

**EE SENIOR DESIGN  
PROJECT STATEMENT OF WORK  
HEXIMED**

**TEXAS STATE UNIVERSITY  
INGRAM SCHOOL OF ENGINEERING**

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*The rising STAR of Texas*

Revision History			
Version	Date	Description	Author
1.0	2/11/18	1. Executive Summary shortened	Vanessa Yanez
1.0	2/11/18	2. Business Need shortened, cited	Franco Justo, Vanessa Yanez
1.0	2/10/18	3. Product Scope shortened, features added, stretch goals revised	Vanessa Yanez

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## 1. EXECUTIVE SUMMARY

*Vanessa Yanez:*

Our product is an IoT connected medication reminder that allows you to integrate a set of click boards using various communication systems. The Internet of Things is a network of connected objects able to collect and exchange data using embedded sensors. It is predicted that by 2020 there will be over 26 billion connected devices. The new rule for the future is going to be, "Anything that can be connected, will be connected." By partnering with NXP, one of the leading producers of microcontrollers and sensors, MikroElektronika was able to create Hexiwear, an IoT development kit packed with sensors to quantify yourself and the world around you.

Often, people buy their prescribed drugs but misunderstand what to take, or how to take them, or even forget doses. The HexiMed system is an IoT solution that will seek to improve medication adherence by establishing an organized medication schedule. A Hexiwear device will be connected to the docking station and will communicate with a smartphone application via Bluetooth to alert users when it is time to take medication. The HexiMed system will include an LED Panel to visually prompt the user which medications to take, and how to take them. Once medications are taken, HexiMed will recognize each specific medicine and log the day and time it was taken to allow easy tracking for the physician, caretaker, and patient..

The members of this project will be Vanessa Yanez (Project Manager), Kelly Carranza, and Franco Justo. The research, development, and testing process will take place at Ingram School of Engineering under the guidance of Alexander Song (Mentor), Mr. Lee Hinkle (Faculty Instructor), Dr. Kevin Kemp (NXP Sponsor), and Dr. Semih Aslan (Faculty Advisor). The HexiMed design project will be completed by the end of the fall semester in December 2018.

## 1. BUSINESS NEED

*Franco Justo, Kelly Carranza:*

Nonadherence to prescribed medication is a widespread problem within the United States and could be potentially be prevented by the respective individual it hinders. According to a review in Annals of Internal Medicine, lack of medication adherence is estimated to cause 125,000 deaths, and at least 10% of hospitalizations, and costs the American healthcare system between \$100 billion and \$289 billion a year, whether it's for a minor infection or deadly condition, people typically take only half of prescribed doses.<sup>1</sup>

With HexiMed medication reminder, your loved one is reminded to take their pills every day, which prevents forgetting important dosages. It enables physicians to become fully aware of how consistent the patient is with their designated medication. The more consistent the patient is the better their long-term health and well-being becomes. HexiMed eventually becomes a cost cutter since the device will remind the user to be more persistent with the medication, avoiding having to visit a doctor and paying expensive medical bills in the long run. There is nothing that your senior must read or figure out. They simply need to take the pills in the compartment after the display lights up red and follow the on-screen instructions.

<sup>1</sup><http://annals.org/aim/fullarticle/1357338/interventions-improve-adherence-self-administered-medications-chronic-diseases-united-states>

## 2. PRODUCT SCOPE DESCRIPTION

*Vanessa Yanez:*

MikroElektronika's Hexiwear, enhanced by NXP, is an IoT development platform that is useful for many applications. Its versatility allows prototypes to be built that can be put to everyday, real-world use. Hexiwear is an ideal platform for IoT technology because of its compact form factor, low power consumption, expandability, cloud connectivity, and availability. HexiMed enhances Hexiwear's core functionality with the addition of three click boards connected to the Hexiwear Docking Station to add wireless connectivity, a display, and transfer of data.

### Features:

- Hexiwear, a compact, low powered device which features several advanced NXP sensors. Works with compatible iOS/Android apps. Connects to the WolkSense Sensor Data Cloud.
- Hexiwear Docking Station: Expands the Hexiwear device with up to three click boards. Allows new firmware to be uploaded through the USB port.
- NFC Click: The NFC tag click will recognize what prescription is being taken by the user and transfer data including the date and time to the WolkSense Cloud.
- Matrix RGB click: The Matrix RGB click will power the 32x32 LED RGB Matrix Panel, which will create a visual display with the medication name and instructions on how to take each dose.
- Bluetooth Click: The Hexiwear device is built with its own Bluetooth connection however, the Bluetooth Click will increase the Bluetooth range with a more secure connection.

