

Development of High Speed Train Driving Simulator for Learning on the North-Eastern Line

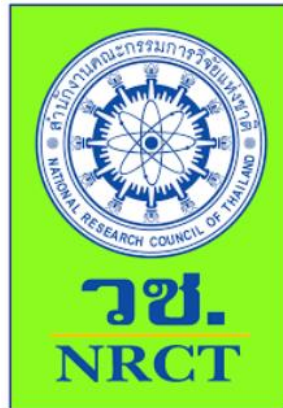
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Acknowledgement

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Outline of the presentation



- 1.Introduction
- 2.Literature Review
- 3.Methods
- 4.Results
- 5.Conclusions

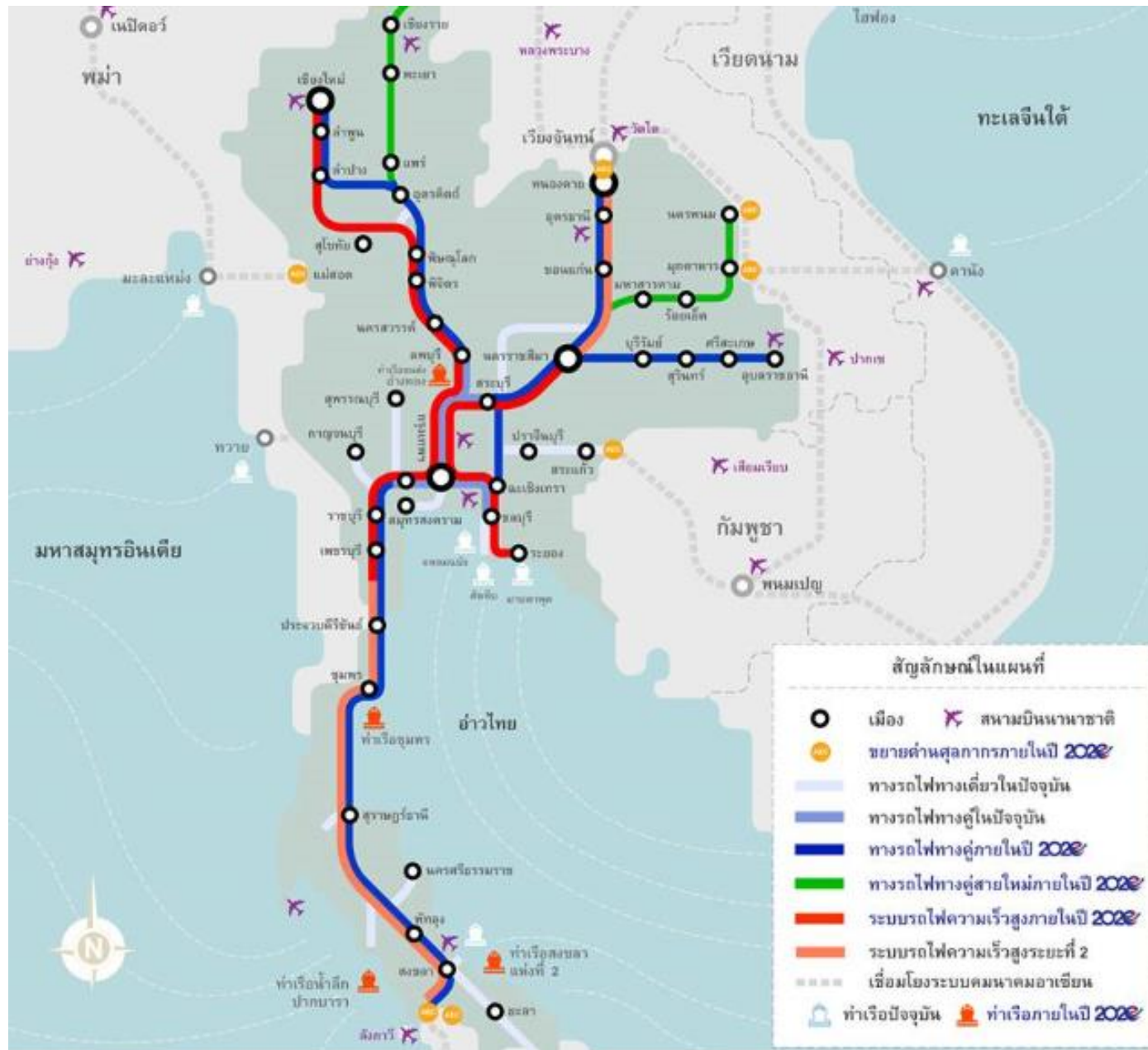
1. Introduction

- Presently, high speed train is started to emerge in the South East Asia aimed to serve effective mass transit which operates on local and national rail networks. Driving high speed train needs specific skilled driver with respect to safety concern. Therefore, driver's training is so important.
- Traditionally, training is used the method which is called on the job training. This method is effective but it is time consuming, expensive and high risk.
- This paper purposes driving simulation of high speed train with imitation emphasizing on driving rules for operation image control interface with devices and software.
- Simulation consists of the major content which is image control interacted with mechanical devices, software and PLC interface.
- Objects of track, stations and so on are firstly created by using 3D model before assembled in the forms of train route.
- Animation is selected for this project.

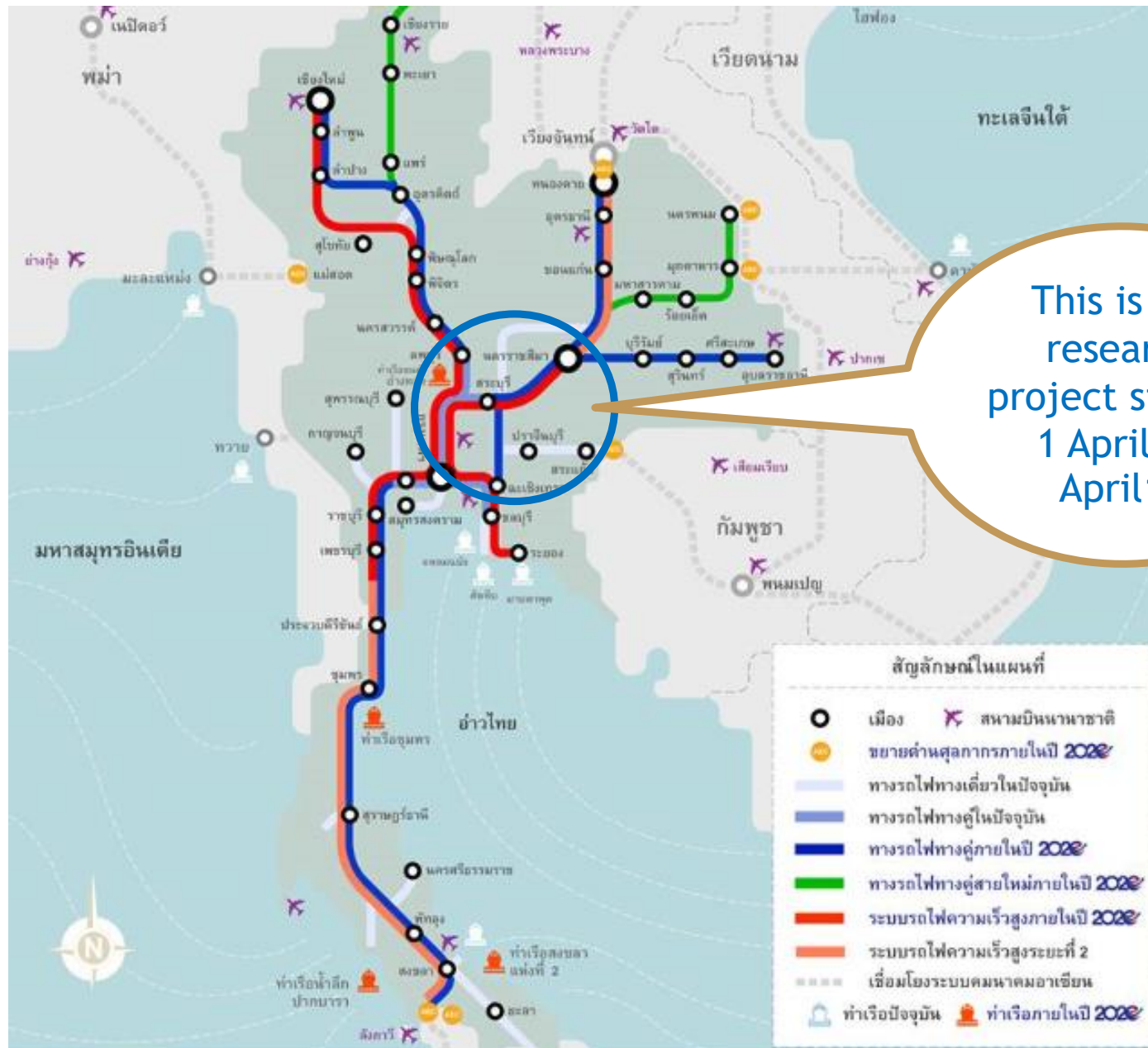
1. Introduction

- An image sequence method is used for presenting the train line moving simulated by virtual reality.
- There are two types of the image sequence creation; video based and animation. Both of them are started by creating 3D model which is called objects. Basically, they are train stations, tracks, electrical cables and columns, supporting columns for tracks, trees, signals, road cross sections and so on.
- All objects are assembled to make a track line and route for simulation either video based or animation.
- The route is started by a station. The image consists of the track in front of a driver while he/she sits on the driving desk.
- In addition, image is also shown the objects beside the track both the left and the right side such as signal, electrical cable, station columns, chairs, stone, buildings, trees, bill board, passengers at station and so on.

