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1st International Conference on Aviation Future:
Challenge and Solution (AFCS 2020)

Development Of Air Traffic Control Simulator System Applied In Education And Training

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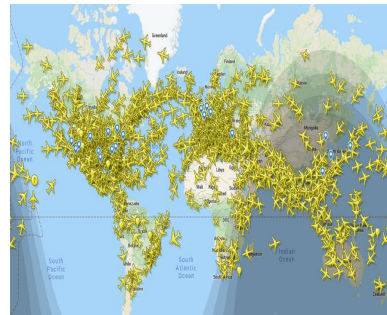
Vietnam Aviation Academy, Vietnam

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CONTENT

1. Introduction

2. Aerodrome Control Tower Simulator System

3. Installing and testing

4. Conclusion

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1. Introduction

➢ Increase demand for aviation

➢ Challenge about human resources

➢ Challenge about infrastructure

Global flight density map
(Flightradar24.com – 26/07/2019)

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1. Introduction

➢ 42 million international commercial flights with 4 billion passengers and 62 million tons cargo operated safely (2017, IATA).

➢ Ensure safety, efficiency: 120,000 global transit flights on 45,000 routes per day (2017, IATA).

➢ Vietnam 2018: 890,398 flights (up 10.4%), revenue reached VND 3,850 billion, ensuring operation of 31 domestic routes and 36 international routes.

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1. Introduction

Training Center of VATM
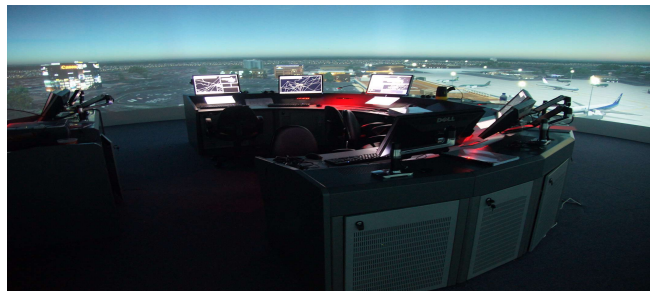
Vietnam Aviation Academy

1. Introduction

Aerodrome Control Tower Simulator Room, Northern Region
Air Traffic Services Company - VATM

1. Introduction

Aerodrome Control Tower Simulator Room, Southern Region Air
Traffic Services Company - VATM

1. Introduction

Aerodrome Control Tower Simulator in Vietnam Aviation Academy, 2000

1. Introduction

➢ Topic: "Development Of Air Traffic Control Simulator System Applied In Education And Training"

➢ Scope: Tan Son Nhat Airport

➢ Aim: building an aerodrome control tower simulation system

2. Aerodrome Control Tower Simulator System

2.1. The diagram of aerodrome control tower simulator system

2.2. Database system

2.3. Tower control simulation software

2.4. Flight simulation software

2.5. The connection between two modules (tower control simulation and flight simulation)

2.1. The diagram of aerodrome control tower simulator system

	The main components
1	Air traffic management simulation module
2	Flight simulation module
3	Graphic simulation module
4	General management software
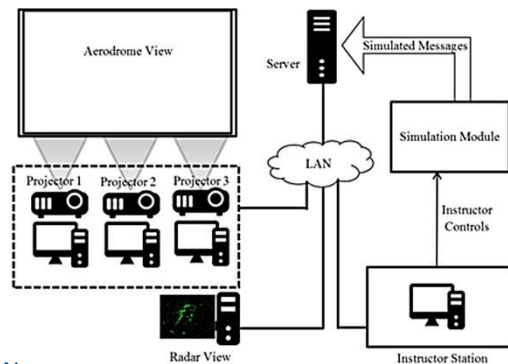
→ The entire system is connected via internal LAN

2.2. Database system

➢ Data collection and processing

+ Primary data collection (Tan Son Nhat airport and vicinity map): RWY, TXY, Apron.

