Air Traffic Ground Based Management System

A Project Report

Submitted by

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Place: Mumbai

Date: 05-04-2021

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CERTIFICATE

This is to certify that the project entitled “Air Traffic Ground-based Management System” is the bonafide work carried out by Shreyash Palodkar, Shubham Patel and Shlok Sambre of MBA Tech, MPSTME (NMIMS), Mumbai, during the IV semester of the academic year 2020-21, in partial fulfillment of the requirements for the Course Programming Language.

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Prof. Ameyaa Biwalkar

Internal Mentor

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Examiner 1 Examiner 2

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Chapter 1: Introduction

Air traffic in this world has been increasing day by day and so as the demand for air travel. Increased number of flights mean increased number of air traffic, which in turn means increase in ruckus created at airports as many flights come and go from airport, so each flight needs to be given a route, parking allocation, permissions for takeoff and landing and several other ground-based tasks. This all makes the job of staff of Air Traffic Control difficult and time consuming. Hence, for better execution of all the tasks at airport, a proper management system is necessary. So, we came up with the Air traffic ground-based management system for better running of airport as well as less load on Air Traffic Control.

The purpose of Air traffic ground-based management system is to allow the staff of air traffic control to track the movements of all the flights which are coming from some place and which may or may not want to go to other place. There is provision for staff of ATC to enter flight details which are coming towards airplane and may or may not want to leave from airport for a specific time. It will also facilitate the staff of ATC to give permission to airplane to land at the airport, allocation of parking or hardstands where boarding/deboarding of passengers or loading/unloading of cargo will take place, guide airplanes to their allocated hardstands, again give them permission to move towards runway for takeoff, guide airplanes towards runway by telling directions and giving permissions to airplanes to takeoff. Also, there is provision for emergency landing of airplanes as well as provision to vie history of all planes which departed from the airport.

Problem Introduction

Problem in tracking of flights: There is a lot of problem for staff of ATC to track current position of different flights as one person can check for only one flight at a time.

Allocation of Parking by checking availability manually: Parking allocation manually can be difficult because of potential delays of flights, so it is better to automate parking allocation for airplanes.

Tracking of flight history: The retrieval of information about flight or airplanes is difficult, the immediate storage of flight details is difficult and also, it is difficult to update flight details.

Scope of the project

The schedule of flights is entered by someone who just enters the details about flight like arrival time, departure time, aircraft ID, flight type, and some other important attributes.

The staff of Air Traffic Control will give permission to land, permission to taxi towards parking, permission to taxi towards runway and takeoff permission.

There will also be a provision for emergency landing of flights which needs to be landed on priority because of certain reasons.

Staff will have access to the view of different terminals to see the vacancy available at different terminals.

Staff can also check the recent airplanes which had taken off from the airports and the details about the airplanes.

Modules

The entire project consists of mainly 3 modules:

- Main module: This is the main module which checks for initial connection with the database and creation of tables as the program runs for first time. Also, this module shows splash screen for the better view for the user.
- Login Module: This module asks for username and password of the staff of ATC who has control of the software. It then checks for username and password. If username is correct, it launces the Home module where all the tasks are performed.
- Home Module: This module is the real graphical user interface where the staff of ATC works and gives permissions to airplanes, guide them towards their terminals, have access to the history of airplanes and can access views of different airport terminals.
- DBop Module: This module contains all the methods which are required for database operations. For eg, List of planes available to land, planes going towards terminal, giving permission to airplanes for takeoff and landing, etc ,all the sql commands are executed in this Module.

Chapter 2: Softwares and API used with Descriptions

- VS Code: Visual Studio Code is a lightweight but powerful source code editor which runs on your desktop and is available for Windows, macOS and Linux. It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages (such as C++, C#, Java, Python, PHP, Go) and runtimes (such as .NET and Unity). Visual Studio Code combines the simplicity of a source code editor with powerful developer tooling, like IntelliSense code completion and debugging. First and foremost, it is an editor that gets out of your way. The delightfully frictionless edit-build-debug cycle means less time fiddling with your environment, and more time executing on your ideas. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git. Users can change the theme, keyboard shortcuts, preferences, and install extensions that add additional functionality. In the Stack Overflow 2019 Developer Survey, Visual Studio Code was ranked the most popular developer environment tool, with 50.7% of 87,317 respondents reporting that they use it.

- DB Browser: DB Browser for SQLite (DB4S) is a high quality, visual, open source tool to create, design, and edit database files compatible with SQLite.
  DB4S is for users and developers who want to create, search, and edit databases. DB4S uses a familiar spreadsheet-like interface, and complicated SQL commands do not have to be learned. Controls and wizards are available for users: to Create and compact database files; Create, define, modify and delete tables; Create, define, and delete indexes; Browse, edit, add, and delete records; Search records; Import and export records as text; Import and export tables from/to CSV files; Import and export databases from/to SQL dump files; Issue SQL queries and inspect the results; Examine a log of all SQL commands issued by the application; Plot simple graphs based on table or query data.

