

**TEST PLAN**  
**HEXiMED**

**PROJECT MANAGER: VANESSA YANEZ**  
**FRANCO JUSTO, KELLY CARRANZA**

**TEXAS STATE UNIVERSITY**  
**INGRAM SCHOOL OF ENGINEERING**

**NXP SEMICONDUCTORS**  
**6501 W. WILLIAM CANNON DRIVE**  
**AUSTIN, TX 78735**

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*The rising STAR of Texas*

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# 1 Overview

The HexiMed system is an IoT connected medication reminder that notifies a patient when to take medications by integrating a set of sensors using various communication systems. The system seeks to improve medication adherence by establishing an organized medication schedule, along with a medication log stored onto an SD card which can be accessed by a physician, caregiver, or patient.

## 2 Features to be tested/not to be tested

### 2.1 *Features to be tested*

The following are the major functionalities of the application that need to be tested in the testing process:

#### 2.1.1 User Input Sequence

#### 2.1.2 User Interface

#### 2.1.3 Audio Alarm

#### 2.1.4 Visual Alarm

#### 2.1.5 Data Logging

#### 2.1.6 Memory Usage

### 2.2 *Features not to be tested*

#### 2.2.1 Hardware

Hexiwear, Hexiwear docking station, SD card, BUZZ click, NFC click, NFC tags, Matrix RGB click and panel will not be tested as they are all off-the-shelf components and we lack the equipment necessary to properly test most components.

### 3. Testing Approach

<i>User Input Sequence</i> 2.1.1	
<b>Approach</b>	<p>The Hexiwear device will allow the user to input the Medication Name, Number of Pills, Time of Day to be taken.</p> <p>That information, most specifically the Time of Day, will be connected to the sound and visual alarms to notify the user when the medication should be taken.</p>
<b>Pass/Fail Criteria</b>	<p>The user input sequence will pass if the information inputted by the user is stored correctly and is able to connect with the visual and audio alarm.</p> <p>The user input sequence will fail if the information stored does not connect with the visual and audio alarm.</p>
<b>Verification Method</b>	<p>The testing will be done by inputting the information of 50 usage instances and verifying that the system can hold the correct information while also turning the visual and audio alarms on at the correct times.</p>

<i>User Interface 2.1.2</i>	
<b>Approach</b>	<p>The user interface will be tested by turning the alarms on to be able to see how fast the information appears onto the LED screen and if the information is displayed clearly for the user to read both during the day and at night.</p>
<b>Pass/Fail Criteria</b>	<p>The user interface display should load within a 5 second time frame and should appear clearly to be considered as a pass criteria.</p> <p>If the display does not look clear or does not load within the 5 seconds, this is considered a fail.</p>
<b>Verification Method</b>	<p>A stop watch will be used to ensure that the display appears clearly and within a 5 second time frame.</p> <p>Otherwise, the code will need to be edited in or for the display appear at the correct time.</p> <p>As for the display the LED colors will be tested both during the day and at night. The LED color selection will be chosen so that the user can see the information clearly.</p>

<b>Audio Alarm 2.1.3</b>	
<b>Approach</b>	<p>The audio alarm will be tested simply by creating a code that will sound the alarm on once the time of day to take the pill is reached.</p> <p>If the alert is ignored after 90 seconds, the alarm will sound off automatically.</p>
<b>Pass/Fail Criteria</b>	<p>After the user enters the time of day that the medication needs to be taken into the Hexiwear system, the alarm will sound off at that specific time.</p> <p>The audio alarm will only fail if and only if the incorrect time of day is entered, otherwise it should go off at the designated time.</p>
<b>Verification Method</b>	<p>The time of day will be entered into the Hexiwear system and will sound will turn on at that specific time. The correct NFC tag will be scanned and the sound will shut off.</p> <p>The time of day will again then be entered, but this time the incorrect NFC tag will be scanned for the entire 90 second interval and should shut off automatically once the 90 seconds is up.</p> <p>The time of day will be entered once again, but this time no NFC tags will be scanned. The alarms will sound off and the system will consider this as an ignored alarm and will shut off after the 90 second interval is over.</p>

<b>Visual Alarm 2.1.4</b>	
<b>Approach</b>	<p>The visual alarm will be tested simply by creating a code that displays the information input by the user including Name of Medication, Time of Day, and Number of Pills while flashing to notify the user to take that certain medication.</p>
<b>Pass/Fail Criteria</b>	<p>The pass criteria includes the correct information being stored into the system and then being displayed onto the LED screen while flashing all at the same time.</p> <p>The fail criteria includes the screen either not showing the correct information or the screen not flashing to alert the user.</p>
<b>Verification Method</b>	<p>The testing for the visual alarm will include implementing the alarm 50 times to ensure that the correct information and the flashing LED occurs.</p>