Research Motivation



Research Motivation



Research Objectives

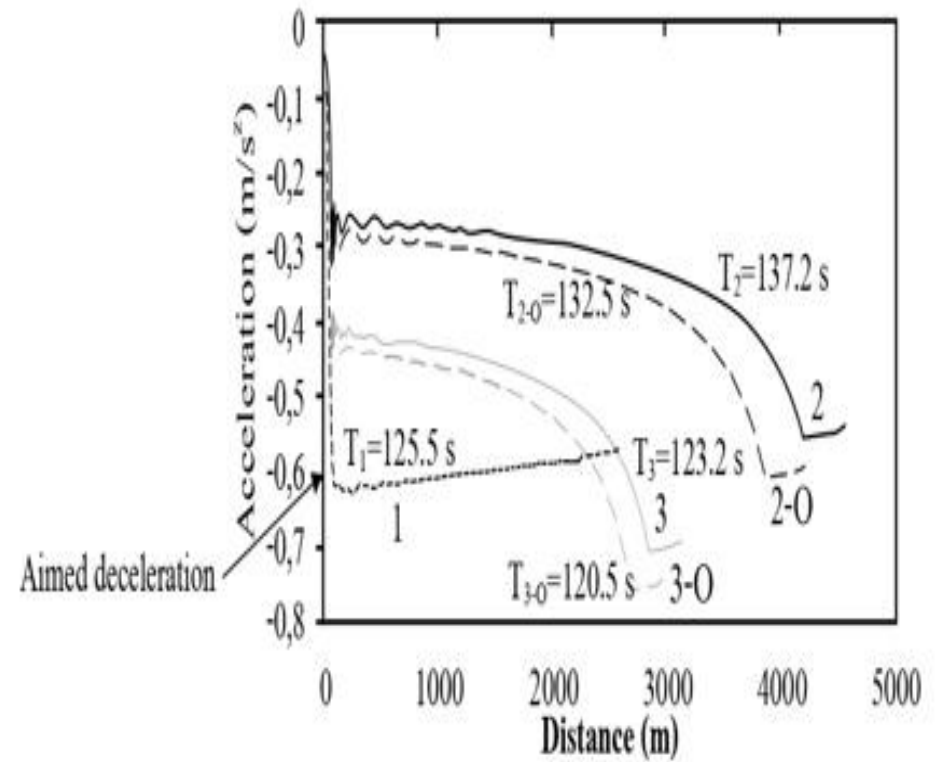
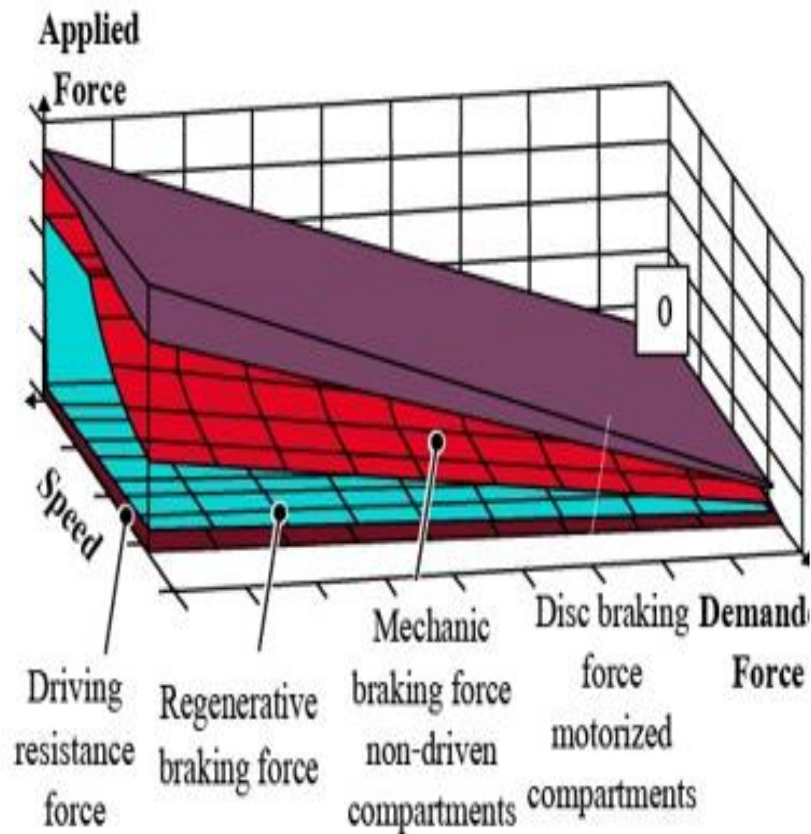
1. Development of high speed driving train simulator for teaching and learning of the North-eastern line.
2. Development animation and sequencing control software system from Bang sue station to Nakhon Ratchasima.
3. Development HST driving system and rules including SM mode, ATO, RM mode, Test track mode
4. Development the station control system communication with driver cab
5. Development of Scenarios and case study.

2. Literature review

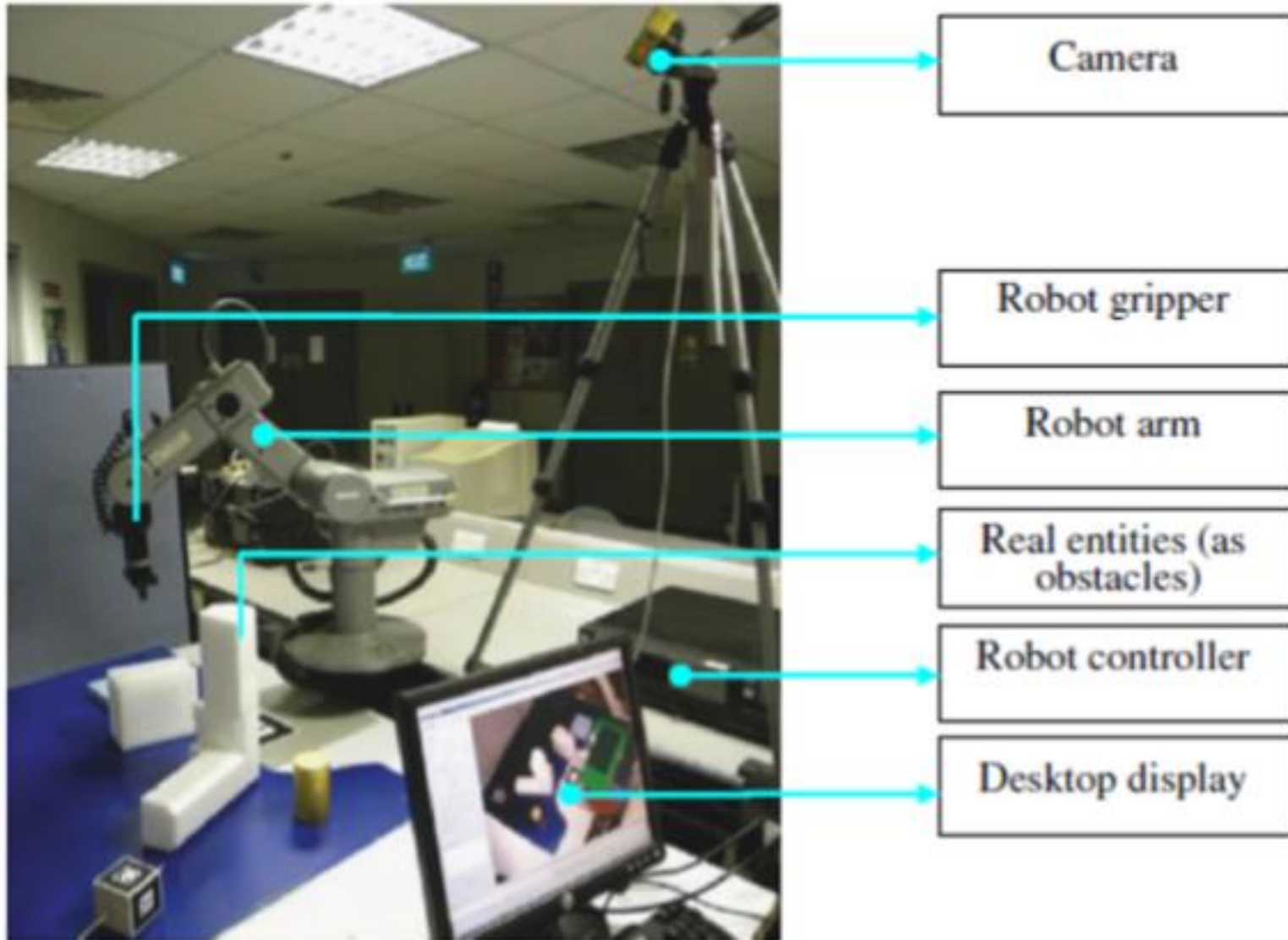
- Augmented Reality (AR) is a fast rising technology and it has been applied in many fields such as gaming, learning, entertainment, medical, military, sports, etc.
- A.Y.C.Nee and S.K.Ong (2013) reviewed some of the academic studies of AR applications in manufacturing operations. Comparatively, it is lesser addressed due to stringent requirements of high accuracy, fast response and the desirable alignment with industrial standards and practices such that the users will not find drastic transition when adopting this new technology.
- The paper looked into common manufacturing activities such as product design, robotics, facilities layout planning, maintenance, CNC machining simulation and assembly planning. Some of the issues and future trends of AR technology are also addressed.

2. Literature review

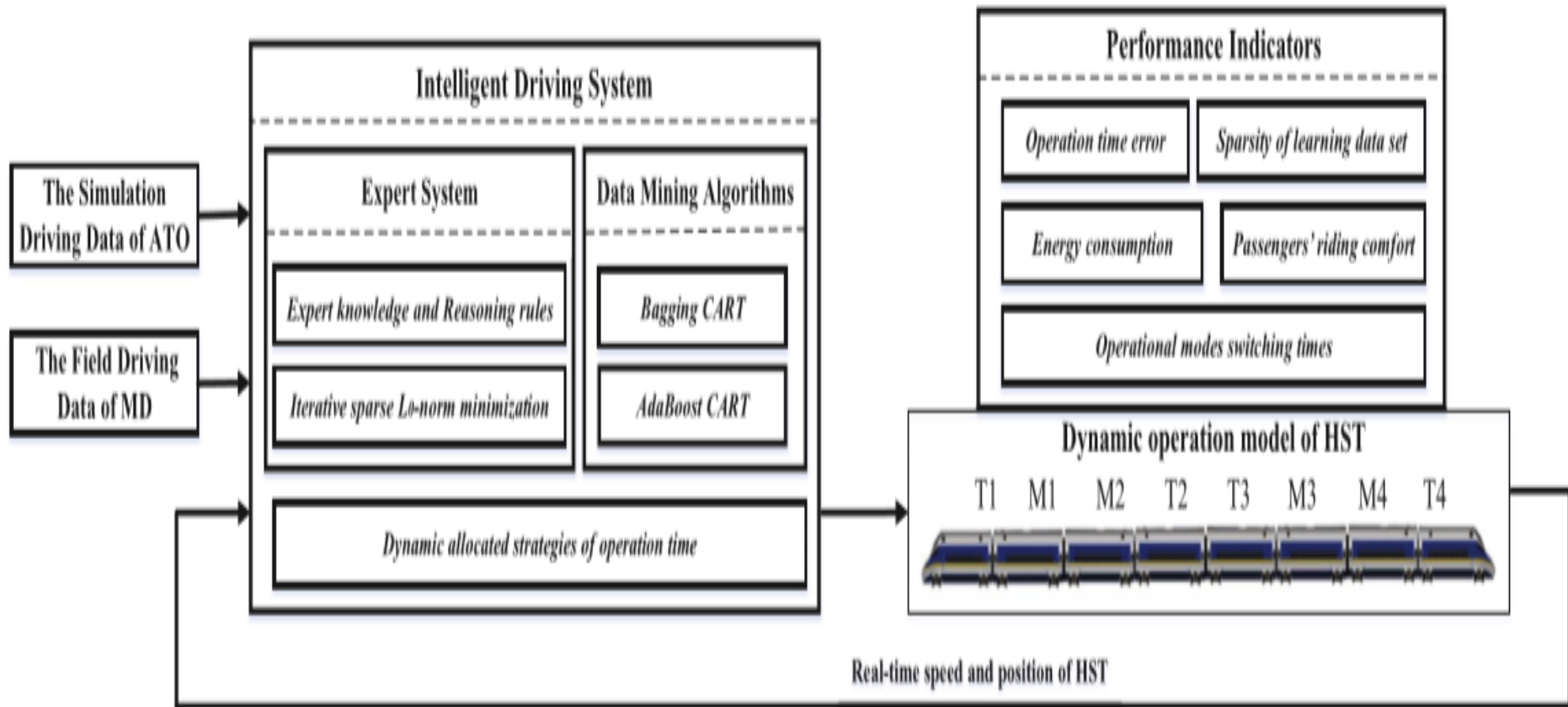
Braking Force Factors and Deceleration Curve Distances



