This feature will not be tested as it will be included in the final product.

6. Features to Be Tested

The following section will describe all the features based on the requirements stated in the System Requirement Specifications that need to be tested.

6.1. Customer Requirements

6.1.1 Android Control Application

Description: Echo shall have an Android Control Application that is associated with it. It will be used to control the Echo system by allowing the user to configure the applications that he/she wishes to display on Echo.

Test Approach: The application (ACA) will be installed on an Android based device, and it will be used to connect with the Echo. Applications will be selected on ACA and then the ACA will be synced with the Echo to transfer the settings and determine if the user configurations have been correctly set.

6.1.2 Display Multiple Application

Description: Echo will be able to display multiple applications on its Home Screen. The user can choose one of the available application to open and display the large interface of the application on the mirror.

Test Approach: The team will test to see if multiple applications are being displayed on the home screen of Echo. Also, the team will open each of the applications and see if it is being displayed in its full version.

6.1.3 Switch between Applications

Description: The Echo will allow the user to switch between the applications that they are currently using.

Test Approach: The team will test Echo to see if it is allowing a user to switch from the current applications to a different application that is available to them.

6.1.4 Voice Recognition

Description: The user will be able to interact with Echo using voice commands.

Test Approach: The team will use pre-selected voice commands to interact with the Echo in order to test this requirement.

6.1.5 How-To Application

Description: Echo will have an application that will allow the user to watch pre-selected How-To videos that are hosted on YouTube.

Test Approach: The team will test to see if Echo has the how-to application on it, if it is on Echo, the team will open the How-To application and play one of the pre-selected how-to videos. Afterwards, the team will test the functionality of How-To by closing the video and opening up another video from the pre-selected video.

6.1.6 Speakers Mounted on Echo

Description: Echo will have speakers mounted on to it. User will be able to hear audio for videos and music.

Test Approach: The team will play music or a video on the Echo to see if they can hear any audio coming out of the speakers.

6.1.7 Microphone

Description: Echo will have a microphone built onto it. This will allow the user to interact with the ACA using voice commands.

Test Approach: The team will speak voice commands into the microphone to test that it is able to take in audio input clearly and correctly.

6.1.8 Power Button

Description: Echo will an external power button to allow the user to conserve energy and to power down and power up the system.

Test Approach: The team will test this by pushing the button on the Echo and see if turns off the system, and then push it again to see if it turns the system back on.

6.2. Packaging Requirement

6.2.1 Mirror Housing

Description: The components of Echo will be attached to the inside of the wooden housing to secure them in place. The housing will prevent any of the components from being exposed to the user.

Test Approach: The components will be tested to make sure that they are securely attached to the insides of the Echo housing. The team will see that none of the hardware that is used will be exposed to the user.

6.2.2 Mirror Size

Description: Echo will be no larger than 44” x 24” x 8”.

Test Approach: The team will measure that the housing is same or less than the measurements shown above.

6.2.3 Mirror Weight

Description: The weight of Echo will not exceed 50lbs.

Test Approach: This will be tested by measuring the weight of Echo.

6.2.4 Power Cable

Description: The cable will be used as the source of power for the Echo. The power cable can be modular.

Test Approach: The team will use the power cable by plugging it into the wall outlet and test that it supplies the power to the system by turning the system on.

6.3. Performance Requirement

6.3.1 Voice Command Recognition Latency

Description: There will exists a small delay up to a second between the input of the voice command and the action that is performed based on the voice command.

Test Approach: The team will test using a stop watch that the delay between the input of the voice command and action being performed by Echo is less than 1 second.

6.4. Safety Requirement

6.4.1 Installation

Description: The system shall include adequate anchors and screws such that it can be safely secured to the wall.

Test Approach: The team will install the Echo onto a wall to test that is it securely mounted.

6.4.2 Packaging Safety

Description: The system shall be packaged such that there will be no exposed circuitry to the user.

Test Approach: The team will test this requirement by testing that there is no exposed circuitry to the user.

6.4.3 Heat Dissipation

Description: The system shall be able to dissipate the heat generated by the components of the system.

Testing Approach: The team will test this by measuring the heat inside the Echo and determine that it’s under the recommended temperature.

7. Testing Approaches

The following section will describe the overall approach and strategy on testing Echo. Echo will be tested for completeness on the requirements stated in the SRS. The section will also detail when Echo will be considered complete.

7.1. Test Phases

7.1.1 Unit Test

As each of the subsystems are being developed, the unit tests will be performed on each of the modules of every subsystem by the members developing that particular module.

7.1.2 Component Test

Component tests will be performed on each of the subsystems, and will also be done by the team members that developed that particular subsystem. The following list shows the subsystems that will be tested:

- Touch Input Subsystem
- Voice Command Subsystem
- Power Input Subsystem
- Touch Input Processor Subsystem
- Hardware Input Processor Subsystem
- Data Processor Subsystem
- Data Formatter Subsystem
- Data Storage Manager Subsystem
- Output Manager Subsystem
- Phone Formatter Subsystem
- Echo Formatter Subsystem
- Server

7.1.3 Integration Test

Integration testing will be done by combining all of the modules into their respective subsystem and then testing those subsystems. This test will be done to verify the integrity of all inter-subsystem and interlayer interfaces and interactions. Each layer will be tested to ensure that they perform their function as stated in the Detailed Design Specification.

