1. **Functional Requirement**

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| --- | --- | --- |
| **ID** | **Functional Requirement** | **Description** |
| FR-01 | The system shall detect cars in parking space. | Arduino H/W control |
| FR-02 | The system shall detect when cars are parked incorrectly (straddling parking slot lanes). If a car straddle parking slot lanes, the system shall blink LED. |  |
| FR-03 | The system shall open and close an entry gate. |  |
| FR-04 | The system shall detect when cars arrive at the gate. |  |
| FR-05 | The system shall interpret correctly parked car when a car break the lane keeping systems for 2 minutes. |  |
| FR-06 | The system shall allow drivers to reserve parking spaces.  Reservations will be made via mobile app, laptop, or desktop app for drivers. | Reservation system for drivers |
| FR-07 | For reservation, drivers must sign up the system. The system will prevent unauthorized users. |  |
| FR-08 | The system shall provide available parking slot information to drivers. |  |
| FR-09 | Drivers shall provide a license plate (identifying information), the day and time they would like to park, and credit card information (payment information). |  |
| FR-10 | The system shall return confirmation information to driver if reservation is success. |  |
| FR-11 | The system shall check confirmation information and verify the deriver's information and reservation. | When drivers come up an entry gate. Checking system. |
| FR-12 | The system shall configure "grace period". | Operating a "grace period" |
| FR-13 | If a customer does not show up at the start of their reservation time, the system will be held for a "grace period". |  |
| FR-14 | If the customer doesn't show up with in grace period, the system will expire that reservation. So that customers lose their reservation. | No-show process |
| FR-15 | The system shall calculate the hour for parking and it will charge on their credit card. | Charge system |
| FR-16 | The system will show which parking spots are open or not. | Monitoring system for attendant |
| FR-17 | The system will show how long a car has occupied a particular parking spot. |  |
| FR-18 | The system will notify the attendant if a driver parks other spot, and it will reallocate the parking spaces. |  |
| FR-19 | The system will notify the attendant after 2 minutes if a car crosses the lanes and LED is blinking. |  |
| FR-20 | The system will show facility usage and revenue.  The facility usage include average occupancy, peak usage hours, parking slot statistics. | Management system for owner |
| FR-21 | The system shall extend analysis algorithms or applications without disrupting operations. | Management system for owner  Extend system |
| FR-22 | The system shall provide login system for preventing unauthorized users. | System security |
| FR-23 | The system should not allow anyone to view facility data (reservations, credit cards, etc.) without owner. |  |
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1. **Use Case Scenario**

**2.1) FR-01**

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| --- | --- |
| Use case title | Description |
| Stakeholder |  |
| Description |  |

|  |  |
| --- | --- |
| **ID: FR-01** | **Description** |
| **Title** |  |
| **General description** |  |
| **Entities involved** |  |
| **Preconditions** |  |
| **Primary use case flow of events** |  |
| **Post-conditions** |  |
| **Alternate use case** |  |

1. **Quality Attribute**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ID** | **Quality Attribute** | **Priority** | **Description** | **Stakeholder(s)** |
| QA-01 | modifiability |  | The system is able to scale out to other parking facilities including large and small parking lots and garages. The size of parking facilities will vary from parking lots with 5 parking places, to multilevel parking garages with 500 or more parking spaces. | Owner, developer |
| QA-02 | availability |  | Each H/W parts and system work correctly. For example, if LED doesn't blink when a car parked incorrectly, it can cause increasing operating cost. | Owner, Attendant, developer |
| QA-03 | Security |  | The system should prevent unauthorized users from accessing information such as reservation, credit card, and so forth. | All stakeholders |
| QA-04 | modifiability |  | The system should be extensible to enable developers to add more analysis algorithms or analysis applications without disrupting operation to add the new features. | Owner, Developer |
| QA-05 | performance |  | Drivers will be able to determine if there are parking spaces available in a garage and reserve a spot. | Owner, attendant, developer |
| QA-06 | performance |  | The owner would like to have basic statistics on facility usage to include average occupancy, peak usage hours, parking slot statistics and revenue. |  |
| QA-07 | Interoperability |  | Arduino and system communicate well. |  |

1. **Quality Attribute Scenario**

**4.1) QA-01**

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| --- | --- |
| **Title** |  |
| **ID** | QA-01 |
| **Quality Attribute** | Modifiability |
| **Scenario** |  |
| **Source of stimulus** |  |
| **Stimulus** |  |
| **Artifact** |  |
| **Environment** |  |
| **Response** |  |
| **Response measure** |  |

1. **Quality Attribute Utility**

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| --- | --- | --- | --- | --- |
| **ID** | **Quality Attribute** | **Description** | **Difficulty** | **Priority** |
|  |  |  | Difficult | High |
|  |  |  | Challenging | Medium |
|  |  |  | Easy | Low |
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1. **Business Constraint**

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| **ID** | **Business Constraint** | **Description** |
| BC-01 | Reducing complain | GTPS wants to reduce driver frustration when customers find an available parking slots and reserve them. |
| BC-02 | Increasing profits | More efficiently utilize the space in the parking facilities. |
| BC-03 | Reducing liabilities | Reduce traffic congestion and the chance for accidents inside the parking facilities. |
| BC-04 | Reducing operating costs | More efficiently utilize personnel and reduce the number of employee. |
| BC-05 | Applying other garage | GTPS would like to market the system to other garage owners around the world. |
| BC-06 | Delivery | The system should be delivered in 5 weeks. |
| BC-07 | Availability of workforce | The team is consist of 5 members. Java expert is only 1 person. |

1. **Technical Constraint**

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| **ID** | **Technical Constraint** | **Description** |
| TC-01 | H/W System | Wi-Fi enabled Arduino(mega 2560)  - Flash Memory: 256KB of which 8KB used by bootloader  - SRAM: 8KB  - EEPROM: 4KB  - Clock Speed: 16MHz |
| TC-02 | Programming language | For development Arduino: C/C++  For server and application: Java |
| TC-03 | Network | Wi-Fi  Wi-Fi configuration |
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**Q&A**

1. The document says, the system will return confirmation information when a driver reserve parking space. And system also give a driver "parking space identifier" when a driver show up an entry gate after reservation. "**confirmation information**" and "**parking space information**" can be same? Or it's just our decision?
2. Can a driver select a special parking spot? For example, parking spots are available with A,B and E. At this time, can a driver choice “A” parking spot?
3. How can we catch up when driver go out of garage? Attendant or sensor?
4. Could you tell me “reallocation” scenario in detail?