QA lists in Initial Presentation

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| **#** | **Quality Attribute** | **Description** | **Priority** |
| QA-01 | Horizontal Scalability | Increase parking slot size of an existing facility. | High |
| QA-02 | Vertical Scalability | Add new parking facility. | High |
| QA-03 | Availability | System should be highly available even if there is a catastrophic failure in a server | High |
| QA-04 | Extensibility | Add new analysis algorithm or analysis application | Low |
| QA-05 | Security | System should be protected from unauthorized access. | High |
| QA-06 | Variability | Market the system to other garage owners | Medium |
| QA-07 | Configurability | Increase or decrease fee of parking slot.  Change the grace-period time | Medium |

Brainstorming about QA

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| QA | Assignee | Scenario | Impact on Architecture |
| Availability | SJ Lee | Application in server does not respond  Controller in facility does not respond  Some of sensors in facility do not respond  Client app is not respond | O  O  O  X |
| Security | SH Yun | Protected Network communication.   * #1: Attack: channel between Arduino and Server * #2: Attack: channel between Client and Server   An unauthorized user tries to use a personal data by hacking.  If unauthorized user tries to access the system.  Secure coding. | O  O  O  X |
| Scalability | BH Kim | How many user accounts should be supported?  How many facilities can be installed?  How many parking slots can be served per each facility?  How many gates can be connected to per each facility?  How many reservations can be made per each user? | X  O  O  O  X |
| Extensibility | SJ Lee | A new application with a new algorithm is added.  A new algorithm is introduced in owner’s application. | O  O |
| Variability | SH Yun | System spec and HW is already fixed by stakeholders. Variability is not necessary for this system. | X |
| Configurability | BH Kim | Owner would like to change grace period time.  Owner would like to change parking fee.  Operator needs to configure gate closing time after passing gate.  Operator needs to configure time for the case that user doesn’t park after passing gate?  Operator needs to configure time for the case that user does not pass after gate open?  Operator needs to configure the # of retries for login.  Operator needs to configure time for the case that “system not respond”?  Operator needs to configure 3 hours rule for reservation? | O  O  X  X  X  X  X  X |
| Performance | BH Kim | How fast sensors should report when there is some event?  How many end users can connect to system? | O  O |
| Modifiability | BH Kim | No requirement change anymore (confirmed by customer). | X |
| Usability | BH Kim | System provide easy GUI for user to make a reservation. | X |
| Accuracy | BH Kim | How accurate system should detects existence of the car at the gate? | X |

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| **Raw Quality Attribute** | **Availability(1)** |
| Scenario | The application in server is unresponsive as a result of failure during normal operations. The system informs the operator and continues to operate with no downtime. |
| Source of Stimulus | Client |
| Stimulus | Server not respond |
| Artifact | Application in server |
| Environment | Normal operation |
| Response | System detects failure of a server and informs the operator.  Processing is switched from a primary server to a secondary server.  Processing is resumed. |
| Response Measurement | Processing is resumed in less than 30 seconds.  System informs the operator within 1 minute. |

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| **Raw Quality Attribute** | **Availability(2)** |
| Scenario | Some of sensors are out of order and so controller can not check status of facility. System detects this situation and inform attendant within 1 minute. |
| Source of Stimulus | Sensor |
| Stimulus | Sensor not working |
| Artifact | Process in controller |
| Environment | Normal operation |
| Response | System disables sensor until repair.  System disables reservation for broken slots.(?)  System informs attendant. |
| Response Measurement | System informs the operator and attendant within 1 minute. |

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| **Raw Quality Attribute** | **Availability(3)** |
| Scenario | Controller is out of order and so doesn’t respond. System detects this situation and inform attendant within 1 minute. |
| Source of Stimulus | Controller |
| Stimulus | Controller not respond |
| Artifact | Process |
| Environment | Normal operation |
| Response | System disable facility until repair  System disable user reservation for facility.  System informs operator and attendant. |
| Response Measurement | System informs the operator and attendant within 1 minute. |

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| **Raw Quality Attribute** | **Extensibility** |
| Scenario | The developer adds new analysis algorithm or a new application to the system during runtime. The changes are made without downtime. |
| Source of Stimulus | Developer |
| Stimulus | Wishes to add new analysis algorithm or analysis application |
| Artifact | System |
| Environment | Run-time |
| Response | User can use new algorithm or application |
| Response Measurement | User can use them without downtime. |

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| **Raw Quality Attribute** | **Security (1)** |
| Scenario | If unauthorized user tries to access the system, the system should detect it. If unauthorized user tries several times, the system should block the attacker and inform operator. |
| Source of Stimulus | Unauthorized user |
| Stimulus | Attempt to access system several times |
| Artifact | System |
| Environment | The system is online or offline |
| Response | The system is protected from unauthorized access.  The system blocks the illegitimate access and Inform the attempt to operator. |
| Response Measurement | User must input right password within 5 times. |

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| **Raw Quality Attribute** | **Security (2)** |
| Scenario | If unauthorized user tries to use a personal data by hacking, the data must be protected by official |
| Source of Stimulus | A human attacker |
| Stimulus | Unauthorized attempt is made to change or copy personal data. |
| Artifact | Data within the system |
| Environment | The system is online or offline |
| Response | The system detect the attempt and alert to operator.  Logs must be written in the system. |
| Response Measurement | Personal data is 100% encrypted by effective encryption algorithm |