7.1.4 System Validation Test

The final test that will be done on the system will be the validation tests. It will ensure that all of the requirements by the customer and the development team mentioned in the SRS are met. It will validate that the functionality of the Echo is exactly as stated in the requirements.

7.1.5 Hardware Test

As the applications needed for the Echo are being developed, the hardware that goes along side it will also be assembled and tested. Each hardware piece will be tested individually and then they will be tested again after integrating them with other hardware pieces and the software apps.

7.2. Test Metrics

Priority	Description	Pass Criteria	Fail Criteria
Critical	These features must be completed for they are critical to the functionality of the system. The system would not be able to function without them.	100%	Less than 100%
High	These are the non-critical features of the system. The system will have some functionality without them, but they should be completed for greater user experience.	90%	Less than 90%
Moderate	These would have moderate impact on the user experience.	75%+	Less than 75%
Low	These features do not impact the performance of the system and are considered to be for future plans.	0%+	N/A

7.3. Test Tools

Team Reflection will be using the following tools for testing:

- Excel
- JUnit
- GitHub

8. Item Pass/Fail Criteria

The following section will determine the criterion needed for the module test to be accepted as passing or failing. Only the modules that have passed will be accepted into the final Echo product, the failed modules will be corrected in order to be acceptable.

8.1. Hardware Tests

Test ID	Component	Pass Criteria	Fail Criteria
HW1	Microphone	Correctly intakes the voice commands and sends it to the system	Does not intake the voice commands or sends wrong commands
HW2	Speaker	Correctly outputs the audio	Does not output audio
HW3	Screen	It turns on o power connection and displays the ACA	It does not turn on or display the ACA
HW4	Android TV Box	It turn on once connected to power and to the screen and shows all the Apps. It lets the user install more applications from play store.	It does not turn on or show the installed apps or does not let the team install more apps.

Table 8-1: Hardware Pass / Fail Criteria

8.2. Units Tests

Test ID	Pass Criteria	Fail Criteria
UTI1	Be able to detect keyboard input, and touch input by screen tap or slide.	Fails to detect keyboard input, or touch input by screen tap and slide.
UTI2	Be able to create list of apps from the selections made by the user.	Fail to create a list of apps from the selection, or create incorrect lists from
UVI1	Be able to recognize the command word “Echo” from the user.	Fail to recognize the command word or activate on a wrong command word.
UVI2	Be able to tokenize the voice commands into corresponding strings.	Fail to tokenize the voice commands or tokenize the voice commands incorrectly into string.

UPB1	Be able to turn on the system when the system is off, and vice-versa.	Fail to turn on the system when the system is off or fail to turn off the system when the system is on.
UTIP1	Be able to create a JSON object from a list of applications correctly.	Fail to create a JSON object from the list of applications, or create JSON object incorrectly.
UTIP2	Be able to display the list of selected applications on phone screen.	Fail to display the list of applications, or display incorrect icons for applications.
UHIP1	Be able to parse the string and remove all of the words that are not command words.	Fail to parse the string correctly, by either removing command words, or not removing words that are not commands.
UHIP2	Be able to turn on the ACA on the echo on system boot up.	Fail to turn on the ACA on boot up.
UDP1	Be able to connect and send JSON object over the Wi-Fi.	Fail to connect, or fail to send the JSON object correctly over the Wi-Fi.
UDP2	Be able to parse the JSON object and retrieve package info for the applications found in JSON object.	Fail to parse the JSON object correctly, or fail to retrieve the package information correctly.
UDP3	Be able to show the icons of the favorite's app to the user on Echo.	Fail to show the icons of the favorite's app to the user.
UDP4	Be able to send the string command to application processor if the command is valid for the situation	Fail to send the string command or send the string command even if the commands aren't valid for the situation
UDP5	Be able to discard the string commands if they are invalid for the situation.	Fail to discard the commands if they are invalid for the situation, or discard the commands even if they are valid.
UDP6	Be able to turn on the ACA on the echo on system boot up.	Fail to turn on the ACA on boot up.
UDP7	Be able to perform the requested action based on string command.	Fail to perform the requested action based on the string command.
UDP8	Be able to display the requested application data	Fail to display the requested application data
UOM1	Be able to display information on Echo correctly.	Fail to display information on Echo correctly.
UOM2	Be able to output audio on speakers properly.	Fail to output audio speakers properly.