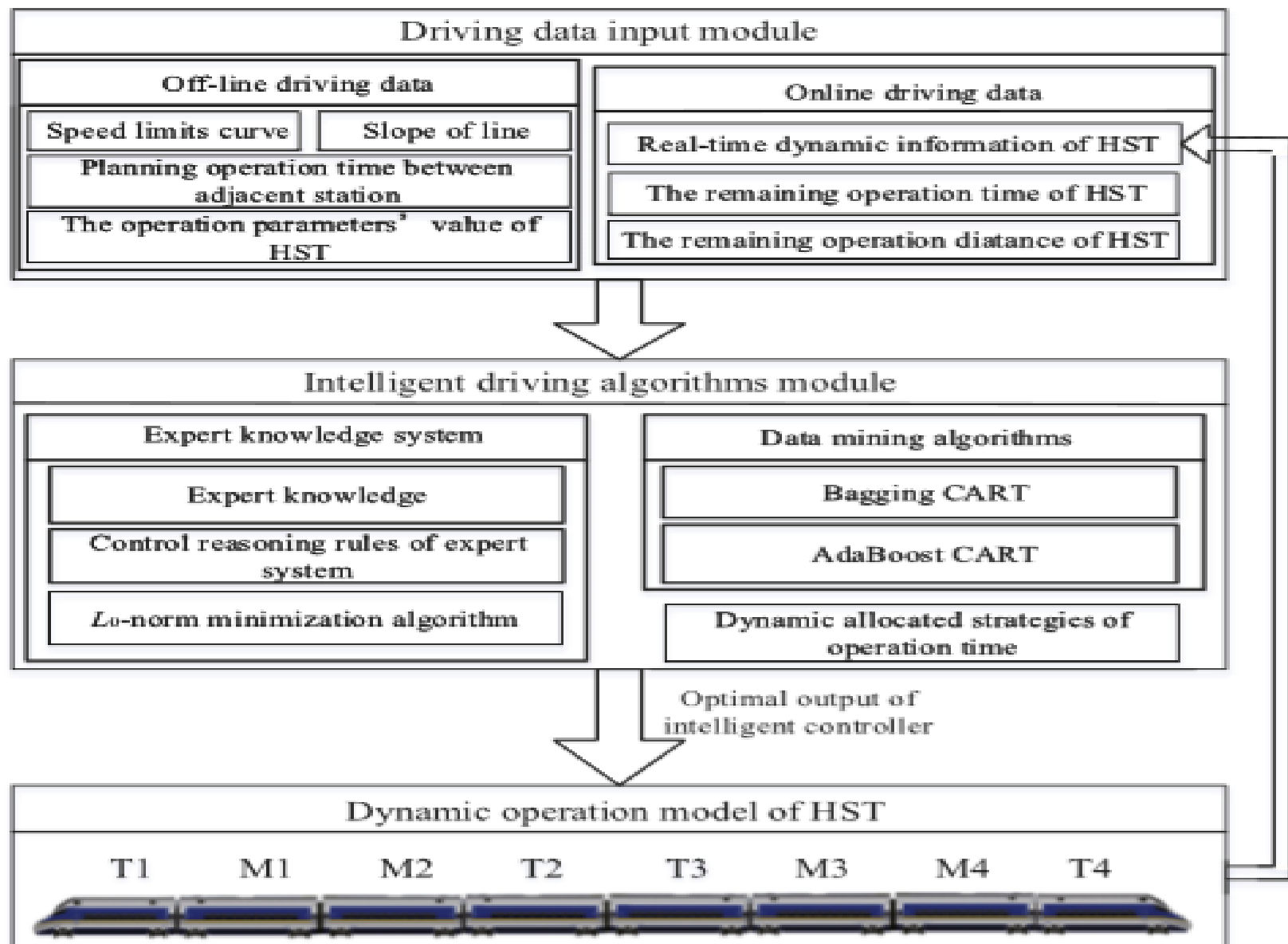
AR for Manufacturing Application



Intelligent Driving System for HST



Intelligent Driving System for HST



The detailed comparison of Speed-Distance curves

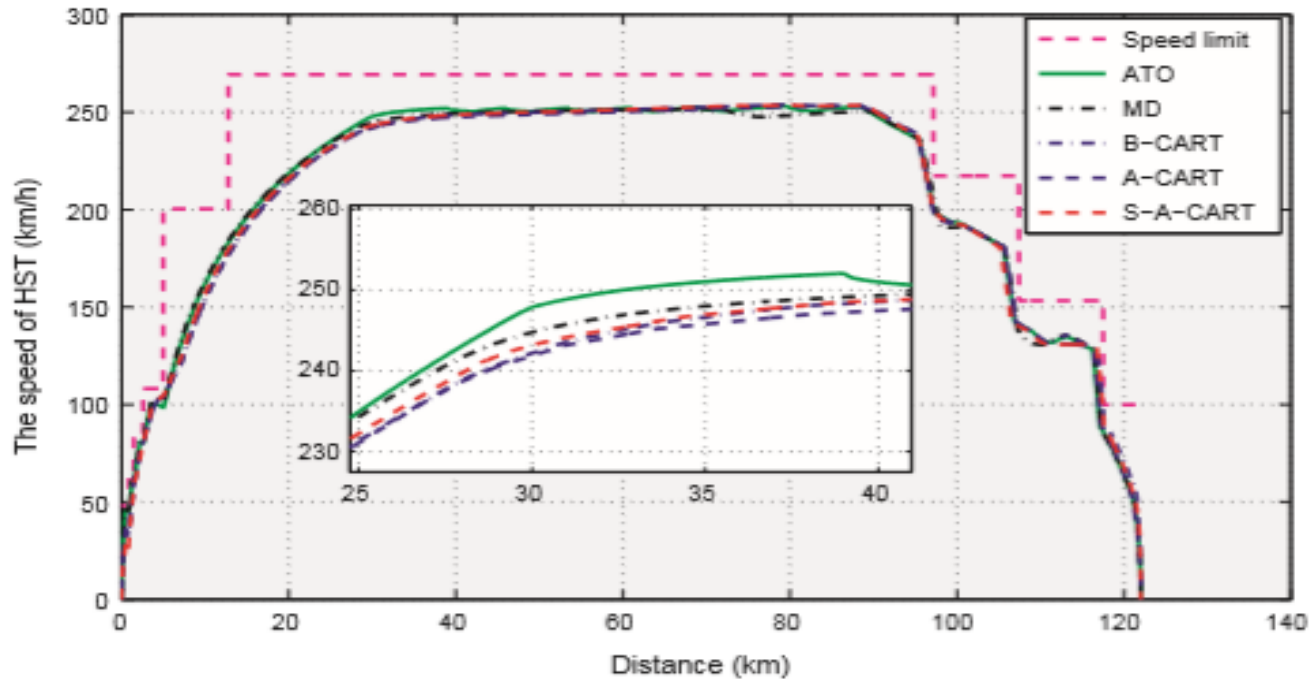
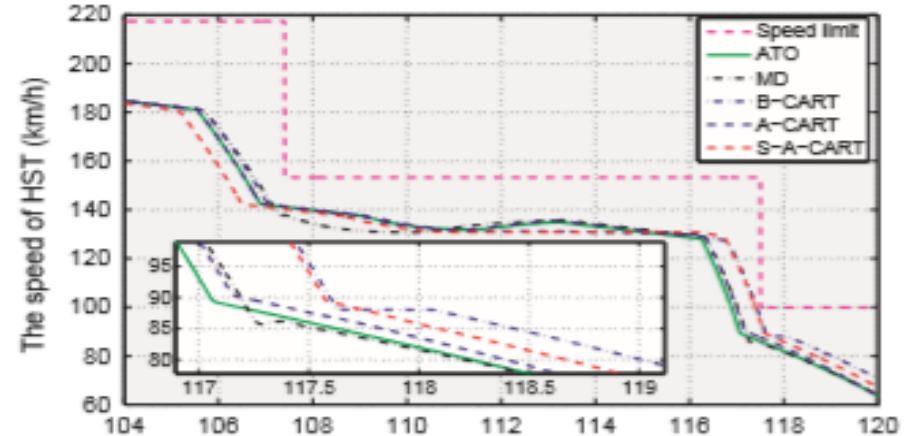
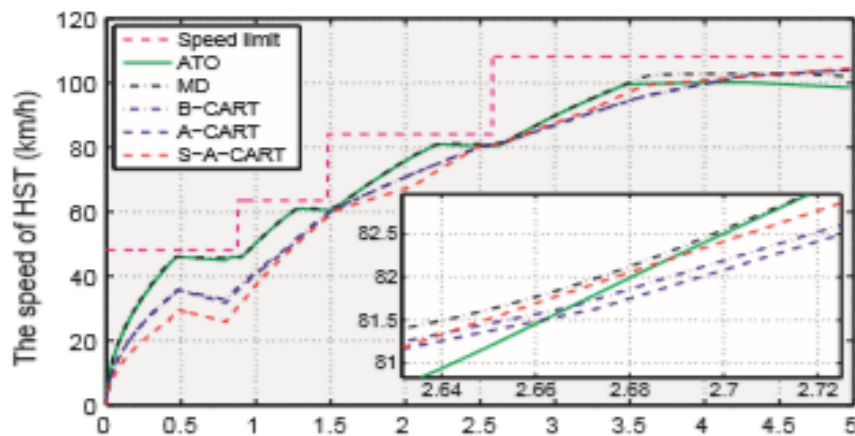


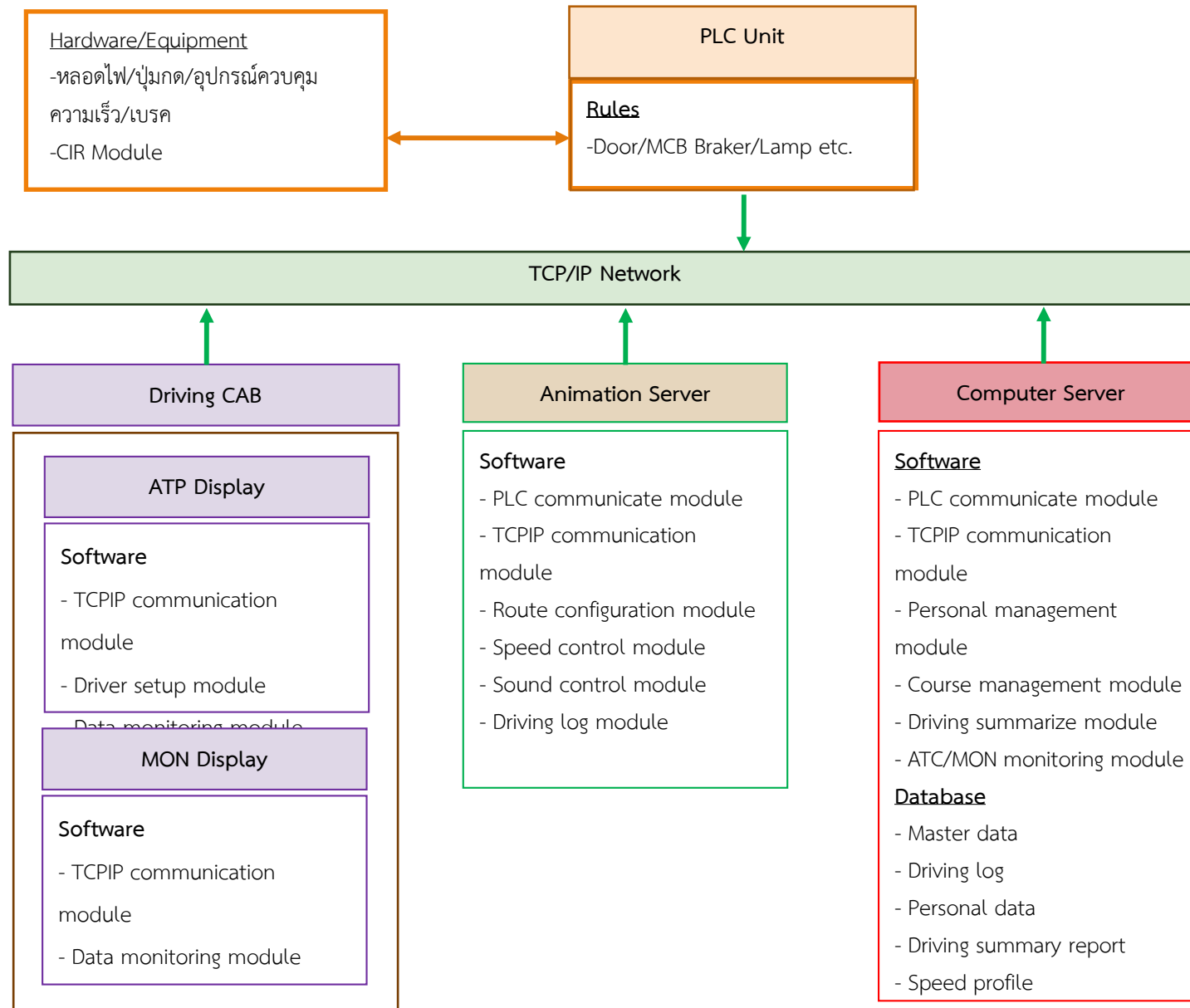
Fig. 3. Speed-distance curves comparison.



