

Preliminary Design

Company D

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Revision summary

Revision	Date	Description
0.1	21.03.2020	Document Created
1.0	22.03.2020	1st Version

Introduction

The purpose of this document is to layout the preliminary technical design of the extension system, which facilitates the ultimate control screening process. It includes the design of implementation and integration of the system into the already existing baggage handling system - CrisBag.

Program Objectives/ Mission Profile

The mission of this project is to provide extension to the baggage monitoring system that serves as an assurance check to the suspicious and unsafe baggage. This solution must be automated to a maximum level possible at the end of which the baggage is guaranteed to be secure or is destroyed.

The following sections contain individual descriptions of subsystems comprising the system in order to meet the requirements. Requirements of the system imply the following perspectives of design:

- Electronic
- Mechanical
- Software
- Civil

Quality Control and Safety

The quality control and safety of the solution should meet all standards acquired by BEUMER Group.

- OHSAS 18001 - Occupational Health and Safety Assessment Series
- ISO 9001 - Quality Management
- ISO 14001 - Environmental Management

Requirements and Verification

So far, the SRS document provides details regarding each individual requirement. As the project stage moves forward and the test specifications will be laid down, each requirement will be paired with a corresponding test by requirement ID, which will serve as a verification for the requirement to be considered passed.

Design Innovation

The goal of the system is to add a layer of security on top of what already exists in the main supply.

The hardware components available are the following: Tote, Transport, Curve, 90° Transfer, Divert, Merge, Top-load, Side-load, Discharge, Vertical Sort, Walk-through, Stacker. The tote

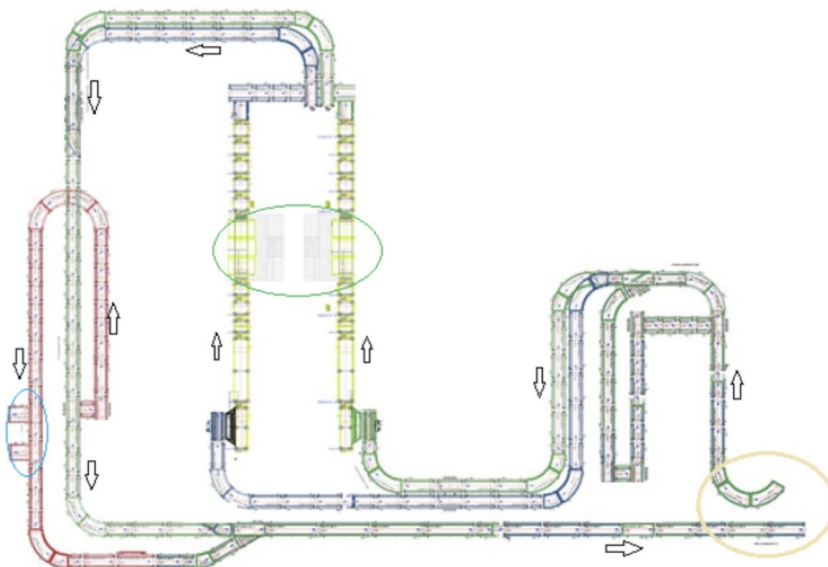
carries the baggage through the extension - a diagram of the extension may be seen in the Systems/Subsystem Design - and is routed through the extension with the use of the rest of the components.

The tote is paired with the baggage it carries from before it enters the extension/system. This way it is known exactly where a bag and a tote are at all times. That information is 'decorated' with the baggage status - secure or unsecure - allowing the system to route the tote and baggage pair properly. Component behaviour and its capability of automatically pairing/unpairing totes with/from baggage is taken from the existing CrisBag system at hand.

All totes that are not marked or are marked as unsecure by the initial scan in the main supply are routed to the extension, where they must go through the additional screening area. There they go through one of two screening machines, which must mark the baggage as secure or unsecure. In order to do that, the screening machines must have a software interface implemented for them, which will 'configure' the way the baggage is marked, thus deciding its route through the rest of the system.

Based on the status marking from the screening machine, the tote that holds the baggage must be routed to the Ultimate Control area, if marked unsecure, or to the original destination, if marked secure. If a tote reaches the Ultimate Control area, its baggage must be taken off and inspected manually. If the baggage is finally deemed unsecure upon manual inspection in the Search Office, it is taken to the Destruction Area, completing the process. If the baggage is deemed secure in the Search Office, it is loaded back onto the extension, re-paired with a tote, either with a hand-held scanner or through keyboard input, and the baggage can then continue to its original destination.

