CHAPTER 5

IMPLEMENTATION AND TESTING

This chapter would discuss the implementation strategy including what system the author used to create the application. It would also describe the observation from the result of testing the proposed solution.

The test conducted by the author would show the expected result and the actual result of the application. The test plan was done to make sure that the application could function according to the specifications. The test also involved all possible input data and should return the correct error handling.

1.1 System Specification

1.1.1 Software

Here was the software needed for the development of the application and system prototype:

- Microsoft Windows 7 (32 bit and 64bit)
- OS X Lion
- MAMP Pro 2.0
- XAMPP 1.7.7
- phpMyAdmin 3.4.5

- PHP 5.3.8
- Netbeans 7.0.1
- Microsoft Visual Studio 2010
- Windows Azure SDK 1.4
- Windows Azure MySQL PHP Solution Accelarator
- Windows Azure SDK for PHP v4.1.0Arduino 0.23
- Mozilla Firefox 9.0.1 (Windows and Lion)
- Google Chrome 16.0.912.75 (Windows and Lion)
- Internet Explorer 9 for Windows
- Safari 5.1.2 for MAC
- Opera 11.60 for Windows

1.1.2 Hardware

Below are list of hardware used by the author when developing and testing the system prototype

Category	MAC	Laptop Windows	PC
OS	OSX Lion/Snow Leopard	Windows 7 - 64 Bit	Windows 7 - 32bit
Processor	Intel i5 - 1.6Ghz/2.7GHz	Intel i5 - 2.4Ghz	Intel CoreDuo - 2.4Ghz
RAM	4GB DDR3	4GB DDR3	2GB DDR2
HDD	128GB SSD	4TB HDD	500 GB HDD

1.1.3 Server

Here was the server specification that was used when testing the system in online server.

Category	Type
OS	Centos 6.2
Processor	Intel i7-2600 3.4GHz 8MB L2
RAM	16GB DDR3
HDD	2 x 3TB SATA 6GB/s 7200rpm

1.2 Implementation Strategy

In the implementation strategy the author will act as a vendor while the users are the potential customers.

As a users it is advised that:

- Users already have internet connection preferably with static IP address for online monitoring
- Users will be given 2 months trial to see whether the application can help them to reduce their electricity cost.
- Users will have to pay for subscription fee after two months trial period have ended.

- Users that are subscribing to the service will be given 3 months free maintenance service
- All users will be given a hands on tutorial and guide book of how to use the system.
- All of the installations will be done by the vendor.

1.3 Module Testing

The module testing was aimed to test each of the modules independently and the test was conducted in a localhost to get more accurate result limiting the system from external environment. The module testing would include testing input, output and the application itself.

1.3.1 Application Testing

Date	3 January 2012	
Test Case	The application successfully run on the localhost	
Pre-condition	Webserver already installed in computer and running	
Steps		
1. Put all application files in xampp\htdocs folder 2. Open web browser and go to http://localhost/appfolder/		
Expected Result:	Application should be opened in web browser	Status: **SUCCESS**

Date	3 January 2012	
Test Case	User registration function	
Pre-condition	Database settings correctly setup in application Application already running in localhost	
Steps		
1. Register user from the menu		
Expected Result:	Success creating user	Status: **SUCCESS**

Date	3 January 2012	
Test Case	AUTH key generator	
Pre-condition	Application already running in localhost	
Steps		
1. Login to the application 2. Go to Authentication menu 3. Try to generate new authentication key either read or write 4. Open phpMyadmin and see if it was updated		
Expected Result:	New auth key was updated in database for that particular user	Status: **SUCCESS**