- Tkinter: Tkinter is a Python binding to the Tk GUI toolkit. It is the standard Python interface to the Tk GUI toolkit, and is Python's de facto standard GUI. Tkinter is included with standard Linux, Microsoft Windows and Mac OS X installs of Python. The name Tkinter comes from Tk interface. Tkinter was written by Fredrik Lundh Tkinter is free software released under a Python license. As with most other modern Tk bindings, Tkinter is implemented as a Python wrapper around a complete Tcl interpreter embedded in the Python interpreter. Tkinter calls are translated into Tcl commands, which are fed to this embedded interpreter, thus making it possible to mix Python and Tcl in a single application. Tkinter is not the only GuiProgramming toolkit for Python. It is however the most commonly used one.
- Microsoft Photos: Microsoft Photos is Microsoft's modern image organizer, graphics editor, and video editor. It was first included in Windows 8 as a functional replacement for Windows Photo Viewer. Photos has Microsoft Sway integration and can use selected photos as a source for creating a Sway project. Users can also upload photos to OneDrive, Facebook, Twitter , Instagram and GroupMe for sharing or saving on cloud. We are using photos in our project to show pictures of routes towards various hardstands present at the airport.
- Datetime: In Python, date and time are not a data type of its own, but a module named datetime can be imported to work with the date as well as time. Datetime module comes built into Python, so there is no need to install it externally.Datetime module supplies classes to work with date and time.These classes provide a number of functions to deal with dates, times and time intervals. Date and datetime are an object in Python, so when you manipulate them, you are actually manipulating objects and not string or timestamps.
- PIL: Python Imaging Library is a free and open-source additional library for the Python programming language that adds support for opening, manipulating, and saving many different image file formats. It is available for Windows, Mac OS X and Linux.
- IO: This module is quite useful when you want to perform file-related I/O operations (eg. File reading/writing). While you can use normal read() and write methods to read/write a file, this module gives us a lot more flexibility regarding these operations.

Chapter 3: Methods Implemented

Methods implemented in Main.py

SSC: (Abbreviation for Splash screen close), in this method, the splash screen window is destroyed using .destroy() function and a call to login screen is made.

Methods implemented in Login.py

Show: In this method, as a call is made from Main.py to show Login Screen, Login screen is opened which requests for username and password of employee.

LGSC: (Abbreviation for Login Screen Close), in this method, as soon as the user enters his/her username and password and clicks on Login Button, and if the username and password matches, the login window is destroyed and home screen is opened.

Methods implemented in Home.py

Hideall: In this method, pack_forget method is applied on all the frames and canvases so as to navigate between different frames and canvases

Abo:(about) is the method to show the introduction of the application in which the overall vies of airport is visible along with the basic introduction of the application

Show: In this method, a call is made from Login.py to show Home screen in which the about page is shown as well as mainloop Is applied on root window for application.

Af: (add flight) is the method in which the staff of ATC can enter details of flights which are scheduled to land or do want to land immediately because of an emergency.\

Afo: (add flight operation) is the method in which the values entered by staff at ATC in the method Af are actually added to database.

T1V: (terminal 1 view) is the method to show the available parking slots at any instance at terminal 1 building of the airport which is for domestic commercial flights only.

T2V: (terminal 2 view) is the method to show the available parking slots at any instance at terminal 2 building of the airport which is for international commercial flights only.

HV: (hangars view) is the method to show the available parking slots at any instance at hangars of the airport which are for private flights only.

OSV: (open spots view) is the method to show the available parking slots at any instance at open parking spots of the airport which are for cargo flights only.

LP: (landing permission) is the method to show the list of available flights which are requesting or will request permission for landing at the runway of airport.

Landawaitpark: This is the method to show list of all flights which have landed and are off the runway and are waiting for parking allocation at the airport.

Ttpp: (taxing towards parking page) in this page, the list of all the airplanes which are taxing towards their allocated parking spots and also, there is an option for showing the route to their allocated parking spots so that staff of ATC can guide them towards their route.

Trrp: (taxing towards runway page) in this page, the list of all the airplanes which are taxing towards runway and will request for take will be shown on the page. Also, there is an option for showing the route to their allocated parking spots so that staff of ATC can guided airplanes towards the runway.

Tp: (takeoff permission) in this page, the list of all the airplanes who reached the runway or are in queue for takeoff at the runway are shown. The staff of ATC has to give permission to the airplane for takeoff permission to leave the airport so that other planes can takeoff or land.\

Vh: (view history) is the page in which the latest flights which have departed from the airport and took off. All the details about the flights are visible on the page.

Methods implemented in Dbop.py

Create_table: This method is used to create the tables if tables does not exists in the database.