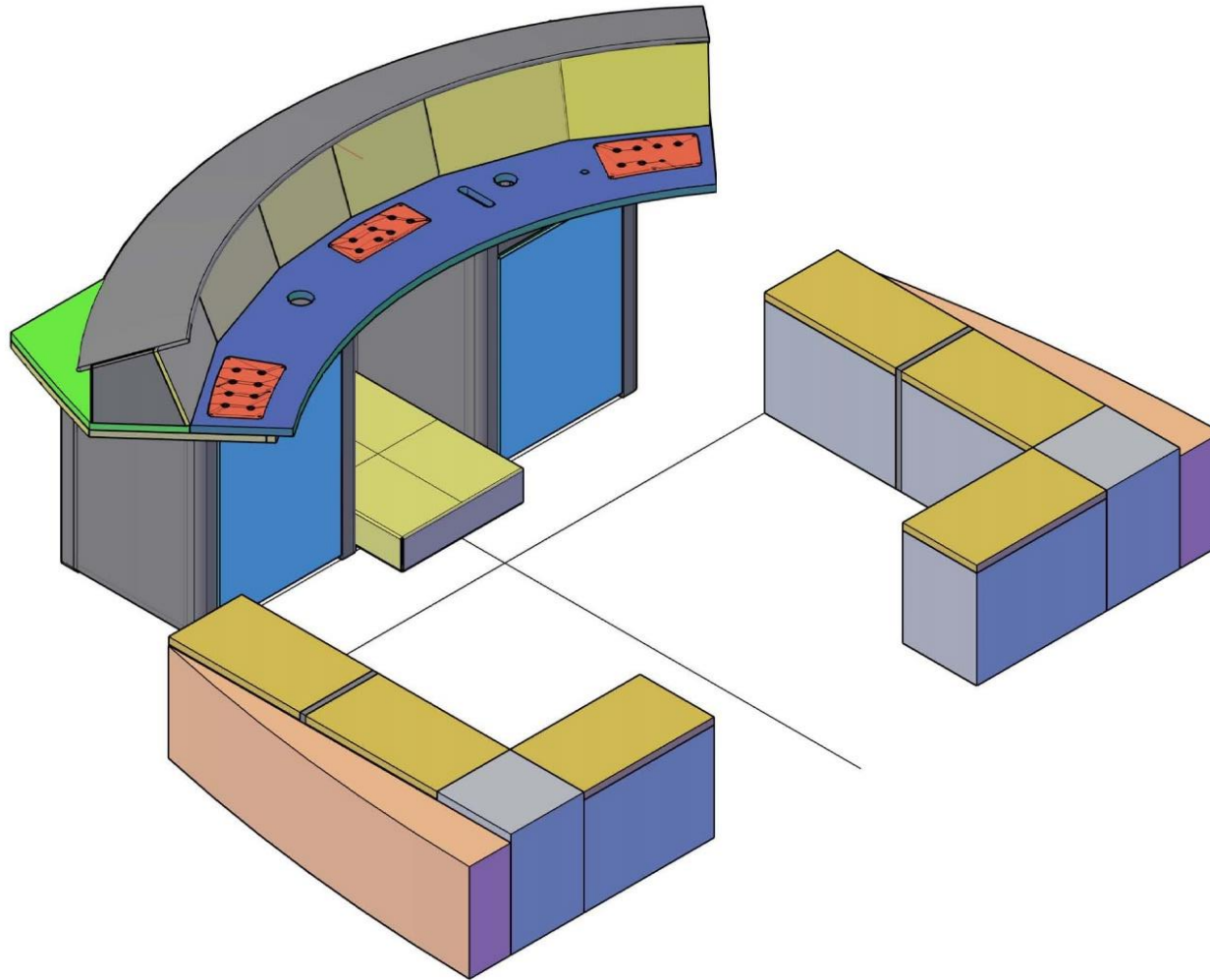
3. Research Methodology

1. CONCEPTUAL DESIGN: INTERACTIVE DESIGN
2. NETWORK SYSTEM: TCPIP –MODBUS
3. IMAGE: ANIMATION 3D
4. INTERFACE: PLC
5. DRIVING SYSTEM: ATO, SM, RM, TEST TRACK
6. TEACHING AND LEARNING STRATEGY: CASE SCENARIOS
7. DATABASE: SQL SERVER
8. SOFTWARE DESIGN: OBJECT ORIENTED
9. DYNAMIC VEHICLE DESIGN: PHYSICS DYNAMIC
10. ROUTE DESIGN: GPS GOOGLE MAPPING
11. SIGNALING CONTROL REFERENCE: ETCT₃

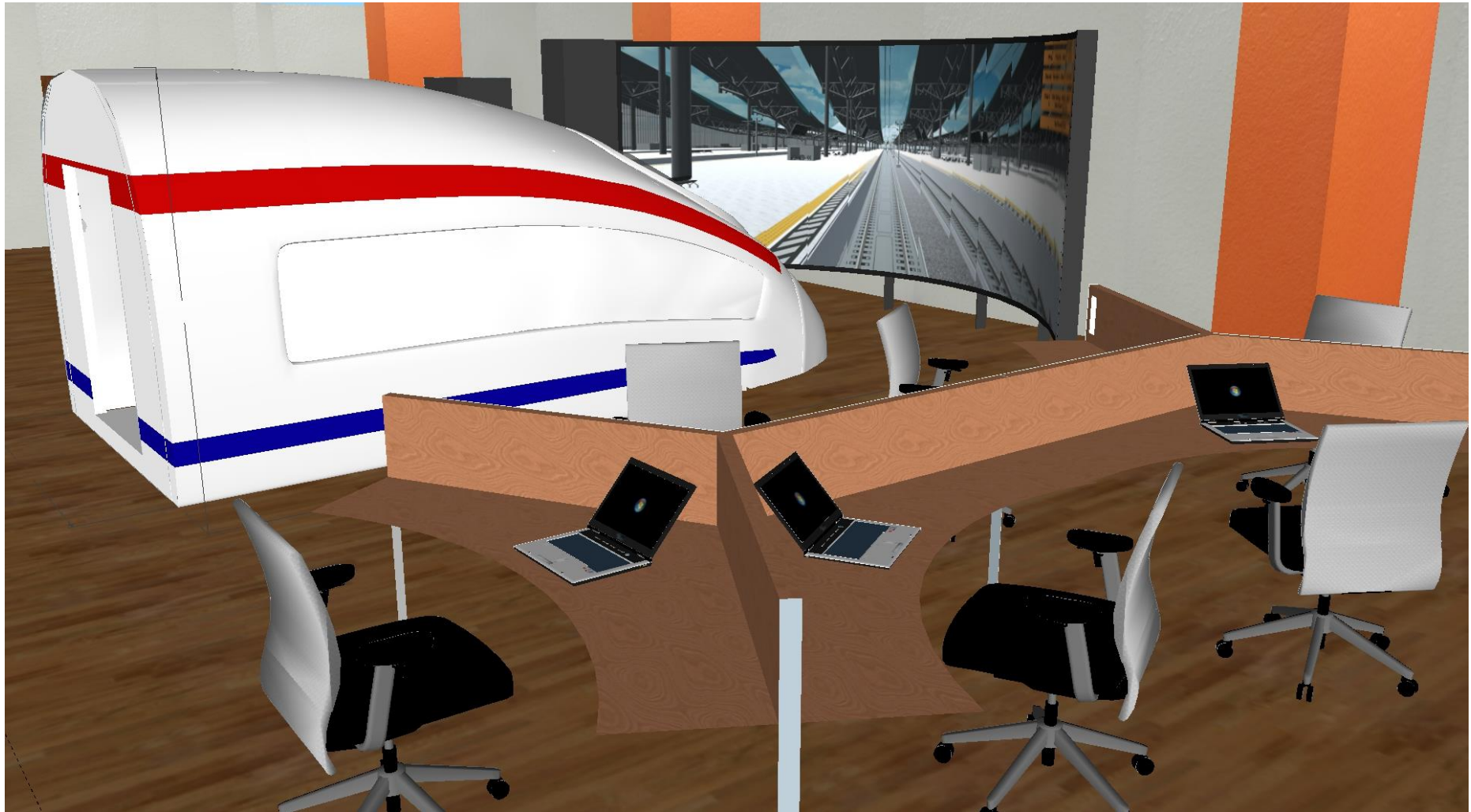
3. Methodology: Conceptual Design



3. Methodology: Driver cap Design



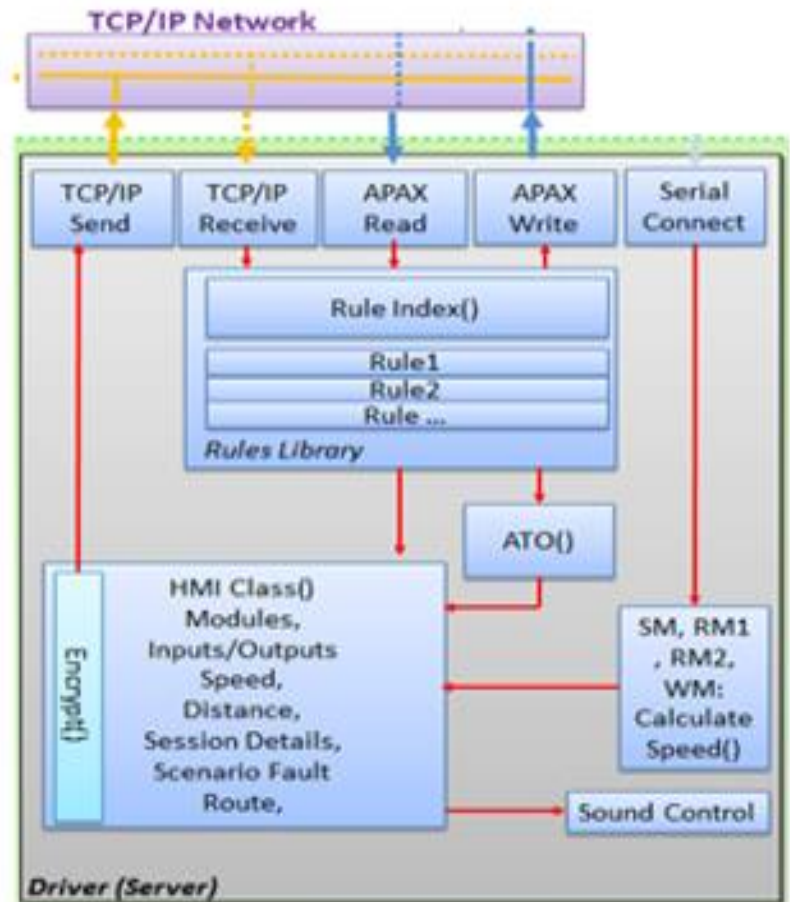
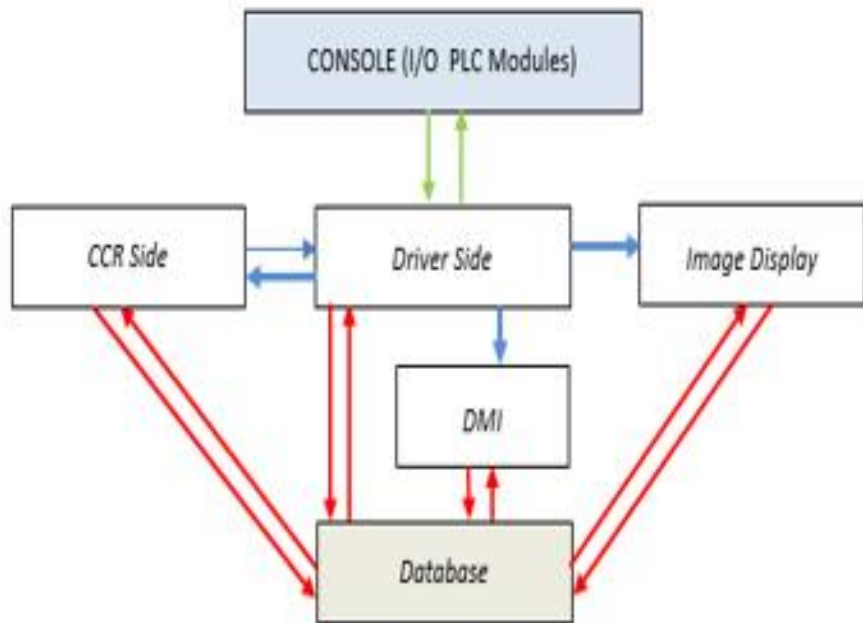
Research Tools and Facilities