+ Secondary data collection (Tan Son Nhat radar airport and vicinity map): buildings, equipment inside and outside of Tan Son Nhat airport

→ synchronize data 2D and 3D model for tower control simulation module

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2.2. Database system

a) 2D airport model → use WorldEditor tool (WED)
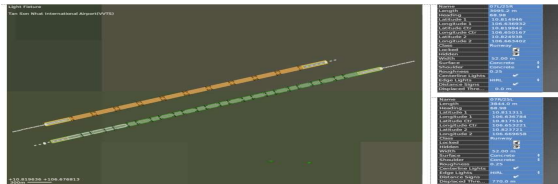
Build runway

Build apron

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2.2. Database system

b) 3D airport model

- Open-source programming framework: tower control simulation and flight simulation software, database system about scene is shared.

- 3D airport model consists of 2 components: scene modelling and 3D entities.
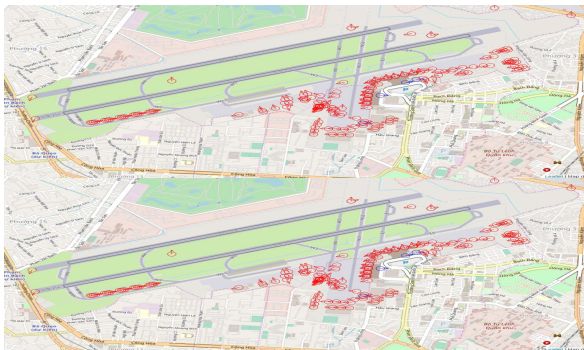
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2.2. Database system

b) 3D airport model – 3D entity model

Map showing the scene and existing works at Tan Son Nhat airport
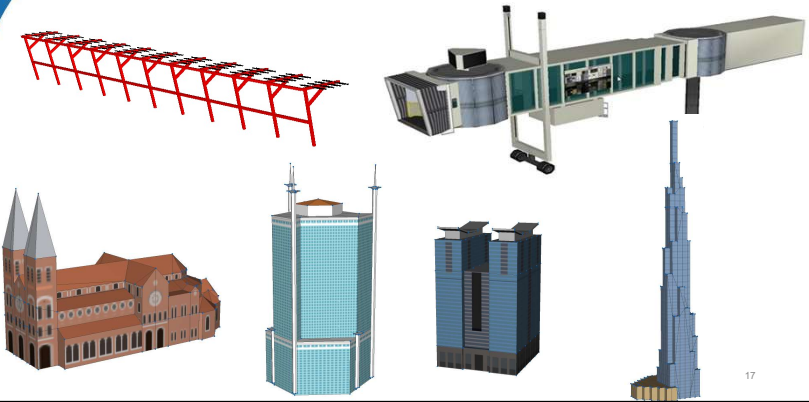
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2.2. Database system
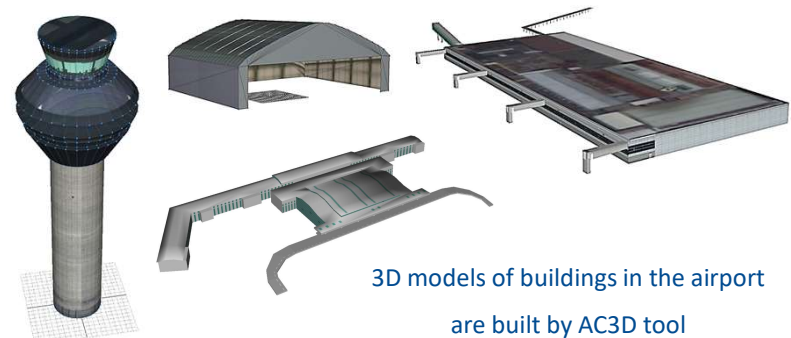
b) 3D airport model