Features	Performance Targets
Medication Alert	Alerts users when it is time to take a prescription within a Bluetooth range of 100m.
Visual Display	Allows user to see what prescription is being called for and how to take it on a Hi-brightness RGB LED matrix panel with 1024 LEDs arranged on a 32x32 grid, total size 160x160mm
Medication Counter	Tracks the number of pills that are being taken using the NFC Click with integrated firmware that performs contactless communication, running on a 3.3 V power supply.
WolkSense Cloud	The smartphone app Hexiwear BLE devices and send sensor readings to WolkSense Sensor Data Cloud.
Medication Log	Reports and statistics of medication adherence, data is accessible via a smartphone app for easy sharing with physician or caregiver
Power Supply	Continuous power supply through the Micro USB port, input voltage of 5V, can be plugged into a 5 V battery as a temporary power source.

Secure Backup	HexiMed securely stores data to the WolkSense Cloud if a power outage were to occur.
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Stretch Goals:

- Create a sound feature on the HexiMed system that beeps as an alarm using the Buzz 2 click.
- Send text message alerts for long-range wireless transmission using the 3G SARA click.
- Create an automatic medicine dispenser using Raspberry Pi for motor control.

### 3. PROJECT SCOPE DESCRIPTION

*Franco Justo, Kelly Carranza:*

Project Schedule - Spring 2018			
Task	Duration, Wks	Start	End
Define Project	1	01/19/18	01/26/18
Meet with Faculty Sponsor	1	01/24/18	01/23/18
Project Research <ul style="list-style-type: none"> <li>• Identify project goals and features</li> <li>• Constraints</li> <li>• Hardware and Software components</li> <li>• Clickboards</li> </ul>	2	1/21/18	2/8/18
Write Statement of Work	3	01/22/18	02/12/18
Functional Specification	4	02/13/18	03/18/18
Initial Design Review Preparation <ul style="list-style-type: none"> <li>• create PowerPoint</li> <li>• rehearse</li> </ul>	2	3/11/18	3/25/18
Updated Specification	1.5	03/19/18	03/28/18
Initialize Project <ul style="list-style-type: none"> <li>• order parts</li> <li>• begin programming</li> </ul>	3	3/25/17	4/8/17
Spring Break	1	03/11/18	03/18/18
Create Code for LED Display	2	03/18/18	03/25/18
Labor Cost Schedule	2	03/28/18	04/11/18
Implement NFC tag click	1	03/26/18	04/02/18
Debug and Improve tag click	1	04/02/18	04/09/18
Poster Draft Submission	2	04/04/18	04/25/18
Hard Copy Test Plan	2.5	04/04/18	04/30/18
Individual Reports	4	04/04/18	05/02/18
Poster PDF Submission	4	04/04/18	05/03/18
Working prototype	4	5/5/18	6/5/18
Project Schedule - Fall 2018			
Meet with Sponsor	.5	8/30/18	9/6/18

Meet with D1	1	8/30/18	9/6/18
Finalize code	2	9/3/18	9/20/18
Testing <ul style="list-style-type: none"> <li>• Monitor power consumption</li> <li>• Verify UI is easy to use</li> <li>• Verify sensors datalogging</li> </ul>	3	9/20/18	10/12/18
Review testing	3	10/12/18	11/5/18
Final design review	1	11/7/18	11/14/18
Final report <ul style="list-style-type: none"> <li>• prep and rehearsal</li> </ul>	1	11/14/18	11/21/18
Hardcopy Poster	2	11/21/18	11/30/18
Project notebook	1	11/30/18	12/6/18
Senior Design Day	1	12/7/18	12/14/18

#### 4. SPONSOR SUPPORT ELEMENTS

Sponsor Support Elements		
Element	First Needed	Needed Until
Feedback	1/24/18	5/11/2018
Approval of Reports and Designs	2/8/2018	2/12/2018
Hexiwear, Docking Station	1/24/18	12/10/2018
Programming Assistance	1/24/18	12/10/2018

#### 5. APPROVALS

The signatures of the people below indicate an understanding in the purpose and content of this document by those signing it. By signing this document, you indicate that you approve of the proposed project outlined in this Statement of Work and that the next steps may be taken to create a Functional Specification and proceed with the project.

Approver Name	Title	Signature	Date
	Project Manager		
	D2 Project Manager		
	Faculty Sponsor		
	Sponsor		
	Instructor		