Architecture Drivers Specification

* *IoT anyware* –



Team number 1

June 2015

Document History

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| --- | --- | --- |
| Ver. | Date | Description |
| 0.1 | 05/11, 2015 | Create initial ADS.  Add Context, Use cases, Quality attributes, Constraints. |
| 0.2 | 05/14, 2015 | Mentor’s comments |
| 0.3 | 05/18, 2015 | Add detail Quality attribute scenarios |
| 0.4 | 05/21, 2015 | Add functional requirements.  Refine Use cases and Quality attribute scenarios. |
| 0.5 | 05/26, 2015 | Shared on Google docs |
| 0.6 | 05/27, 2015 | Refine QA’s and set priority |
| 0.7 | 05/30, 2015 | Refine use cases |
| 0.9 | 06/17, 2015 | Updated |
| 1.0 | 06/18, 2015 | Move *Use case scenarios* section to “*Team1\_02\_Architecture Design Document.doc*”  Freeze and release v1.0 |

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# **1. Introduction**

The aim of this document is to describe the architectural drivers of the IoT project: high level functionality in the form of use cases, quality attributes scenarios and constraints.

## Project Goals

* Create an IoT infrastructure to support accessing sensors and actuators installed in the home or business.
* Create an infrastructure to provide an ecosystem to develop cost competitive home or business IoT products for value-added-resellers and other 3rd party hardware and software application developers, service providers, and installers and maintainers.
* Build a basic data centric infrastructure to provide IoT data sets for developers to create future data mining, analytic operations, and services.

## Stakeholders

* Consumers.
* Sensor/Actuator producers.
* Home builders.
* Third-party service providers.
* IoT application developers.
* Anthony J. Latanze & his development team.

# **2.** **High Level Functional Requirements**

## Functional Requirements

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| **Access secured services** | FR01 |
| **Description**:  User accesses the system in secured environment. User must login to the system for services. Unauthorized persons are not allowed to control sensors installed in home, register SA Nodes, or access any data gathered in the system. | |

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| **Discover SA Nodes** | FR02 |
| **Description**:  User queries home to find out how many nodes are installed and what sensors/actuators are installed on each node. | |

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| **Determine sensors and control actuators** | FR03 |
| **Description**:  User can determine the temperature/humidity, turn on and off lights, open and close the door, turn on the alarm, and determine if anyone is home. However, user must set the alarm off prior to opening the door. | |

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| **Log user commands and sensor values** | FR04 |
| **Description**:  User commands and sensor values are stored in IoT infrastructure for some period of time. This data set can be utilized by developers to create future data mining, analytic operations, and services. | |

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| **Send emergency message** | FR05 |
| **Description**:  An emergency message is sent to the user when door is opened manually or the house is suddenly occupied while alarm is set. | |

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| **Lock house automatically** | FR06 |
| **Description**:  User is informed upon the vacancy of house and asked to lock the house. If the user failed to respond to the message within 5 minutes, the door is closed, and the alarm is set automatically. | |

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| **Turn off light automatically** | FR07 |
| **Description**:  When no one is home for 10 minutes, the light is turned off automatically. | |

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| **Register SA node** | FR08 |
| **Description**:  User adds nodes to the system. Equipped sensors and actuators are recognized. | |

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| **Unregister SA node** | FR09 |
| **Description**:  User removes nodes from the system. | |

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| **Sharing SA node control right to other user** | FR10 |
| **Description:**  **User who registered a node is able to give a right (FR03) to other user (eg. his/her child, his/her mom, or other family).** | |

# **3.** **Quality Attribute**

3.1. Summary

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| **Total** | **High Priority** | **Medium Priority** | **Low Priority** |
| 9 | 5 | 4 | 0 |

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| **ID** | **Priority** | **Quality Attribute** | **Descriptions** |
| QA01 | H | Security | Hackers or malicious people try to break into the system. When unauthorized user attempts to login to the system, the system maintains the audit trail. If the attempt is repeated more than 5 times, the account is locked, and the source of tempering is identified. |
| QA02 | H | Security | Hackers or malicious people try to register the SA node that is not owned by them. When unauthorized user attempts to register the SA node that he/she doesn’t own, the system maintains the audit trail, and cancel the registration in 10 minutes. |
| QA03 | H | Availability | SA node can crash, hang, or be disconnected from the network for various reasons. If SA node is inoperable or out of reach, the system should be aware of such events, and notify user within 2 minutes. |
| QA04 | M | Availability | SA node can be disconnected from the network for various reasons. If SA node is not able to reach the system due to network failure, it should store recent logs at least for one day. When the network is restored, SA node should send the logs to the system. |
| QA05 | M | Scalability | The number of SA node user can be more than one. The system should be able to serve 10 user controls to the same SA node. (Concurrent access and control is not considered in this scenario) |
| QA06 | M | Scalability | More than one SA node can be installed at home. The system should be able to support at least 100 nodes concurrently. |
| QA07 | H | Modifiability | The system should make it easy to add emerging protocols (eg. Bluetooth 802.15, ZigBee 802.15.4) to the system. Average skilled developers should be able to implement it within two months. |
| QA08 | M | Usability | The system should make it easy for users to register or unregister SA nodes. Ordinary user should be able to register or unregister the node within 5 minutes by following the provided manual. |
| QA09 | H | Extensibility | The system should make it easy for application developers (private persons, VARs, or other 3rd parties) to build custom apps, services, and/or make mashups from existing available services. Average skilled developers should be able to build the application in six months. |