<b>Data Logging 2.1.5</b>	
<b>Approach</b>	The NFC sensor will read medication NFC tags scanned within 2-3cm and log medication name and time to SD card.
<b>Pass/Fail Criteria</b>	<p>The pass criteria includes the correct NFC tag being scanned the information logged onto the SD card.</p> <p>The fail criteria includes in the incorrect the tag being scanned and the information being logged onto the SD card as fail.</p>
<b>Verification Method</b>	The testing for the Log Data will be done by scanning 50 NFC tags at different distances and also scanning the incorrect tags as well just to insure the information is uploaded correctly to the SD card.
<b>Logging</b>	
<b>Approach</b>	The NFC sensor will read medication NFC tags scanned within 2-3cm and log medication name and time to SD card.
<b>Pass/Fail Criteria</b>	<p>The pass criteria includes the correct NFC tag being scanned the information logged onto the SD card.</p> <p>The fail criteria includes in the incorrect the tag being scanned and the information being logged onto the SD card as fail.</p>
<b>Verification Method</b>	The testing for the Log Data will be done by scanning 50 NFC tags at different distances and also scanning the incorrect tags as well just to insure the information is uploaded correctly to the SD card.

<b>Memory Usage 2.1.6</b>	
<b>Approach</b>	Hexiwear's Kinetics K64 MCU has a limit of 1MB of flash memory, so all of the information that we will store into the system must not exceed that.
<b>Pass/Fail Criteria</b>	The pass simply includes all the information being able to be stored into the 1MB flash memory, otherwise any information left out will be considered a fail.
<b>Verification Method</b>	The code will be uploaded and the we will observe the functionality and performance of the system after 50 usages.

## 4. Test Cases

### 4.1 Test Case #1: User Input Sequence

Tested By:		Franco Justo
Test Case Number		1
Test Case Name		User Input Sequence
Test Case Description		The Hexiwear device will allow the user to input the Medication Name, Number of Pills, Time(s) of Day to be taken. That information, most specifically the Time of Day, will be connected to the sound and visual alarms to notify the user when the medication should be taken.
Item(s) to be tested		
1	Hexiwear Device	
Specifications		
Input		Expected Output/Result
User inputs NFC Tag Number, Number of Pills in Bottle, Time(s) of Day to take Medication (Alarm Time), Days of Week, Number of Pills per Dose		User is able to input all information through Hexiwear Device, information is saved onto Hexiwear flash memory.
Resources Required		
1	ARM Mbed OS	
Procedural Steps		
1	Build working code for user input sequence on ARM Mbed OS.	
2	Connect Hexiwear to PC through USB Port, Import Code.	
3	Press Reset button on Hexiwear Docking Station.	
4	Navigate OLED screen on Hexiwear and input information prompted.	

## 4.2 Test Case #2: User Interface

Tested By:		Franco Justo
Test Case Number		2
Test Case Name		User Interface
Test Case Description		
Item(s) to be tested		
1	Matrix RGB Click	
2	Matrix RGB Panel	
Specifications		
Input		Expected Output/Result
Code is built to display messages on the LED Panel.		Each message is displayed with clear text and loads within 5 seconds or less.
Resources Required		
1	Arm Mbed OS	
2	Stopwatch	
Procedural Steps		
1	Build working code for user interface on ARM Mbed OS.	
2	Connect Hexiwear to PC through USB Port, import code.	
3	Press reset on Hexiwear Docking Station to run code.	
4	Create a timer for each time a message is displayed on LED Panel.	
5	Record how many seconds it takes for each message to load as well as the text size, font, and color.	



### 4.3 Test Case #3: Audio Alarm

Tested By:		Kelly Carranza
Test Case Number		3
Test Case Name		Audio Alarm
Test Case Description		<i>The audio and visual alarms will be tested simply by creating a code that will turn the alarms on once the specific time is entered.</i> <i>If the alert is ignored or the user does not scan the correct medication after a 90 second interval, the alarms will turn off automatically.</i>
Item(s) to be tested		
1	Hexiwear Device	
2	BUZZ2 Click	
Specifications		
Input		Expected Output/Result
Times for specific alarms will be inputted into the Hexiwear device.		Once it is time for an alarm to go off the BUZZ2 Click will emit any necessary sound alarms at the times inputted.
Resources Required		
1	Arm Mbed OS	
Procedural Steps		
1	Build working code for BUZZ2 Click on ARM Mbed OS.	
2	Enter time for audio alarm to be triggered onto Hexiwear device.	
3	Connect Hexiwear to PC through USB Port, import code.	
4	Press reset on Hexiwear Docking Station to run code.	
5	Once it is time for the alarm to go off, observe if the BUZZ2 Click emits a sound alarm at the correct time.	