3D models of buildings in the airport are built by AC3D tool

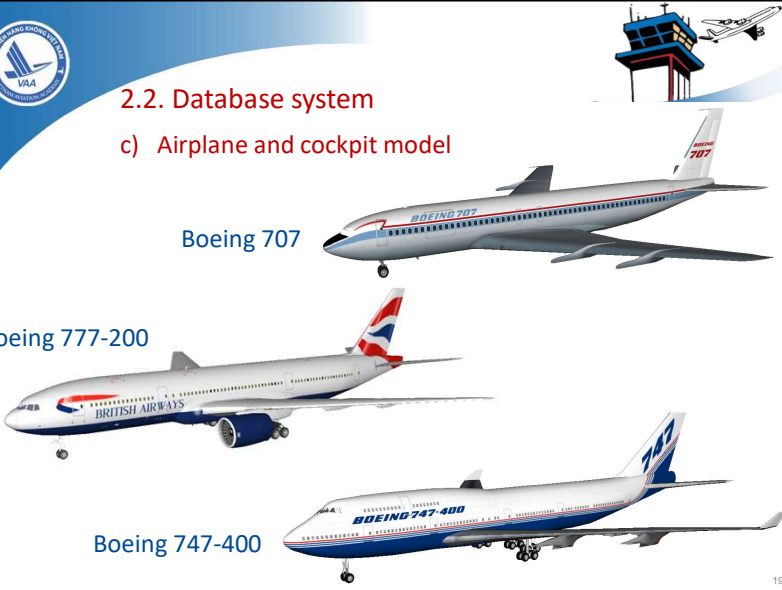2.2. Database system

b) 3D airport model – 3D entity model

2.2. Database system

c) Airplane and cockpit model

Cessna 172 model and

cockpit equipment

2.2. Database system

c) Airplane and cockpit model

Boeing 707

Boeing 777-200

Boeing 747-400

2.2. Database system
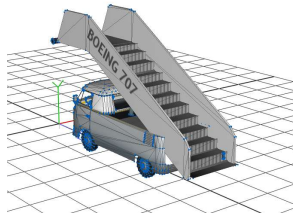
c) Airplane and cockpit model

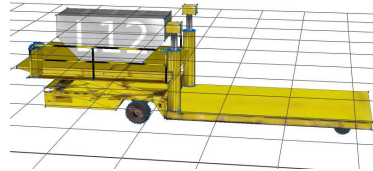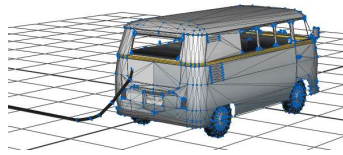Airbus A320

Airbus A340

Airbus A380

2.2. Database system
d) Ground equipment
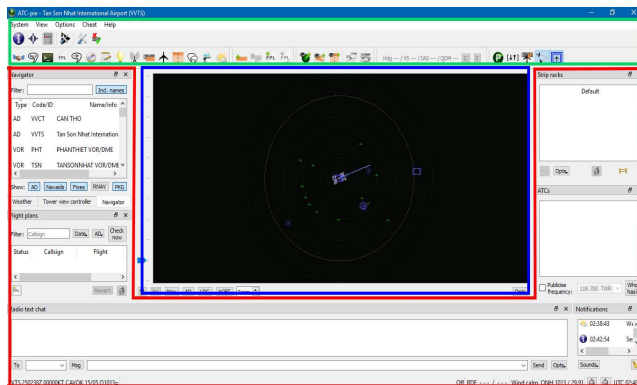

2.3. Tower control simulation software

➢ **Open-source programming framework:** ATC-pie

➢ **Programming language:**
+ Python version 3
+ Additional library pyqt5

ATC-VAA interface

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2.3. Tower control simulation software

The main screen of ATC-VAA

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2.4. Flight simulation software

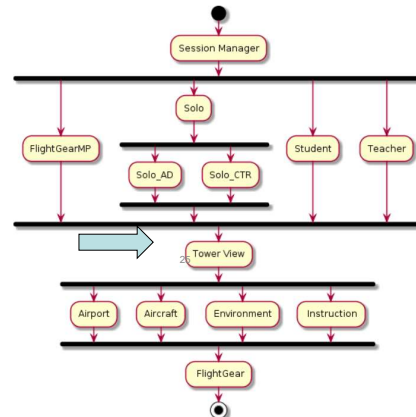➢ The authors choose FlightGear software to exploit and develop.

➢ The developer supports standard 3D model formats and most of the configuration is controlled via xml-based ASCII files.