Date	3 January 2012	
Test Case	AUTH key generator	
Pre-condition	Application already running in localhost	
Steps		
1. Login to the application 2. Go to Authentication menu 3. Try to generate new authentication key either read or write 4. Open phpMyadmin and see if it was updated		
Expected Result:	New auth key was updated in database for that particular user	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Input reading registered correctly	
Pre-condition	Application already running in localhost	
Steps		
1. Login to the application 2. Go to Authentication menu 3. Copy the URL for debugging the input sensors. 4. Open new browser window and paste the previous copied URL 5. It should return “Feeds OK” status 6. Go to menu Inputs in the application		
Expected Result:	See if JSON formatted input from the copied URL was registered successfully in Inputs menu	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Feeds functionality	
Pre-condition	Application already running in localhost Inputs already registered in Inputs menu	
Steps		
1. Go to inputs menu 2. Click on one of the input reading 3. Choose the process from the drop down menu to ‘Log to feed’ 4. Add the argument 5. Copy paste the Debugging URL again from Authentication menu 6. Go to Feeds menu again		
Expected Result:	The feeds list was updated to the latest reading	Status: **SUCCESS**
Date	3 January 2012	
Test Case	Test bar graph from Feed list	
Pre-condition	Application already running in localhost Inputs already registered in Inputs menu Feeds already registered in Feeds menu	
Steps		
1. Go to feeds menu 2. Click on one of the feeds reading 3. Choose bar graph		
Expected Result:	The application would show the corresponding chart	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Test realtime chart from Feed list	
Pre-condition	Application already running in localhost Inputs already registered in Inputs menu Feeds already registered in Feeds menu	
Steps		
1. Go to feeds menu 2. Click on one of the feeds reading 3. Choose realtime		
Expected Result:	The application would show the corresponding chart	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Test raw data chart from Feed list	
Pre-condition	Application already running in localhost Inputs already registered in Inputs menu Feeds already registered in Feeds menu	
Steps		
1. Go to feeds menu 2. Click on one of the feeds reading 3. Choose raw data		
Expected Result:	The application would show the corresponding chart	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Test Panel view	
Pre-condition	Application already running in localhost Inputs already registered in Inputs menu Feeds already registered in Feeds menu	
Steps		
1. Go to Panel menu 2. Click on edit panel 3. Input the panel as explained in the chapter 4 4. Click Save and then Close		
Expected Result:	The application would show the corresponding panel with the reading as shown in Feed list	Status: **SUCCESS**

Date	3 January 2012	
Test Case	Check links on application	
Pre-condition	Application already running in localhost	
Steps		
1. Login to the app 2. Check on every link and see if it redirected to the correct page		
Expected Result:	All links worked correctly	Status: **SUCCESS**

1.3.2 Input Module Testing

Date	27 December 2011	
Test Case	The board could be powered by battery	
Pre-condition	Have 2x AA battery ready	
Steps		
Insert 2xAA battery in correct position		
Expected Result:	Green LED turned ON after battery was inserted	Status: **SUCCESS**

Date	27 December 2011	
Test Case	The board RF transmitter is working	
Pre-condition	Board connected to power supply	
Steps		
Check the green LED on the board		
Expected Result:	The Green LED blinked every 10s	Status: **SUCCESS**

Date	27 December 2011	
Test Case	The board sensor 1 is working	
Pre-condition	1. Board connected to Power Supply 2. Arduino IDE already installed in computer	
Steps		
1. Connect the board to computer using FTDI cable 2. Open Arduino and go to Tools -> Serial monitor 3. See the output of sensor1		
Expected Result:	Sensor 1 showed a reading	Status: **SUCCESS**

Date	27 December 2011	
Test Case	The board sensor 1 is working	
Pre-condition	1. Board connected to Power Supply 2. Arduino IDE already installed in computer	
Steps		
1. Connect the board to computer using FTDI cable 2. Open Arduino and go to Tools -> Serial monitor 3. See the output of sensor2		
Expected Result:	Sensor 2 showed a reading	Status: **SUCCESS**

Date	27 December 2011	
Test Case	The board sensor 1 is working	
Pre-condition	1. Board connected to Power Supply 2. Arduino IDE already installed in computer	
Steps		
1. Connect the board to computer using FTDI cable 2. Open Arduino and go to Tools -> Serial monitor 3. See the output of sensor2		
Expected Result:	Sensor 2 showed a reading	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board had been correctly calibrated	
Pre-condition	Board was connected using FTDI cable to computer	
Steps		
1. Open Arduino IDE, go to Tools – Serial Monitor 2. See the output of sensor1 and sensor2 from serial monitor		
Expected Result:	Sensor 1 and Sensor 2 showed value below 10	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board could send data via RF Transmitter	
Pre-condition	Board was connected using FTDI cable to computer	
Steps		
1. Open Arduino IDE, go to Tools – Serial Monitor 2. See the output of the program from serial monitor		
Expected Result:	It should be looping continuously showing the value of sensor 1 and sensor 2	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board Microcontroller was working	
Pre-condition	Board was powered ON	
Steps		
1. Connect the board to computer using FTDI cable 2. Open Arduino and go to Board – Arduino Uno 3. Go to File – Sketchbook and choose the correct sketches for the board 4. Click Upload from the icon		
Expected Result:	It should blink the led on the FTDI cable and the IDE showed 'Done Uploading'	Status: **SUCCESS**

1.3.3 Output Module Testing

Date	27 December 2011	
Test Case	Board was powered ON	
Pre-condition	Have the correct USB cable	
Steps		
1. Connect USB cable from computer to the board		
Expected Result:	The Red LED should be flashing continuously	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board RF was working	
Pre-condition	Board was connected using FTDI cable to computer	
Steps		
1. Open Arduino and go to Tools -> Serial monitor 2. See the output from serial monitor		
Expected Result:	It should show the Node ID of the input board	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board RF was able to receive data from Input Board	
Pre-condition	Connect the board to computer using FTDI cable	
Steps		
1. Open Arduino and go to Tools -> Serial monitor 2. See the output from serial monitor		
Expected Result:		Status: **SUCCESS**