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| **Raw Quality Attribute** | **Security(3)** |
| Scenario | If unauthorized user tries to control the system or dump a transported data on communication protocol, the system prevents the attempt. |
| Source of Stimulus | A human attacker |
| Stimulus | Attempt to control the system illegitimately. |
| Artifact | Communication channel |
| Environment | The system is online |
| Response | The system blocks illegitimate connection to the system. |
| Response Measurement | The system protects all communication data on protocol |

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| **Raw Quality Attribute** | **Horizontal Scalability** |
| Scenario | The owner would like to increase parking slot size of an existing facility. The system operator installs new microcontroller for new slots. After then, the system detects it and notifies the operator. The operator selects the facility which owner wants to add new slots to.  The owner is able to scale up to 500 or more parking slot with undue effort. |
| Source of Stimulus | Owner |
| Stimulus | Install new microcontroller to increase parking slot size of existing facility |
| Artifact | Parking facility |
| Environment | Run-time (Normal Operation) |
| Response | The operator is notified. (Operator selects an existing facility which user wants to add new slots to.)  The system increase capacity (the number of available parking slots) of the facility.  The system make new communication channel with new micro-controller if it is added. |
| Response Measurement | The system should increase parking slot size within 30 minutes after installation. |

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| **Raw Quality Attribute** | **Vertical Scalability** |
| Scenario | The owner would like to add new parking facility. The system operator installs new microcontroller for new facility. After then, the system detects it and notifies the operator. The operator assign name of the new facility.  Because owner wants to apply this system to N facilities, it should not require undue effort to add new facility. |
| Source of Stimulus | Owner |
| Stimulus | Add parking facility. |
| Artifact | System |
| Environment | Run-time (Normal Operation) |
| Response | The operator is notified. (Operator assigns a name of new facility.)  The system make new facility and assigns new slots to it.  The system make new communication channel with new micro-controller if it is added. |
| Response Measurement | The system can provide service with new parking facility in 30 minutes after installation. |

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| **Raw Quality Attribute** | **Horizontal Scalability** |
| Scenario | The owner would like to add new gate of a facility. The system operator selects one among microcontrollers of the facility and add a servo to the it. After then, the system detects new servo and notifies the operator. The operator selects a role of new gate (entry or exit gate). |
| Source of Stimulus | Owner |
| Stimulus | Install new servo to add new gate to the existing facility |
| Artifact | Parking facility |
| Environment | Run-time (Normal Operation) |
| Response | The operator is notified. (Operator selects a role of new gate) |
| Response Measurement | The system supports that user enters to the facility through new entry gate within 30 minutes after installation, or  The system supports that user leaves from the facility through new exit gate within 30 minutes after installation. |

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| **Raw Quality Attribute** | **Configurability** |
| Scenario | The owner would like to increase or decrease fee of parking slot.  Also, owner could change the grace-period time to make parking faculties effect if there are many no-show cases.  Hence, without system disrupting, system should support to change parking slot fee and grace-period time. |
| Source of Stimulus | Owner |
| Stimulus | Change fee of parking slot  Change grace period |
| Artifact | System |
| Environment | Run-time (Normal Operation) |
| Response | Change made |
| Response Measurement | There should be no system-down time because of this change. |

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| **Raw Quality Attribute** | **Performance** |
| Scenario | The values from sensor are arrived in controller and controller changes them to specific event and send it to server within 5 seconds. |
| Source of Stimulus | Sensors |
| Stimulus | Values from sensors |
| Artifact | Process in controller |
| Environment | Normal operation mode |
| Response | Values are changed to event and send it to server |
| Response Measurement | Server should receive event within 5 seconds. |

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| **Raw Quality Attribute** | **Performance** |
| Scenario | Many users tries to make reservations simultaneously. |
| Source of Stimulus | User |
| Stimulus | Make a new reservation |
| Artifact | System |
| Environment | Overload mode |
| Response | The user is able to make a new reservation. |
| Response Measurement | The server should respond to make reservation within 30 seconds. |

Playing Poker (based on requirement / customer’s response)

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| QA | Scenario | Priority | Difficulty | PxD |
| Availability | **Application in server does not respond**  Controller in facility does not respond  Some of sensors in facility do not respond | 9  3  3 | 9  3  3 | 81  9  9 |
| Security | **Protected Network communication.**   * #1: Attack: channel between Arduino and Server * #2: Attack: channel between Client and Server   An unauthorized user tries to use a personal data by hacking.  If unauthorized user tries to access the system. | 9  9  3 | 3  1  3 | 27  9  9 |
| Scalability | **Owner wants to apply this system to N facilities**  Owner wants to scale up to 500 or more parking slot with undue effort.  How many gates can be connected to per each facility? | 3  3  1 | 9  3  1 | 27  9  1 |
| Extensibility | A new application with a new algorithm is added.  A new algorithm is introduced in owner’s application. | 1 | 3 | 3 |
| Configurability | Owner would like to change grace period time.  Owner would like to change parking fee. | 3 | 1 | 3 |
| Performance | How fast sensors should report when there is some event?  How many end users can connect to system? | 1  3 | 3  3 | 3  9 |