Systems/Subsystem Design



Picture showing the layout of the extension

The yellow circle is the point of entry from the main supply into the extension.

The green circle is the Additional Control Area, which holds two additional screening machines.

The red track is the track toward the Ultimate Control area.

The blue circle is the Ultimate Control area itself. It has one workstation for taking baggage off the system, and a second workstation for loading baggage back into the system.

Product Breakdown Structure

The system can be split into the following subsystems:

- System handling the general movement of the baggage - adapted from CrisBag system
- System handling scanning - dependent on SecureScreen RX 5001

Electronic System Design

SCR-1

The totes will have an RFID chip attached on them in order to track their movement. The AC motors that move the conveyor belts will be driven by inverters which can vary the speed in order to ensure that at least 70 seconds passes before the tote enters the additional screening area.

SCR-2

The inverters need to vary the speed of the AC motors in order for the totes to have at least 30 seconds between the additional screening area and the beginning of the Ultimate Control track.

Mechanical Design

The mechanical design of the system must follow the pictures mentioned in Systems/Subsystems design section, while always being in check with the requirements that are defined for the individual parts of the system:

SCR-3

The system must allow for baggage to be manually removed through an offset workstation in the Ultimate Control area.

SCR-4

The system must allow for baggage to be manually transported from the Ultimate Control Area to the search room and destruction area after being removed from the system.

SCR-5

The system must have all baggage that was marked as unsecure by the additional screening machines wait for the final result from the operator.

SCR-6

The system must allow for baggage cleared in the Ultimate Control area to be loaded into the system through one dedicated workstation.

SCR-7

The system must not allow for totes with baggage to pass the Ultimate Control area, regardless of other elements being in error.

SCR-8

The system must allow for bags at the Ultimate Control area to be loaded to an empty tote and paired with it with the use of a hand-held scanner or manually entering the proper code with a keyboard.

Civil Design

DCC-2 Search Office

Manually removed baggage from the system should be inspected in the search room. Specified requirements for the room is size 15m² (6m x 2.5m).

DCC-3 Destruction Area

Discovered unsecured items should be destroyed in the destruction area. Specified requirements for the room is size 10m² (5m x 2m, with free high 3m).

Design and Unique Task Descriptions

Subsystem	Description	Tasks
System handling the general movement of the baggage	<p>Responsible for overall movement and routing behaviour.</p> <p>Behaviour and components adapted from the CrisBag system.</p>	<ul style="list-style-type: none">• Acquire necessary components for moving and routing totes through the system.• Inspect and test components separately and in combination where possible• Assemble route from entry point to Additional Screening (AS)• Assemble route from AS to Ultimate Control (UC)• Assemble route from UC to exit point
System handling scanning	Responsible for scanning of the baggage within the system, marking it with the appropriate status and	<ul style="list-style-type: none">• Acquire the additional screening machines - 2 of type SecureScreen RX 5001

	<p>ensuring the rest of the system is properly aware of it and how to handle and route the baggage</p> <p>Behaviour is largely dependent on the implementation of the software interface for the additional screening machines, where the scanning and status marking happens.</p>	<ul style="list-style-type: none"> • Implement software interface for the machines - configure scanning, marking and impacts on routing of the baggage <p>(Note: this task includes simultaneous implementation of automatic testing)</p> <ul style="list-style-type: none"> • Inspect and test the machines - separately and in combination with some necessary components • Install machines into Additional Screening Area
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References

Beumer Group. 2020. Sustainability. [online] Available at:

<https://www.beumergroup.com/about-us/sustainability/> [Accessed 17 March 2020].

Wikipedia. 2020. OHSAS 18001. [online] Available at:

https://en.wikipedia.org/wiki/OHSAS_18001 [Accessed 17 March 2020].

ISO. 2020. ISO 9001-Quality management. [online] Available at:

<https://www.iso.org/iso-9001-quality-management.html> [Accessed 17 March 2020].

ISO. 2020. ISO 14001-Environmental management. [online] Available at:

<https://www.iso.org/iso-14001-environmental-management.html> [Accessed 17 March 2020].