3.2. Quality Attribute Scenarios

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| **Security** | | **ID:** QA01 |
| **Quality Attribute:** System should identify unauthorized access and protect data and services from it. The system tracks all activities, and detect unauthorized access 100%. | | |
| Stimulus | Unauthorized access | |
| Source(s) of the stimulus | Human or another system | |
| Relevant environmental conditions | Normal operation | |
| Architectural elements | Data, System | |
| System response | Data and system are protected from unauthorized access. The system tracks activities within by recording attempts to access data, resources when an apparent attack is occurring | |
| Response measure(s) | Detect unauthorized access 100%. | |

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| **Availability** | | **ID:** QA02 |
| **Quality Attribute:** The system monitors SA nodes and should be able to detect their failures. User will be notified upon such events. SA node should be recovered within ten minutes. | | |
| Stimulus | SA node failure | |
| Source(s) of the stimulus | SA node | |
| Relevant environmental conditions | Normal operation | |
| Architectural elements | System, SA node | |
| System response | Detect the failure:   * System logs failures. * System notifies to the user.   SA node recovers from the failure. | |
| Response measure(s) | System notifies failure to user within 5 minutes.  SA node recovers from the failure within 10 minutes. | |

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| **Performance** | | **ID:** QA03 |
| **Quality Attribute:** Many family members can access the system at once. The system should be able to serve ten user controls to the same SA node concurrently and send feedback to the users within 1 second. | | |
| Stimulus | Multiple user access | |
| Source(s) of the stimulus | User | |
| Relevant environmental conditions | Normal operation | |
| Architectural elements | System | |
| System response | New connection should be accepted and new service request should be care appropriately even it had connection links already if the counts is not over the maximum. | |
| Response measure(s) | System can support max 10 user connections at the same time. | |

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| **Scalability** | | **ID:** QA04 |
| **Quality Attribute:** User can install more SA Node to experience various services. So system should be support max 100 nodes. | | |
| Stimulus | New SA nodes | |
| Source(s) of the stimulus | User | |
| Relevant environmental conditions | Normal Operation | |
| Architectural elements | System | |
| System response | System accepts new nodes. | |
| Response measure(s) | System can support max 100 nodes. | |

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| **Modifiability** | | **ID:** QA05 |
| **Quality Attribute:** Easy to add emerging protocols (eg. Bluetooth 802.15, ZigBee 802.15.4). Average skilled developers can implement it within two months. | | |
| Stimulus | Need to support emerging protocols | |
| Source(s) of the stimulus | User, Market | |
| Relevant environmental conditions | After release | |
| Architectural elements | System, Node | |
| System response | All future devices having other protocols should be supported by the System. | |
| Response measure(s) | Average skilled developers can implement it within two months. | |

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| **Usability** | | **ID:** QA06 |
| **Quality Attribute:** When users add/remove a new node to system, system could register or unregister node(s) within five minutes. | | |
| Stimulus | Add/Remove a new node to system | |
| Source(s) of the stimulus | Use | |
| Relevant environmental conditions | Normal operation | |
| Architectural elements | System, SA node | |
| System response | System registers or unregisters SA nodes.  System and other SA nodes are not rebooted. | |
| Response measure(s) | System registers or unregisters node(s) within five minutes. | |

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| **Extensibility** | | **ID:** QA07 |
| **Quality Attribute:** Application developers (private person, VARs, or other 3rd parties) can build application and service for our IoT system easily. | | |
| Stimulus | New application or service | |
| Source(s) of the stimulus | Developers (including 3rd party), VARs | |
| Relevant environmental conditions | After release | |
| Architectural elements | System | |
| System response | New application/service is able to be operated on system | |
| Response measure(s) | Number of average skilled engineers dedicated for new application/service development project should be less than three. | |

# **4.** **Constraints**

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| **ID** | **Type** | **Description** |
| TC01 | Technical | JAVA compiler, Arduino 1.0.6 |
| TC02 | Technical | Permissible languages for this system (excluding the SA Nodes) include JAVA and Python. |
| TB01 | Business | 5 weeks and about 3 hours/day are available |
| TB02 | Business | It should be delivered on 25th, June. |
| TB03 | Business | 5 developers due to the temporary development organization. |