# 1. Design requirements/constraints

The Quicket System sets out to revolutionize an area everyone understands: waiting in line. Currently, almost all ticketing systems operate on the two fundamentals of single ticket processing and a non-continuous queue flow. The Quicket System offers a new option, a system that accommodates multiple customers at one time and only stops customers upon an error. It uses a passive approach through radio frequency identification (RFID) that improves efficiency and reduces contact between parties. This document divides several design constraints for The Quicket System into three categories of technical design constraints, practical design constraints, and constraints based on engineering standards.

## 1.1 Technical Design Constraints

The Quicket System meets numerous technical constraints to provide a competitive and universally applicable product. These metrics are testable to prove the functionality of the system and are detailed below in Table 1.1.

Table 1.1. Technical Design Constraints

|  |  |
| --- | --- |
| **Name** | **Description** |
| Read Count | The system identifies up to two tags at once. |
| Range | The reader operates within a 2-meter range of tags. |
| Response Time | The system signals errors within 2 seconds of attempting to read a tag. |
| Security | The system determines the number of individuals approaching the reader, up to four people. |
| Error Signaling | The system alerts both the tag holders and nearby personnel of errors during ticket validation. |

**1.1.1 Read Count**

As long as the RFID reader operates under traditional RFID conditions, it scans a group of tags from one single reader position. To improve upon existing designs and maintain competitive advantages, The Quicket System scans the tags of up to two people as they enter. This higher threshold offers improvements in efficiency and throughput. By capping the number of tagholders entering, the system normalizes possible scenarios and reduces sacrifices in security and reliability.

**1.1.2 Range**

The system is installed at least 2 meters above the ground to give ample head clearance for most people. A range of 2 meters enables the reader to provide adequate coverage of the ticketing area. This range also allows the reader to be angled slightly towards the flow of traffic, giving the system a proactive approach and more time for error processing.

**1.1.3 Response Time**

The system detects and signals an error within two seconds of attempting to scan a tag. The average person is capable of walking 5.8 feet within one second [1]. This timing helps facilitate social distancing of parties entering the gate and provides enough room for human intervention upon errors.

**1.1.4 Security**

The system identifies how many people approach and enter the gate at the time of scanning. This subsystem is designed to handle two sets of individuals at once. Each set contains up to two people to mirror the ticket processing capabilities. These two distinct sets enable the system to determine the required ticket number for the current group and the expected number for the approaching group.

**1.1.5 Error Signaling**

The system notifies individuals passing through the gate and nearby security personnel of errors while processing tickets. To prevent disruptions in the flow of traffic, security pulls the current group aside and performs a second, manual check for valid tickets.

## 1.2 Practical Design Constraints

The Quicket System adheres to several practical constraints to maintain a proper emphasis on health, safety, and competitiveness. Table 1.2 lists this set of constraints.

Table 1.2. Practical Design Constraints

|  |  |  |
| --- | --- | --- |
| **Type** | **Name** | **Description** |
| Economic | Price Point | The retail value of the system is under $3000. |
| Safety | Tracking | The system utilizes reusable RFID tags that work to track locations of patrons. |
| Manufacturability | Installation | The detection components of the system are readily mountable to most surfaces via the use of common hardware. |
| Health | Health | Passive reading limits contact between parties. |
| Environmental | Location | The system is suitable for indoor and non-severe outdoor conditions. |

**1.2.1 Economic**

The Quicket System implements a new approach compared to existing systems but remains similar in price to sustain a competitive advantage. In a personal interview, Mississippi State University employee Jason Walker explains how the campus recently invested in several near-field communication (NFC) readers for campus sporting events; these units run about $5000 per unit and utilize attendees’ smartphones [2]. The Quicket System retails for $3000 and works with a wide variety of reusable tags. This system flexibility at this price point gives ample room for profit margins, leaves options for future upgrades, and opens funding for additional projects while keeping the overall investment on par with existing systems.

**1.2.2 Safety**

The Quicket System allows administrators to track the entries and exits of tagholders. By tracking the number of tags scanned and referencing each tag with the database, administrators can determine if a tagholder is present or not. This functionality provides further security benefits for customers handling larger volumes of tagholders.

**1.2.3 Manufacturability**

The detection components of The Quicket System are capable of being mounted to a variety of surfaces through common methods such as screws, adhesive strips, snap-in chassis, and many others. These options allow owners to seamlessly install the system and integrate it with existing structures while ensuring it still meets their needs.

**1.2.4 Health**

The Quicket System allows for contactless check-in to events. Tagholders are not required to come into contact with event staff except for cases where there is an error with scanning. Additionally, contact between different tagholders is reduced as no one needs to touch any surfaces.

**1.2.5 Environmental**

The Quicket System operates in as many environments as possible; its enclosure complies with certain testing requirements for the prevention of water and dust intrusion. These requirements keep the operation of the system unaffected by environmental dust or weather except in inclement conditions.

## 1.3 Engineering Standards

Table 1.3 contains the engineering standards to which The Quicket System adheres.

Table 1.3. Appropriate Engineering Standards

|  |  |  |
| --- | --- | --- |
| **Specific Standard** | **Standard Document** | **Specification / Application** |
| FCC Title 47 Chapter 1 Part 15 | FCC Title 47 Telecommunication | The system operates in the proper RFID frequency range and radiates acceptable power levels. |
| IEC 60529 | Degrees of Protection Provided by Enclosures (IP Code) | The system is compliant with Ingress Protection 56 (IP56) testing requirements to prevent intrusion of water and dust. |
| ADA | Americans with Disabilities Act III Regulations | The system is compliant with ADA standards for wheelchair clearance. |

**1.3.1 FCC Title 47 Chapter 1 Part 15**

The Federal Communications Commission (FCC) regulates the use of both wired and wireless devices. The Quicket System must comply with all RFID mandates set forth by the FCC which are found in the Part 15 standards of the Title 47 document [3]. These standards outline many operating procedures, most notably the permissible operating frequencies and the output power associated with each frequency range.

**1.3.2 IEC 60529**

The IEC 60529 [4] outlines a series of testing procedures for certain enclosure durability standards that are formalized in and referred to as IP Codes. For the specific needs of the system, all enclosures are compliant with the IP56 testing standards. More specifically, enclosures are protected from dust ingress (but not dust-tight) and protected from powerful water jets. This protection is to account for situations in which the system is deployed in an outdoors context, which may entail a degree of dust, dirt, or sand, as well as rain, fog, or similarly inclement weather.

**1.3.3 ADA**

The Quicket System functions within Americans with Disabilities Act III [5] regulations on passageways. This standard states that passageways must be at least 60 inches wide to allow for wheelchair clearance with 80 inches of minimum headroom to accommodate blind or visually impaired individuals.

References:

[1] “An Average Person’s Walking Speed / Distance.” ecocredits.org. [Online]. Available: http://www.echocredits.org/downloads/2051055/With%2Bmy%2Bwalk.pdf [accessed Sep. 4, 2020].

[2] Walker, Jason. Personal Interview, August 2020.

[3] *Title 47 Telecommunication,* Part 15, Federal Communications Commission, April 2020. [Online]. Available: https://www.ecfr.gov/cgi-bin/text-idx?SID =1e8132d7991785ff755abdd48b2456ec&mc=true&node=pt47.1.15&rgn=div5#se47.1.15\_1247

[4] *Degrees of protection provided by enclosures (IP Code),* IEC 60529, International Electrotechnical Commission, August 2013.

[5] Americans with Disabilities Association, "2010 ADA Standards for Accessible Design,” Dec 7, 2020. [Online]. Available: https://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm#36404. [Accessed Sept. 7, 2020].