# 1. Design requirements/constraints

One area of daily life that holds room for improvement stems from how tickets are processed for individuals attending an event, entering a venue, or boarding transportation. As of now, almost all ticketing systems revolve around two main ideas: single ticket processing and a non-continuous queue flow. The Quicket System does away with both concepts and, instead, offers a system that can handle multiple customers at one time and only stops customers upon an error. It takes a passive approach through radio frequency identification (RFID) that improves efficiency and reduces contact between parties. This document breaks down 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

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

**Table 1.1. Technical Design Constraints**

|  |  |
| --- | --- |
| **Name** | **Description** |
| Read Count | The system can identify up to two tags at once. |
| Range | The reader operates within an eight-foot range of tags. |
| Response Time | The system signals errors within two seconds of attempting to read a tag. |
| Security | Thermal imaging determines the number of individuals approaching the reader, up to four people. |
| Power Supply | The system runs off a 120-volt, 15-amp power supply. |

**1.1.1 Read Count**

So long as the RFID reader operates under normal Ultra High Frequency (UHF) conditions, such as those defined in the ISO 18000-6 standard (860 MHz to 960 MHz), it can scan a group of tags from one single reader position. To improve upon existing designs and maintain competitive advantages, The Quicket System scans at least two tags when patrons enter in rapid succession. The gate facilitating the device allows for two persons to comfortably walk through at a time. The computer processes multiple tag identification requests as well as receives responses for multiple requests at a fast rate to allow for seamless error detection.

**1.1.2 Read Range**

The team sees the system installed roughly eight feet above the ground to give ample clearance beyond standard head clearances. Thus, the reader needs a comparable read distance to provide adequate coverage. This also gives options to angle the reader 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 without disrupting the flow of traffic should there be a problem with scanning a tag.

**1.1.4 Security**

A thermal imaging system is used to identify how many people approach and enter the gate at the time of scanning. If there is a discrepancy between the number of tags scanned and the number of people identified by the thermal camera, the system raises an error and calls for human intervention.

**1.1.5 Power Supply**

The system runs off a 120-volt, 15-amp power supply in order to be compatible with most standard wall sockets in the United States. This allows the device to be used in a variety of settings without needing separate or specialized power supplies.

## 1.2 Practical Design Constraints

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

**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 | Mounting | 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 | Appearance | System is housed within installable box for integration into surroundings. |

**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]. Since The Quicket System offers a new option, the team believes it should retail for under $3000. This gives ample room for profit margins, frees up funds for future upgrades, and keeps the 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 the tag scanned, administrators can determine if a tagholder is present or not. This functionality provides further security benefits for customers dealing with larger volumes of tagholders.

**1.2.3 Manufacturability**

To be interoperable with as many hallway-like or gate-like passageways as possible, the detection components of The Quicket System are capable of being mounted to a variety of surfaces. This includes, but is not limited to, destructive methods such as screws or wall-mounted snap-in chassis, or non-destructive methods such as adhesive strips.

**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 in cases where there is an error with scanning. Additionally, contact between different tagholders also sees reduction.

**1.2.5 Environmental**

For marketing and application needs, the system installs in existing corridors, gateways, or similar structures. The Quicket System is housed within a single entity to stand out less and reduce the visual impact it makes on the surrounding environment. Additionally, by reducing the detector’s footprint, the device benefits lower-profile security measures.

## 1.3 Engineering Standards

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

**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 operated in the proper frequency range and radiates acceptable power level. |
| 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 mandates set forth by the FCC which are found in the Part 15 standards of the Title 47 document. 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 outlines a series of testing procedures for certain enclosure durability standards which are formalized in and referred to by 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 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 with Americans with Disabilities Act III regulations on passageways.

References:

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

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