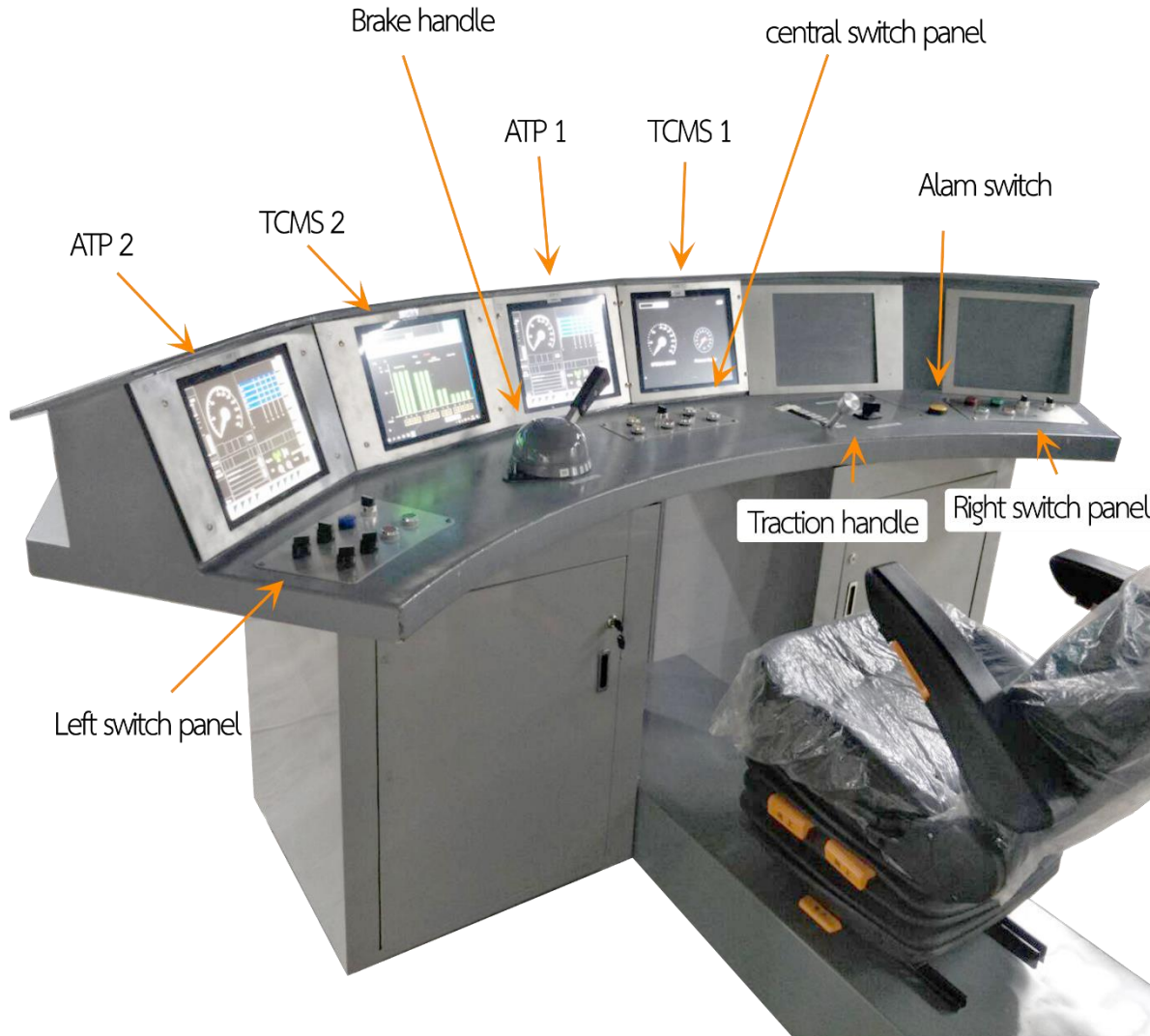
Research Tools and Facilities



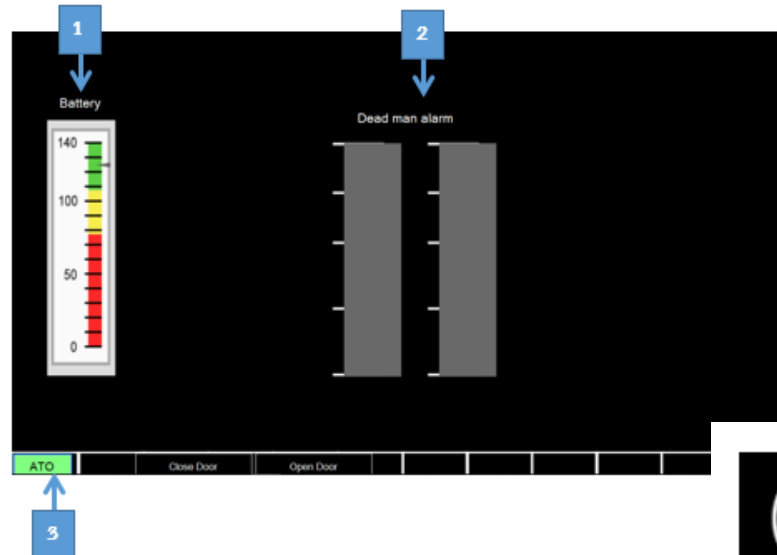
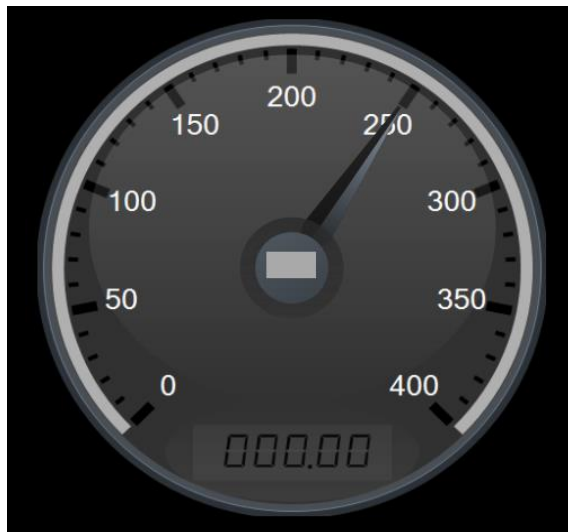
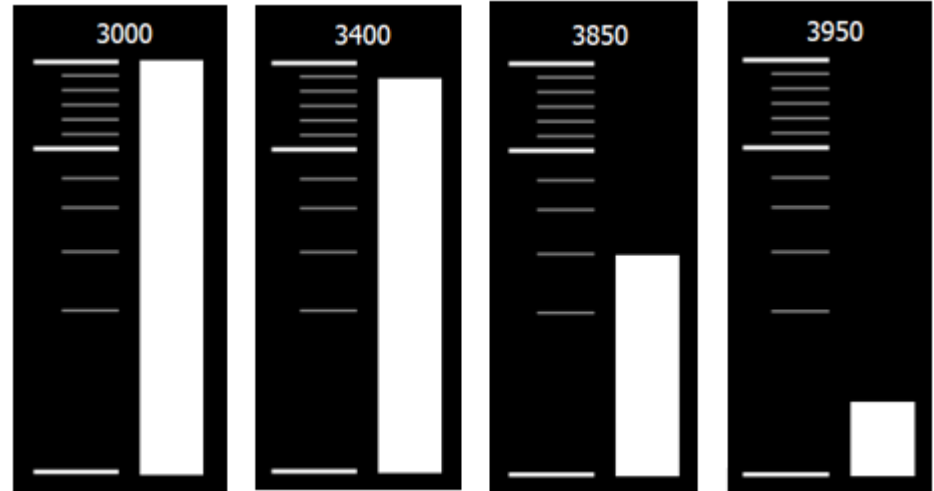
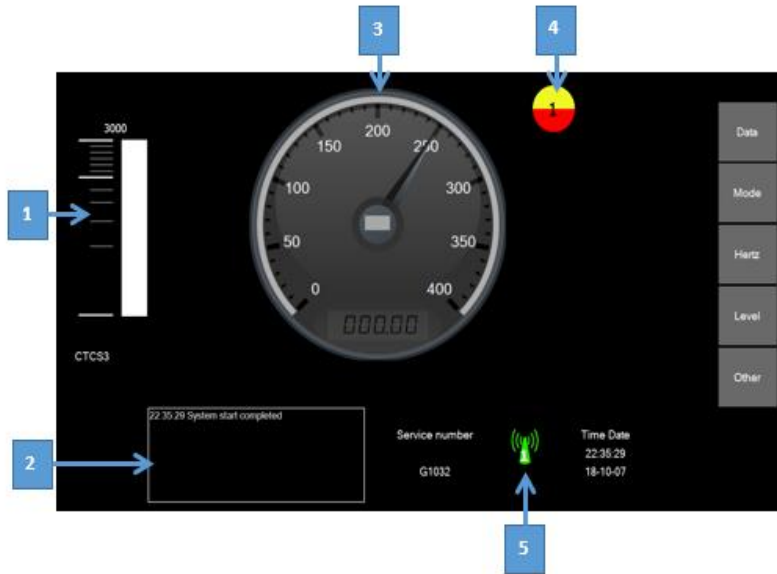
TCPIP: Mod bus network system