Table 8-2: Unit Tests Pass/Fail Criteria

8.3. Component Tests

Test ID	Subsystems	Pass Criteria	Fail Criteria
CTI1	Touch Input	Input from ACA is recognized and processed	Input from ACA is not recognized or not processed
CVCI2	Voice Command Input	The command word is recognized when spoken and voice commands are recognized	The command word is not recognized by the subsystem, or the voice commands are not being processed
CPB3	Power Button Input	The power button press is recognized and TV box is turned on	The power button input is not recognized and the TV box doesn't turn on.
CTIP1	Touch Input Processor	The JSON object is made and transferred to the Server on Echo correctly.	The JSON object is not made, or the transfer does not happen correctly.
CHIP2	Hardware Input Processor	The voice commands are parsed and validated	The voice commands are not parsed properly, or not validated correctly.
CDP3	Data Processor	JSON object is retrieved and parsed and tables of relevant information are created for storage.	JSON object is not retrieved or the proper tables are not being created, or are created incorrectly.
CDP4	Data Processor	The voice commands are acted upon and proper action is taken upon the applications	The voice commands are not being acted upon, or the incorrect actions are being performed on applications
CDP5	Data Processor	The System makes an Android System call after the startup button is pressed.	It does not make an Android system call
COM1	Output Manager	The subsystem displays the Application interfaces on the Screen correctly.	The subsystem will not display application Interface on the screen.

Table 8-3: Component Test Pass/Fail Criteria

9. Test Deliverable

This section will list what is to be delivered by this test plan that is system test plan, test cases, test report and Incident/Bug/Problem Reports (IRs). Under each subsection we will list the parts that go with them.

9.1. System Test Plan

The System Test Plan will provide an overview of what will be tested, how it will be tested, and the pass/fail criteria for each test depending on the expected input/outcome

9.2. Test Cases

Each test case will consist of the following section.

- **Test ID:** The ID corresponding to the test case
- **Test Item:** The name of the subsystem/module to test
- **Purpose:** Reasoning for the test
- **Test Description:** a short summary of what will be done as part of the test
- **Input:** Input that will be supplied to the test item
- **Expected Results:** Expected result of the test
- **Priority:** The priority of the test (low, medium, high, Critical**)**

9.3. Test Report

Each of the test report will consist of the following section.

- **Test ID:** The ID corresponding to the test case
- **Test Date:** The date when the test will be performed
- **Tester:** The name of the team member performing and recording test report
- **Output Results:** what the test yield as results
- **Pass/fail Criteria:** Criteria if the test passed of failed
- **Comment**: Any comments relevant to the test as well as a description of any errors

9.4. Bug Report

Each of the bug report will consist of the following section.

- **Bug ID –** A unique ID for each bug
- **Test ID:** The ID corresponding to the test case

- **Test Date:** The date the bug was first observed
- **Priority:** The priority of the bug to be fixed with respect to severity (low, medium, high, critical)
- **Tester:** Name of team member performing and recording test report
- **Fixer:** Name of team member who fixed the bug
- **Bug Description:** A short summary about the bug and what caused it.
- **Resolution Date:** When the bug was fixed
- **Bug Comments:** Any comments on the bug or defect

10. Test Schedule

Task Name	Planned Start Date	Planned Due Date
Hardware Testing	11-1-14	11-5-14
Unit Testing	11-5-14	11-15-14
GUI Listener Testing	11-5-14	11-15-14
Event Testing	11-5-14	11-15-14
Request Processor Testing	11-5-14	11-15-14
Voice Input Testing	11-5-14	11-15-14
Command Validator Testing	11-5-14	11-15-14
Command Processor Testing	11-5-14	11-15-14
Power Button Testing	11-5-14	11-15-14
Request Handler Testing	11-5-14	11-15-14
Application Request Processor Testing	11-5-14	11-15-14
System Boot Up Testing	11-5-14	11-15-14
Data Formatter Testing	11-5-14	11-15-14
Data Storage Testing	11-5-14	11-15-14
Dispatcher Testing	11-5-14	11-15-14
Display Formatter Testing	11-5-14	11-15-14
Speaker Formatter Testing	11-5-14	11-15-14
Component Testing	11-15-14	11-20-14
Touch Input Testing	11-15-14	11-30-14
Voice Input Testing	11-15-14	11-30-14
Power Input Testing	11-15-14	11-30-14
Touch Input Processor Testing	11-15-14	11-30-14
Hardware Input Processor Testing	11-15-14	11-30-14
Data Processor Testing	11-15-14	11-30-14
Output Manager Testing	11-15-14	11-30-14
Phone Formatter Testing	11-15-14	11-30-14
Echo Formatter Testing	11-15-14	11-30-14
Data Formatter Testing	11-15-14	11-30-14
Data Storage Testing	11-15-14	11-30-14
Integration Testing	11-20-14	11-30-14
Input Layer Testing	11-20-14	11-30-14
Data Processing Layer Testing	11-20-14	11-30-14
Presentation Testing	11-20-14	11-30-14
Data Storage Testing	11-20-14	11-30-14

Table 10-1: System Testing Schedule

11. Approval

Name	Role	Signature
Mike O'Dell	Project Supervisor	
Eric Becker	Project Sponsor	
Sean Nesburg	Team Leader	
Sumeet Kaur	Team Member	
Tanmay Kumar Patel	Team Member	
Aisha Kulindwa	Team Member	
Jacob Fisher	Team Member	