Date	27 December 2011	
Test Case	Board Microcontroller was working	
Pre-condition	Connect the board to computer using FTDI cable	
Steps		
1. Open Arduino and go to Board – Arduino Duemilanove or Nano w/ ATmega328 2. Go to File – Sketchbook and choose the correct sketches for the board 3. Click Upload from the icon		
Expected Result:	It should blink the led on the FTDI cable and the IDE showed 'Done Uploading'	Status: **SUCCESS**

Date	27 December 2011	
Test Case	Ethernet port was working	
Pre-condition	Board was powered ON	
Steps		
1. Check the LED on the Ethernet port		
Expected Result:	The green LED on the port should be turned ON	Status: **SUCCESS**

Date	27 December 2011	
Test Case	The Ethernet could send data to the server	
Pre-condition	Connect the board to computer using FTDI cable	
Steps		
1. Open Arduino and go to Tools -> Serial monitor 2. See the output from serial monitor		
Expected Result:	It should show status OK and show JSON formatted data looping continuously.	Status: **SUCCESS**

1.4 Integration Testing

1.4.1 Reliability Testing

Date	6 January 2012	
Test Case	Wireless Distance Testing	
Pre-condition	All devices were up and running	
Steps		
1. Connect the Output Board with FTDI cable to computer 2. Open Arduino IDE, Go to Tools – Serial Monitor 3. Move the Input board away from the output board 4. See from the Serial monitor as the author moved the input board further		
Expected Result:		Status: **5m – SUCCESS** **10m –SUCCESS** **15m – SUCCESS** **20m – SUCCESS** **1 Floor difference –SUCCESS** **2 Floor difference – FAIL**

Date	6 January 2012	
Test Case	All functions worked properly	
Pre-condition	All devices were up and running Application already running	
Steps		
1. Login to Application 2. See the functionality of Inputs, Feeds, and Graphing		
Expected Result:	All functions worked correctly	Status: **SUCCESS**

Date	6 January 2012	
Test Case	All data posted correctly to web server	
Pre-condition	All devices were up and running Application already running Output board is connected to computer using FTDI cable	
Steps		
1. Open Arduino IDE 2. Go to Tools – Serial Monitor in Arduino IDE 3. Open phpMyAdmin and look for the feeds 4. Compare the feeds value from phpMyadmin and Arduino IDE serial monitor		
Expected Result:	The data should match between arduino IDE and phpMyAdmin	Status: **SUCCESS**

1.4.2 Compatibility Testing

Date	6 January 2012	
Test Case	Browser compatibility test for application	
Pre-condition	All devices were up and running Application already running on webserver	
Steps		
1. Open application using various kinds of browser 2. The test would include Firefox, Chrome, Opera, Safari, Internet Explorer		
Expected Result:	Everything worked normally on various browsers	Status: **Firefox – SUCCESS** **Chrome –SUCCESS** **Opera – SUCCESS** **Safari –SUCCESS** **IE – FAIL**

Date	6 January 2012	
Test Case	Operating System compatibility test for application	
Pre-condition	All devices were up and running Application already running on webserver	
Steps		
1. Open application using different kinds of computer OS 2. The test would include Windows Vista 32 bit, Windows 7 – 32 bit, Windows 7 – 64 bit, Lion OSX, Leopard OSX		
Expected Result:	Everything worked normally on various platforms	Status: **Vista 32 bit – SUCCESS** **7 32 bit – SUCCESS** **7 64 bit – SUCCESS** **OSX Leopard –SUCCESS** **OSX Lion – SUCCESS**

1.4.3 Security Testing

Date	7 January 2012	
Test Case	SQL Injection test	
Pre-condition	All devices were up and running Application already running	
Steps		
1. Check for SQL injection in username and password also from all textbox inputs		
Expected Result:	It should return error on all sql injection attempts	Status: **SUCCESS**

Date	6 January 2012	
Test Case	Username and password validation	
Pre-condition	All devices were up and running Application already running	
Steps		
1. Try to register using recommended pattern		
Expected Result:	Show error message with required pattern	Status: **SUCCESS**

Date	6 January 2012	
Test Case	URL Rewriting function	
Pre-condition	All devices were up and running Application already running	
Steps		
1. Login to Application 2. All links in web address should not show the file .php files which were being requested		
Expected Result:	No .php files were shown on web address	Status: **SUCCESS**