HST Driver Console Design



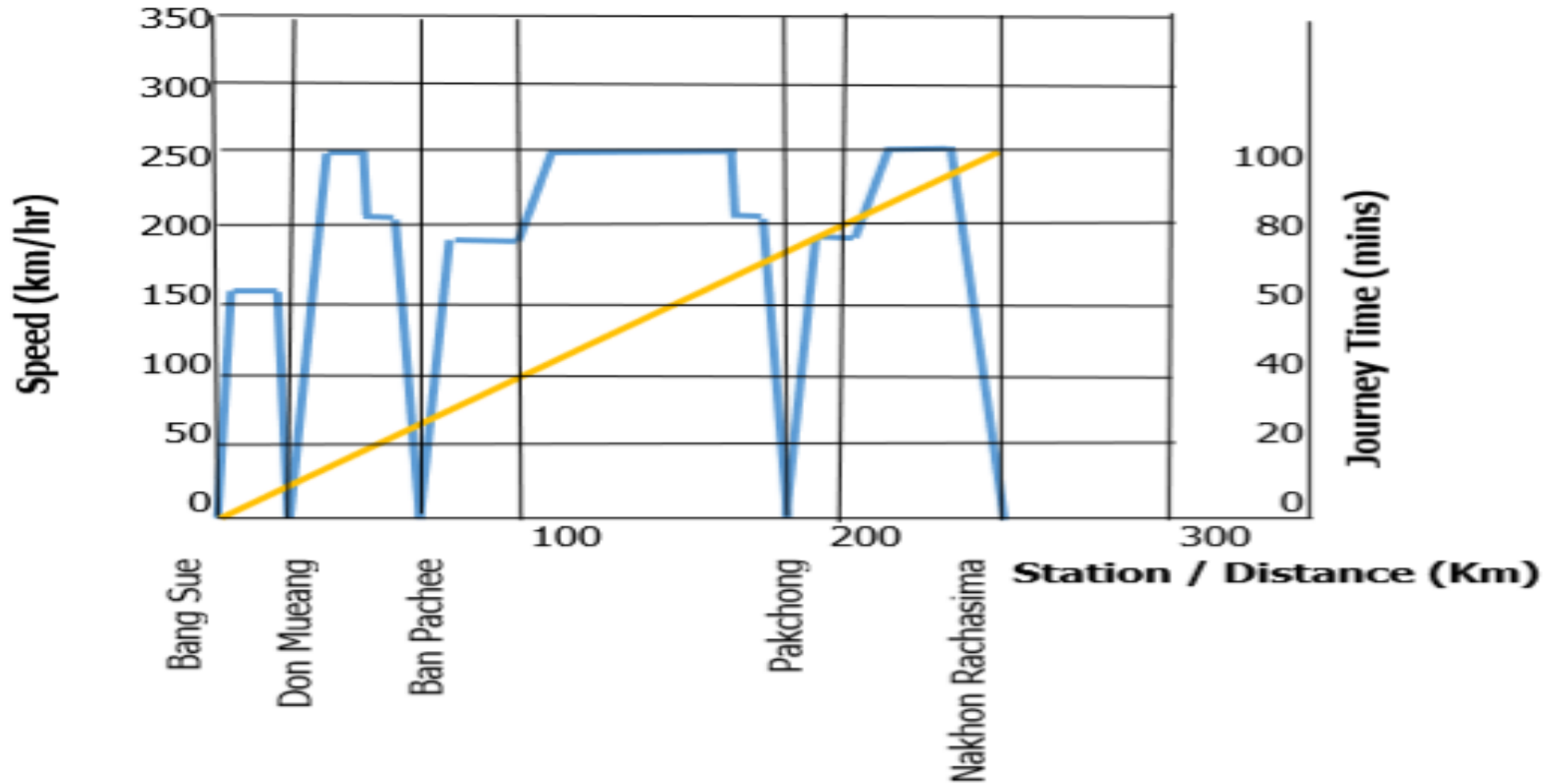
DMI Panel Control



ETCS3



Speed Profile Design



North-Eastern HST Line for Research

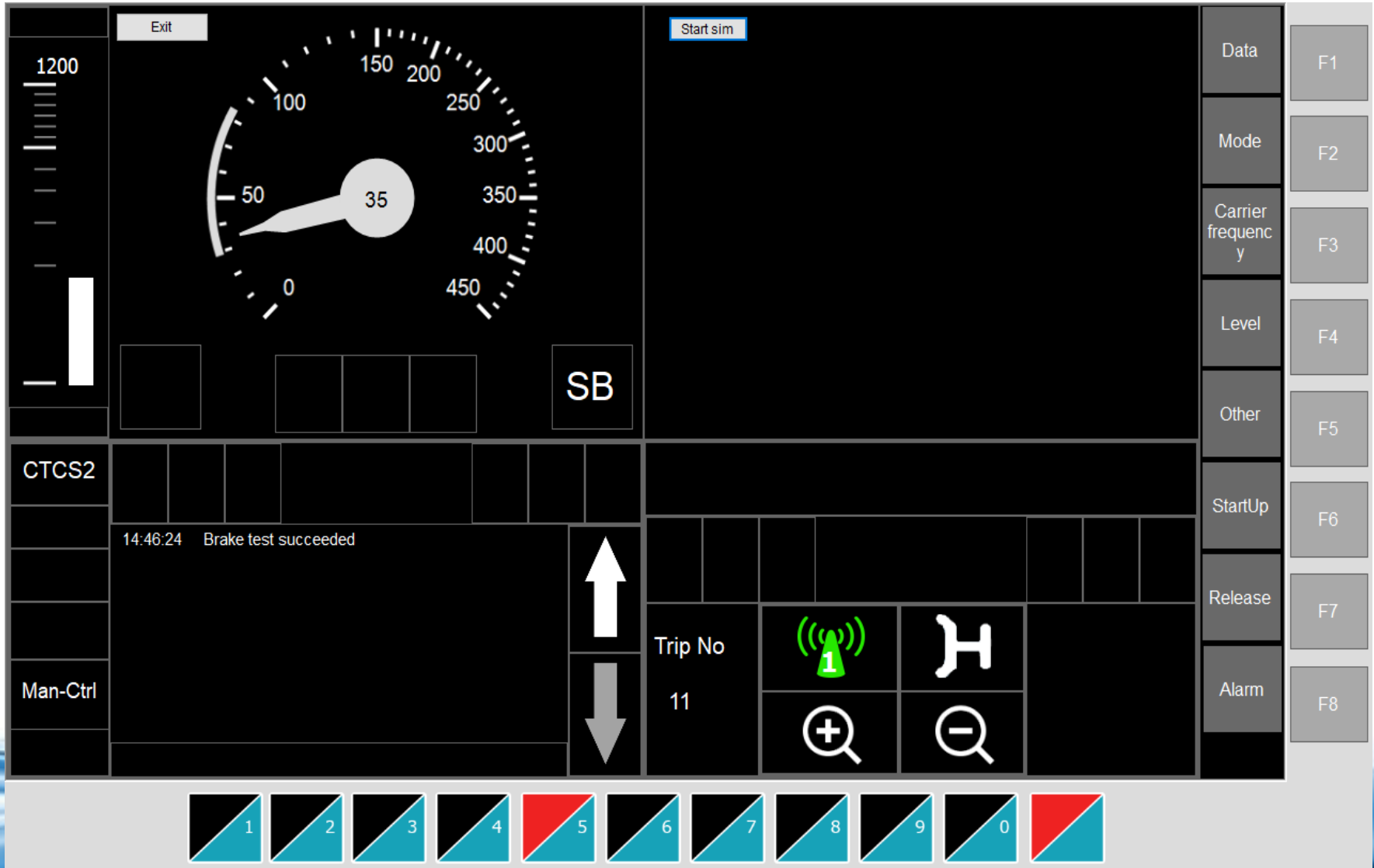


BANG SUE - NAKHONRATCHASIMA

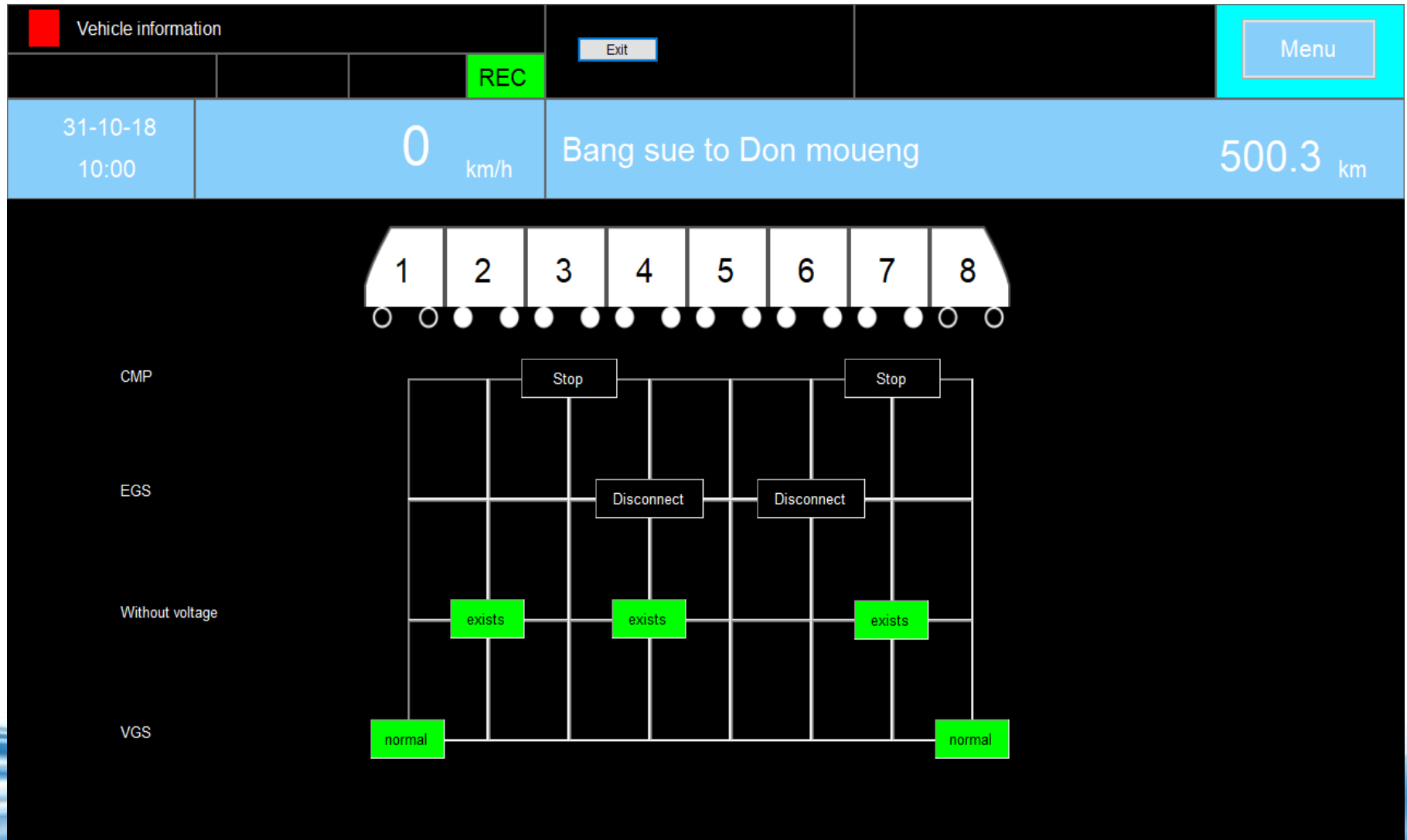
HIGH SPEED RAILWAY MAP



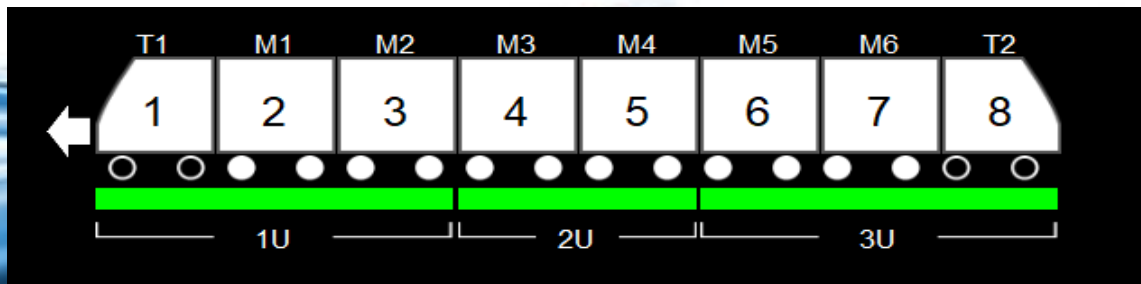
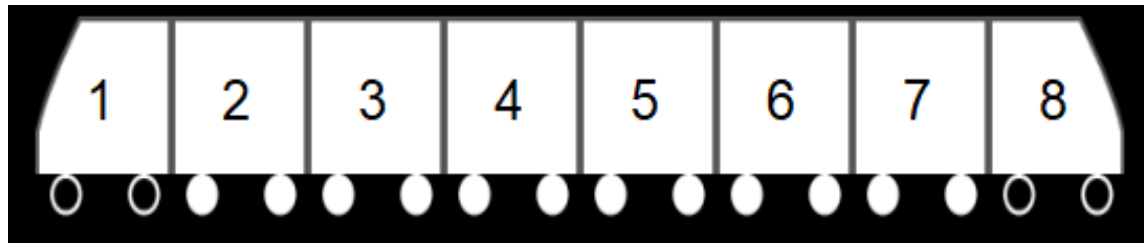
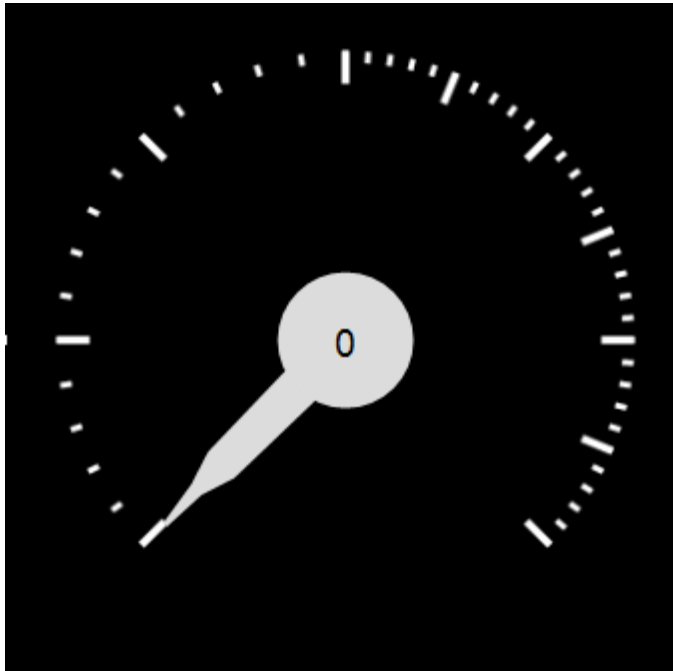
Monitor Driver Control