## 4.4 Test Case #4: Visual Alarm

Tested By:		Vanessa Yanez
Test Case Number		4
Test Case Name		Audio Alarm
Test Case Description		<i>The audio and visual alarms will be tested simply by creating a code that will turn the alarms on once the specific time is entered.</i> <i>If the alert is ignored or the user does not scan the correct medication after a 90 second interval, the alarms will turn off automatically.</i>
Item(s) to be tested		
1	Hexiwear Device	
2	Matrix RGB Click	
3	Matrix RGB Panel	
Specifications		
Input		Expected Output/Result
Times for specific alarms will be inputted into the Hexiwear device.		Once it is time for an alarm to go off the Matrix RGB Panel will display any necessary visual alarms at the times inputted.
Resources Required		
1	Arm Mbed OS	
Procedural Steps		
1	Build working code for Matrix RGB Click on ARM Mbed OS.	
2	Enter time for a visual alarm to be triggered onto Hexiwear device.	
3	Connect Hexiwear to PC through USB Port, import code.	
4	Press reset on Hexiwear Docking Station to run code.	
5	Once it is time for the alarm to go off, observe if the Matrix RGB Panel emits a visual alarm at the correct time.	

## 4.5 Test Case #5: Data Logging

<b>Tested By:</b>		Vanessa Yanez
<b>Test Case Number</b>		5
<b>Test Case Name</b>		Data Logging
<b>Test Case Description</b>		The NFC sensor will read medication NFC tags scanned within 2-3cm and log medication name and time to SD card.
<b>Item(s) to be tested</b>		
1	Hexiwear Device	
2	NFC Click	
3	NFC Tags	
4	Matrix RGB Click	
5	Matrix RGB Panel	
<b>Specifications</b>		
<b>Input</b>		<b>Expected Output/Result</b>
NFC Tag Number will inputted into the Hexiwear Device for the Matrix RGB Panel to display when the alarms go off.		Once the correct NFC Tag is scanned to the sensor, it will save the tag number onto the SD Card.
<b>Resources Required</b>		
1	Arm Mbed OS	
<b>Procedural Steps</b>		
1	Build working code for Matrix RGB Click and NFC Click on ARM Mbed OS.	
2	Enter NFC Tag number to be displayed on the Matrix RGB Panel.	
3	Connect Hexiwear to PC through USB Port, import code.	
4	Press reset on Hexiwear Docking Station to run code.	
5	Once the Matrix RGB Panel displays the NFC Tag number to be scanned, scan the NFC Tag.	
6	Check SD Card to see if the correct/incorrect tag numbers were stored in an organized manner.	

## 4.6 Test Case #6: Memory Usage

Tested By:		Kelly Carranza
Test Case Number		6
Test Case Name		Memory Usage
Test Case Description		Hexiwear’s Kinetics K64 MCU has a limit of 1MB of flash memory, so all of the information that we will store into the system must not exceed that.
Item(s) to be tested		
1	Hexiwear Device	
2	NFC Click	
3	NFC Tags	
4	Matrix RGB Click	
5	Matrix RGB Panel	
6	BUZZ2 Click	
Specifications		
Input		Expected Output/Result
All code programmed and imported into the Hexiwear device.		All information imported into the Hexiwear device should be stored and the system should function properly.
Resources Required		
1	Arm Mbed OS	
Procedural Steps		
1	Import working code for each feature listed in the previous sections.	
2	Connect Hexiwear to PC through USB Port, import code.	
3	Press reset on Hexiwear Docking Station to run code.	
4	Check SD Card to see if the correct/incorrect tag numbers were stored in an organized manner.	

## 5. Testing Schedule

Test Dates	Test Case Number	Test Name	Responsible Engineers
4/10-8/27	#5	Data Logging	Vanessa Yanez
4/10-8/27	#1	User Input Sequence	Franco Justo
4/10-8/27	#3	Audio Alarm	Kelly Carranza
9/27-10/11	#4	Visual Alarm	Vanessa Yanez
9/27-10/11	#2	User Interface	Franco Justo
10/11-11/11	#6	Memory Usage	Kelly Carranza