1 Introduction

* 1. Product Overview

This part of the system will be a software prototype of the train controller for a light-rail passenger transit system. The software will be used as a demonstration of a proposed North Shore Extension of the Port Authority of Allegheny County. This module of the system will be responsible for controlling the state of the train.

* 1. Purpose

The purpose of this document is to define a set of requirements which will define all the functions and features required by train controller

* 1. Scope

The scope of this document includes an overall description of the controller, a list of specific functions and features it shall or should have, as well as the list of necessary safe features.

* 1. Reference
     1. IEEE-830 software requirements specification
  2. Definitions and abbreviations

Authority - how far (how many blocks) in distance the train is permitted to travel

Block – a section of a railway line

Setpoint – the target distance that an automatic control system sim to reach

CTC – Centralized Traffic Control

CUI – Graphical User Interface

1. Overall Description
   1. Product Perspective

The Train Control System makes CTC office to be able to view data of trains and tracks graphically and send control signals to trains and tracks. The CTC executes commands to the trains via the track controllers. The track controllers encodes the data into the corresponding track block with relays into the train when it enters the block.

* 1. Product Functions

The product shall properly receive command from the track which was given by CTC and modified by the track controller, as well as give commands to the train.

* 1. User Characteristics

Needs to be discussed

3 Specific Requirements

3.1 External Interface Requirments

3.1.1 Software Interface

3.1.1.1 Inputs from track

3.1.1.1.1 Train authority

3.1.1.1.2 Track Speed limits

3.1.1.1.3 Route information

3.1.1.1.4 Emergency Stop signal due to 2 trains clashing into each other

3.1.1.1.5 Tunnel Light Signal

3.1.1.2 Outputs to track

3.1.1.2.1 Train Speed

3.1.1.2.2 Train Direction

3.1.1.3 Input into trains

3.1.1.3.1 Authority

3.1.1.3.2 Acceleration

3.1.1.3.3 Emergency brake signal

3.1.1.3.4 Speed Limit

3.1.1.3.5 Light signal

3.1.1.3.6 Door Signal

3.1.1.3.7 Failure handle signal

3.1.1.4 Output from Train

3.1.1.4.1 Current speed

3.1.1.4.2 Current Light status

3.1.1.4.3 Door Status

3.1.1.4.4 Authority Update

3.1.1.4.5 Failure type signal

3.1.2 Communications Protocols

3.1.2.1 Communication shall be passed from module to module as follows:

3.1.2.1.1 CTC office to Track Controller

3.1.2.1.2 Track Controller to Track Model

3.1.2.1.3 Track Model to Train Controller

3.1.2.1.4 Train Controller to Train Model

3.1.3 Operation

The system will need to be operated by the CTC office. The CTC shall be able to determine the trains overall status. However, the train system shall be able to automatically execute its authority, including deny the authority and speed limit and authority. Thus, given a route schedule, the transit system should be fully automatic.

3.2 Product Function

3.2.1 The train controller shall regulate the speed of the train to the set point while not exceeding the speed limit or authority allowed by the system.

3.2.2 The train controller shall use track signals as input and decode the information to determine speed limit and autyority

3.2.3 The train controller shall be able to open and close train doors when at stops or for emergency exit.

3.2.4 The train controller shall be able to turn on or off the lights both automatically while enter tunnels or done manually

3.2.5 The train controller shall monitor the train for failures and act upon failure.

3.3 Performance requirements

3.3.1 The train control shall receive activities within 0.1 second

3.4 Design constraints

3.5 Software System Attributes

3.5.1 Reliability

The system shall operate a simulation in a fail-safe manner. The train controller is a safety critical while train has a failure. Thus the train controller should be 100% reliable and should account for all possible failures.

3.5.2 Security

3.5.3 Portability