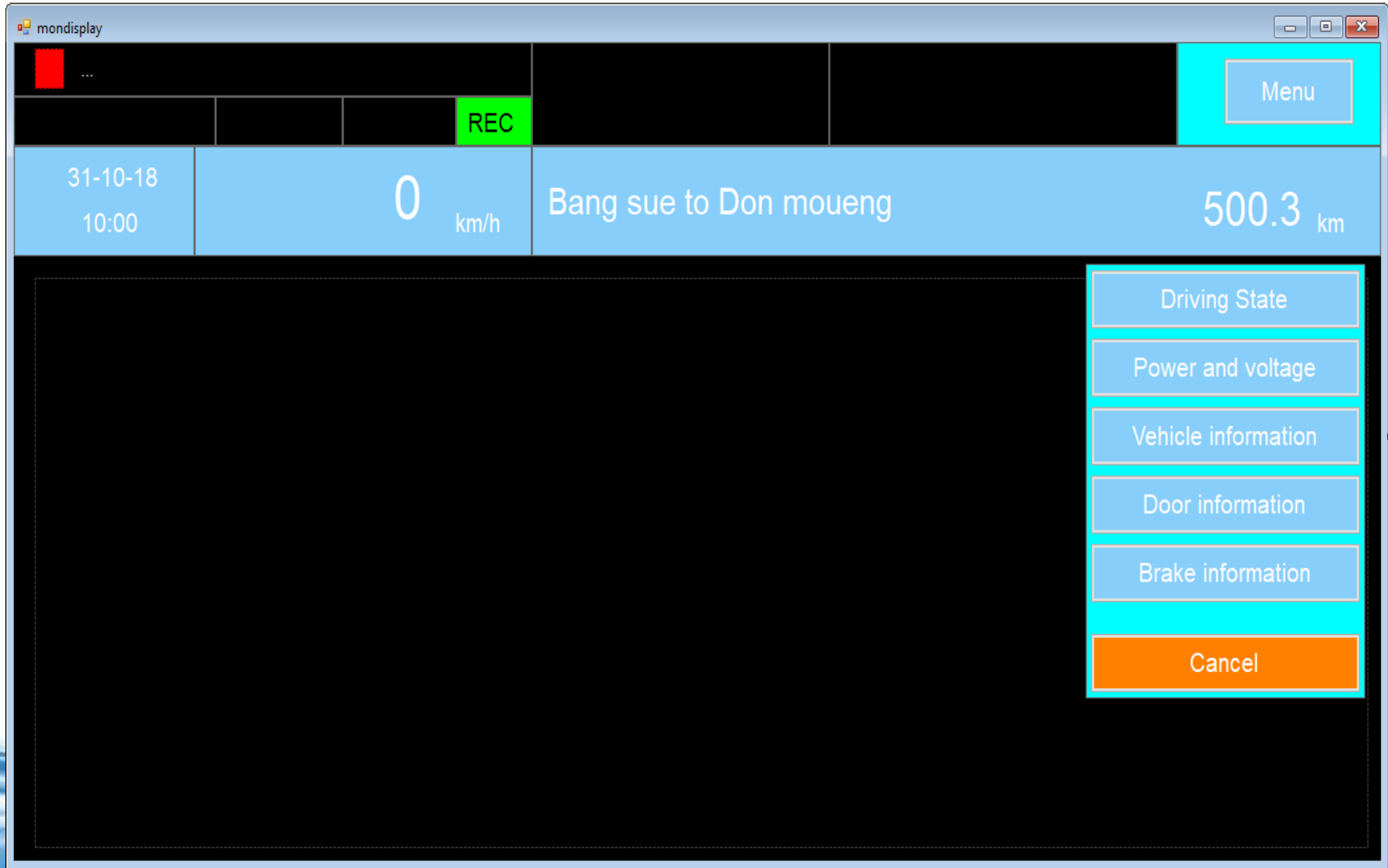
Monitor Driver Control



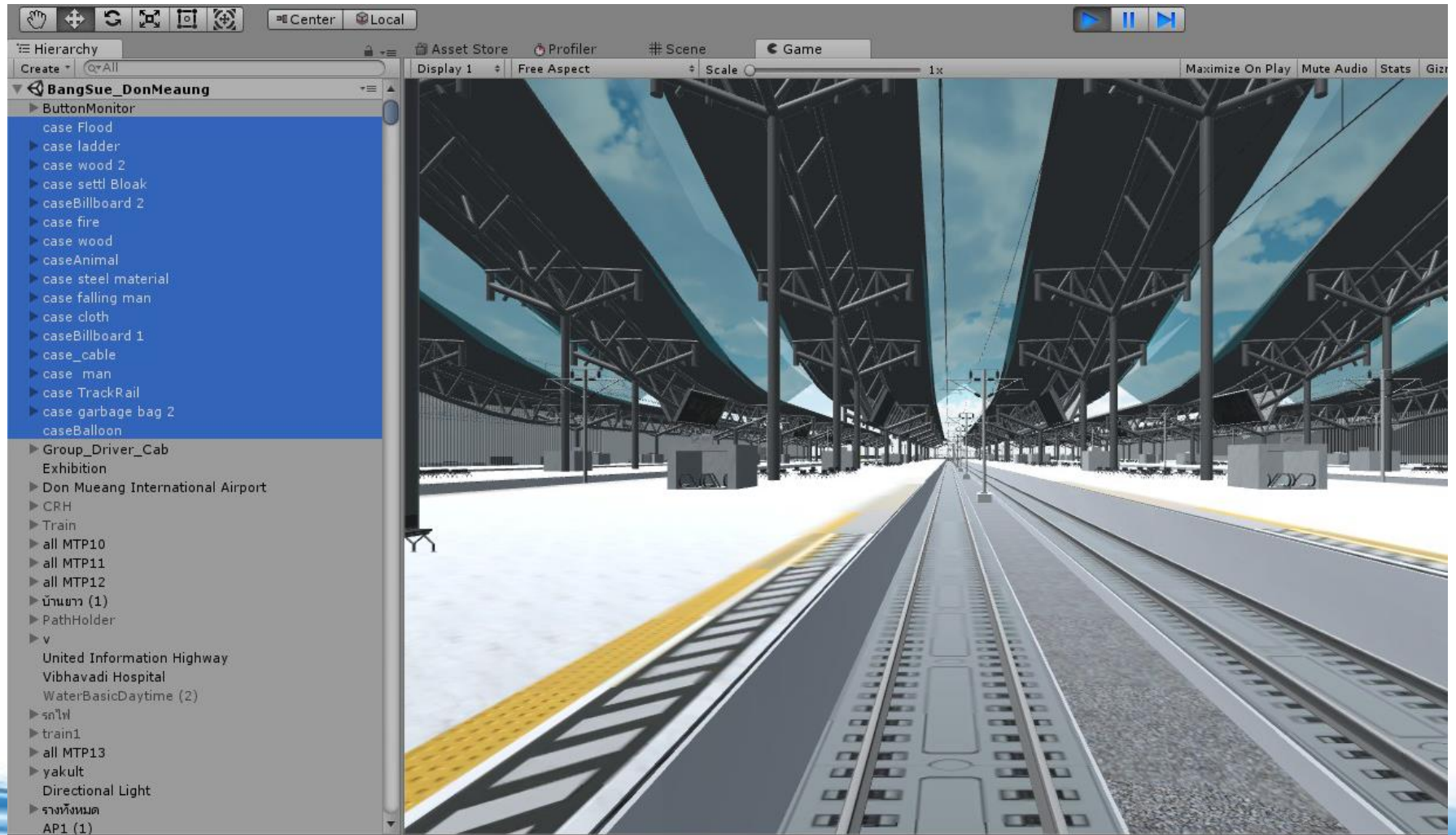
Monitor Driver Control



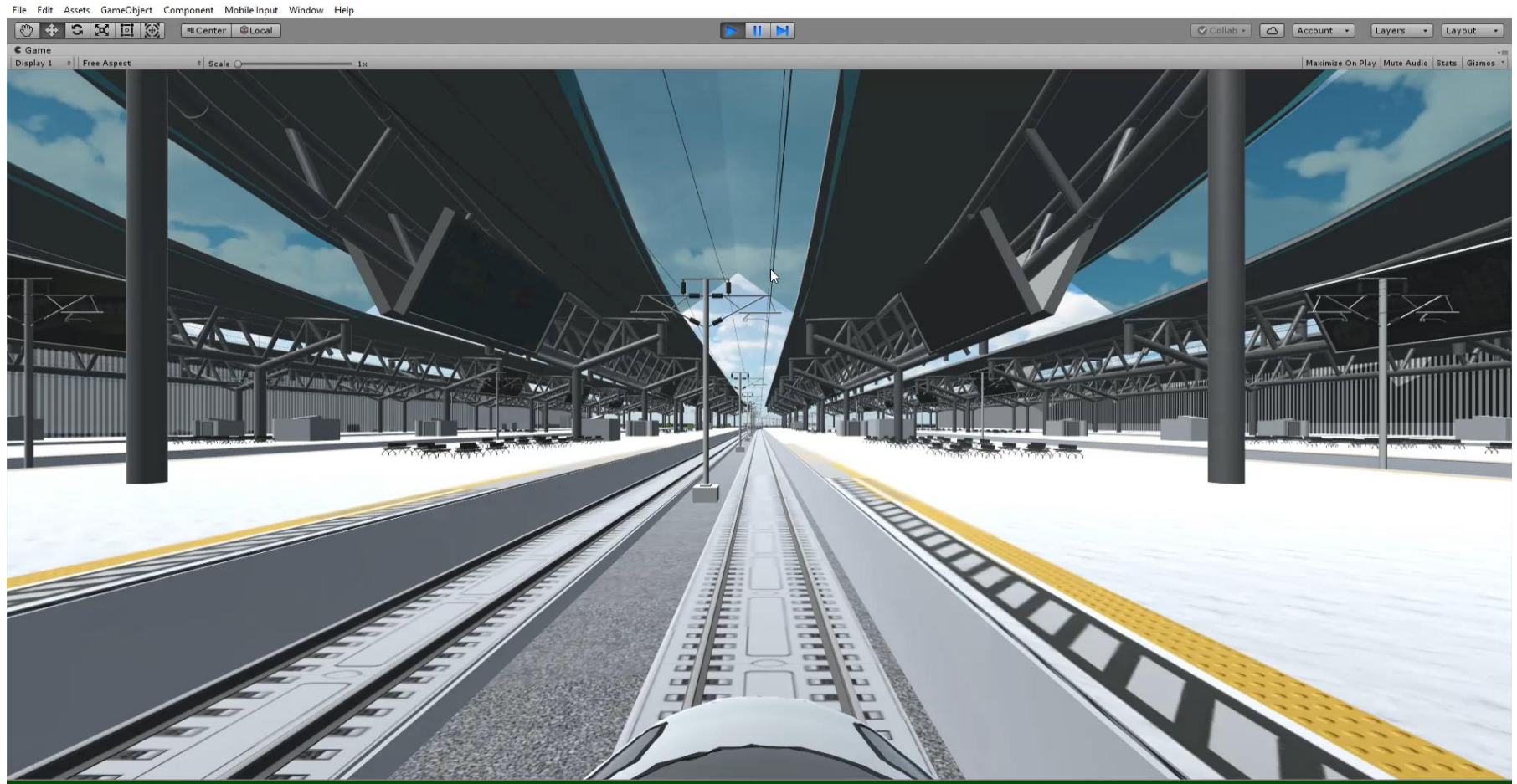
Monitor Driver Control



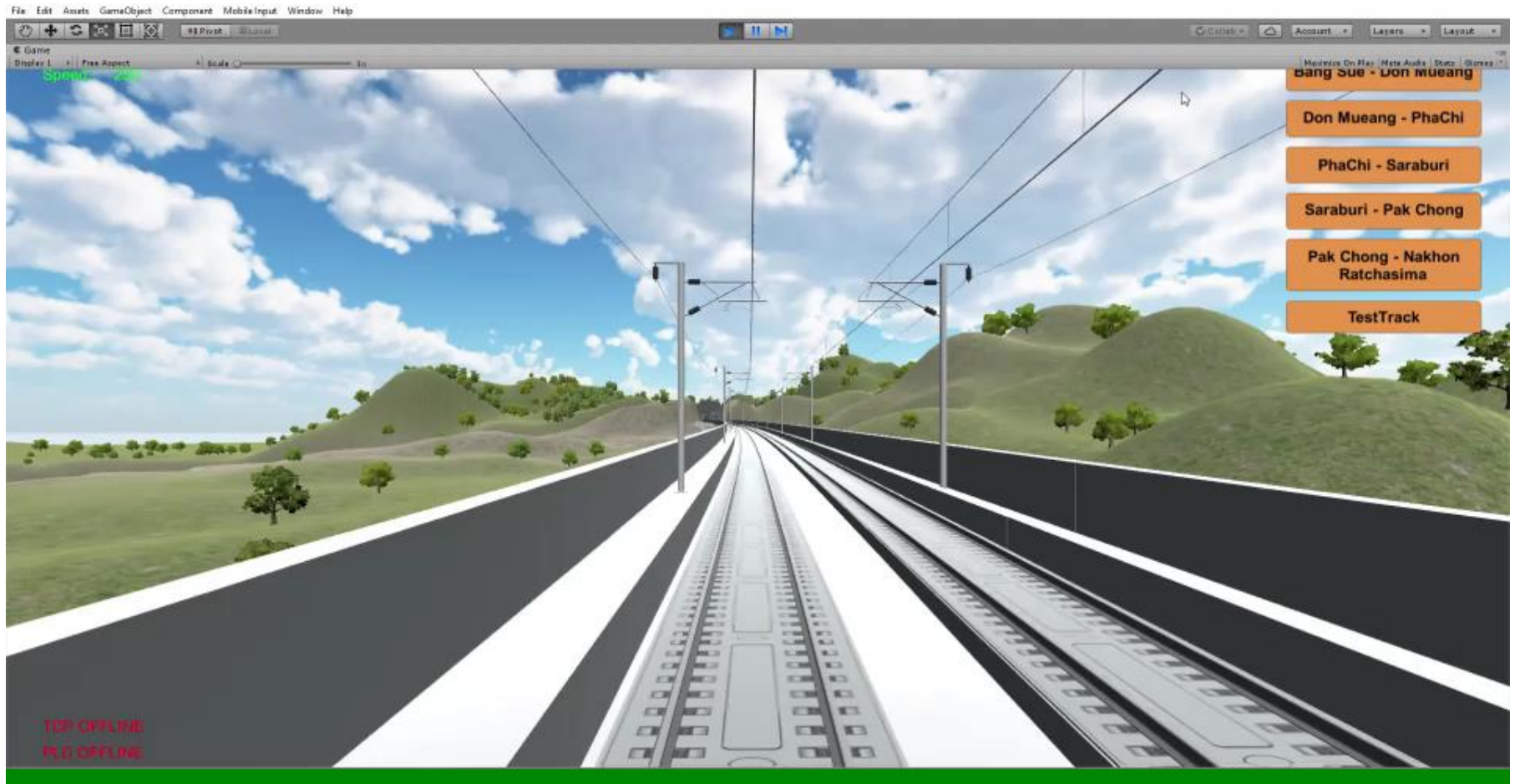
Case Scenario Design by Unity



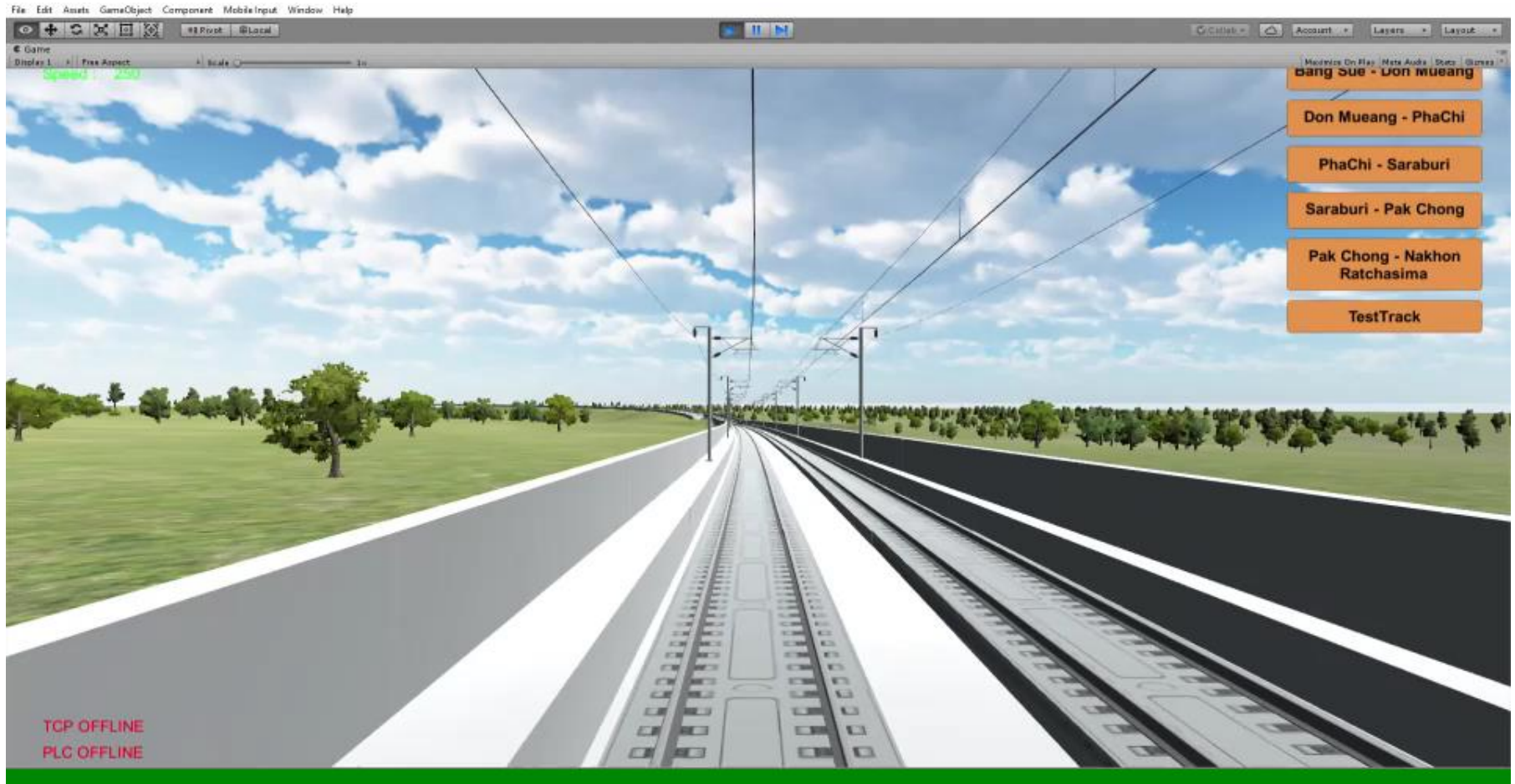
4. Results: Bangsue-Donmeung



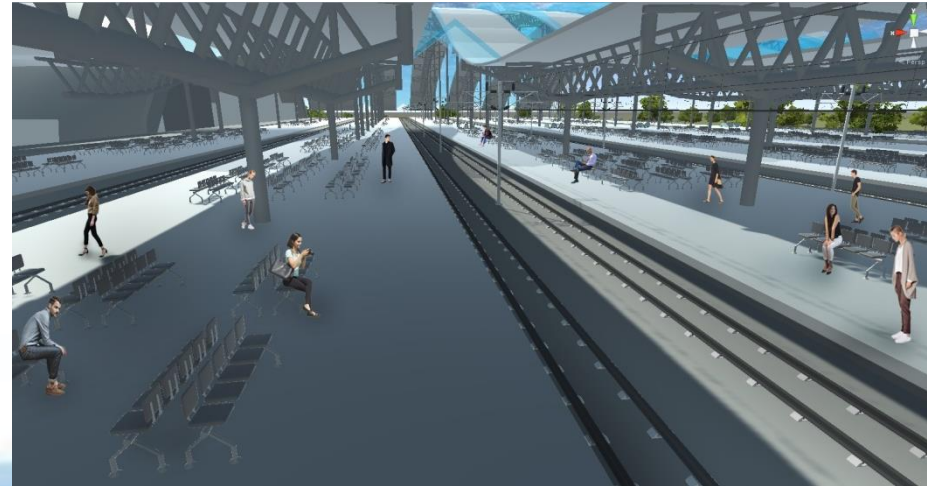
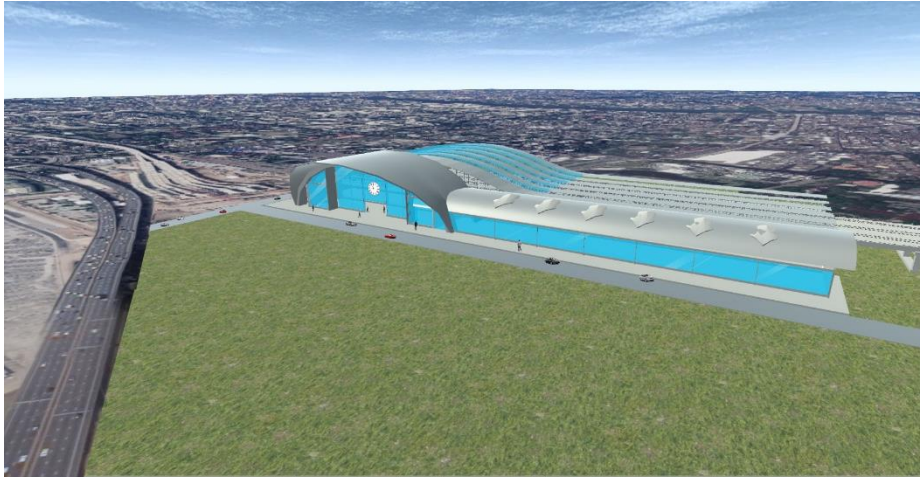
4. Results: Saraburi-Pakchong



4. Results: Pakchong-Nakornrachasima



Bang Sue Station



4. Results

Simulation is done by picture displaying which controlled by speed and interfaced with hardware devices both digital and analog I/O signal.

Such pictures are individually created and stored in the library. Route is assembled based on reality landscape objects. The data is captured by Google map together with local map to use for a guide to create 3D models.

The assembled picture is rendered for moving the image in order. Algorithm and driving rules are used to control the image displaying on the screen.

As the result, a driver can interact with the simulation. Figure shows the Bang Sue station which is the central station for high speed train project in Thailand.

5. Conclusions

The image control for high speed driving simulation has been presented. Previous research reviews are discussed to show a lot of idea to use advantages from simulation and modelling for high speed train design, operate, control, service and so on particularly on the aspects of safety. The proposed methodology is explained such as system architecture design, driving rule and speed profile. It is found that 3D animation controlling by C# program is more effectively than using video image sequencing approach.

**THANK YOU
FOR YOUR ATTENTION**