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2.5. The connection between two modules (tower control simulation and flight simulation)

> Tower control module and flight simulation module are connected via Tower View feature on Tower control module.
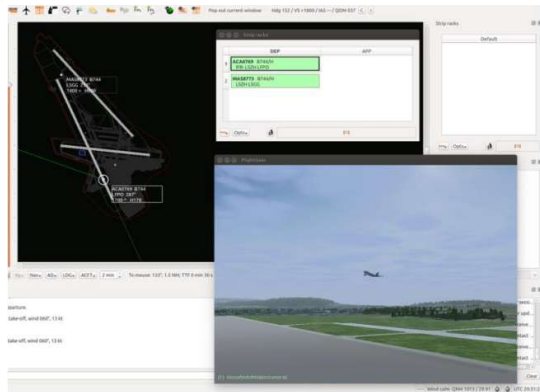

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2.5. The connection between two modules (tower control simulation and flight simulation)

Solo	• Users practise flight management at the airport • Scenarios: GND, TWR, APP • Give instructions to control aircraft • Change weather and environmental factors
Flightgear Multiplayer	• Practice mode with the community (via the internet) • Communicating with aircraft, receiving and transferring the control of aircraft to next ATC units
Teacher session	• Teacher initiates new session and selects work mode • Teacher creates each hypothetical situation and issue direct instructions to the aircraft • Only one student connects to the session • Teacher does an example and student follows up • Teacher changes external conditions
Student session	• Connect to the teacher's session via LAN • Monitor teachers' air traffic control process • Can not give clearance to aircraft

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2.5. The connection between two modules (tower control simulation and flight simulation)
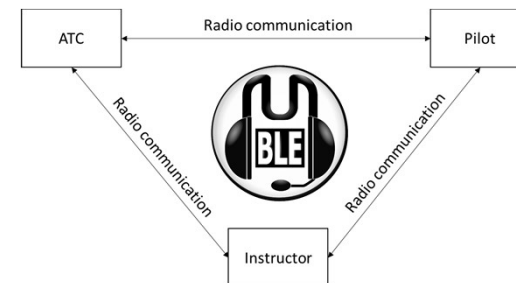

Illustrate the connection between two modules

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2.5. The connection between two modules (tower control simulation and flight simulation)

Flowchart of setting up radio communication between ATC and pilot (Mumble app)

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3. Installing and testing

3.1. Hardware infrastructure

3.2. Installing and testing

3.1. Hardware infrastructure

➤ **The overall system includes:**

- Observator position: Control working session
- ATC position: Observe and give instructions to pilot
- Pilot position: Control aircraft
- Projector and projector screens system: the rendered 3D result of total airport scenes
- Communication system: Ensure communication between ATC and pilot

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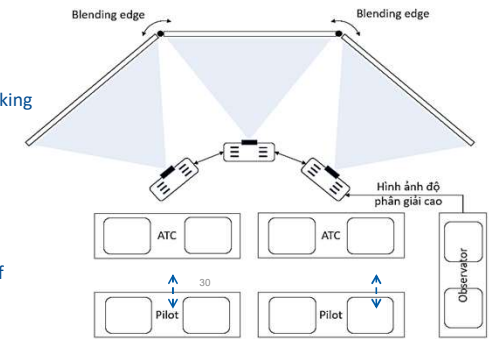
3.2. Installing and testing

3.2. Installing and testing
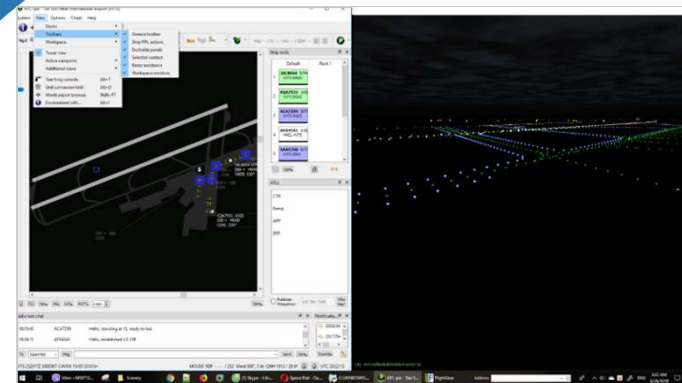
Flight simulation software and tower control simulation software interface at night

3.2. Installing and testing

Construction of aerodrome control tower simulation software
in practice room

Construction of aerodrome control tower simulation software
in practice room

4. Conclusion

➢ The research has built two software systems (tower control simulation and flight simulation) for training air traffic controllers

➢ Designe and set up a laboratory using above system to apply for training.

➢ Create exercises to run on software

➢ Write user manual

➢ For further studies, it is easy to integrate new modules (approach control, area control) to serve training.

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