Data_entry: This method is used to enter the default entries only one time in database in some tables such as parking where p_id, p_name are constant and will never change, terminals id and name also will never change, flight type will never change, status id will also be common and no of entries in all of these tables will never change and will remain constant.

Verify: this method checks the combination of username and password entered by the user in Login.py and if the combination is correct, access to that user to the home.py module is granted, else correct username and password is demanded.

addEntry: in this method, details of flight which were entered by user is added to Database and all the details of flight is stored in database.

T1_status: this method returns list of all the occupied parking spots in terminal 1.

T2_status: this method returns list of all the occupied parking spots in terminal 2.

hg_status: this method returns list of all the occupied parking spots in hangars.

op_status: this method returns list of all the occupied parking spots in open parking spots.

Rtl: (ready to land) is the method which returns list of airplanes which are in the air and will ask for permission to land.

Ptl: (permission to land) is the method which updates the status of a flight from in air to landed.

Law: (landed and awaiting) is the method which returns list of flights which have landed but not been allocated any parking.

Pallot : (parking allot) is the method in which any free parking is allocated to the airplanes.

Usttp: (update status taxing towards parking) is the method in which as soon as the parking is allocated, status of the flight is updated from landed to taxing towards parking and parked.

Rttp: (ready to taxi towards parking) is the method which returns the list of airplanes which are taxing towards parking.

Ptttr: (permission to taxi towards runway) is the method in which the status of the flight is changed from taxing towards parking and parked to taxing towards runway.

Gtr: (going towards runway) is the method in which the list of airplanes which are taxing towards runway for takeoff is returned.

Ptt: (update status permission of take of is next): in this method, the status of airplane is changed from taxing towards runway to reached runway

Rtt: (ready to takeoff) is the method which in which the list of airplanes which has reached runway and are waiting to takeoff permission.

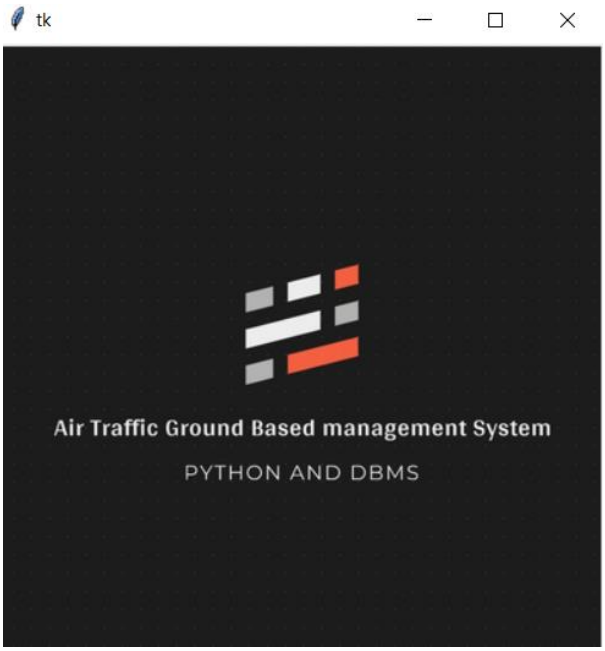
Usto: (update status taken off) is the method in which the status of flight is set from reached to runway for takeoff to taken off.

His: (history) is the method which returns the list of flights which had recently taken off from the airport.

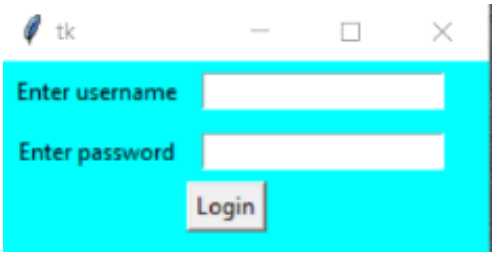
Showroute1: This is the method in which the route from runway to allocate parking for flights is returned.

Showroute2: This is the method in which the route from parking spots to runway for takeoff is returned.

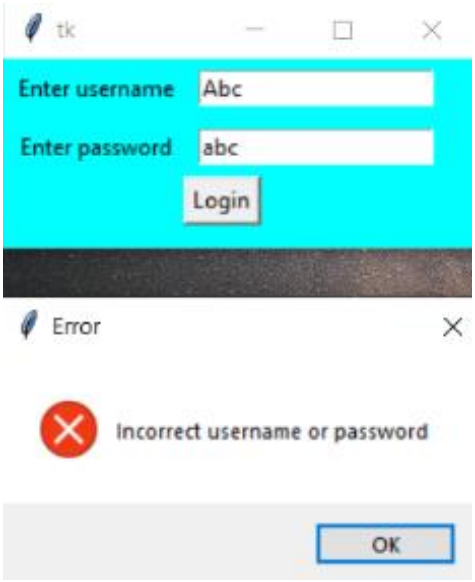
Chapter 4: Screenshots



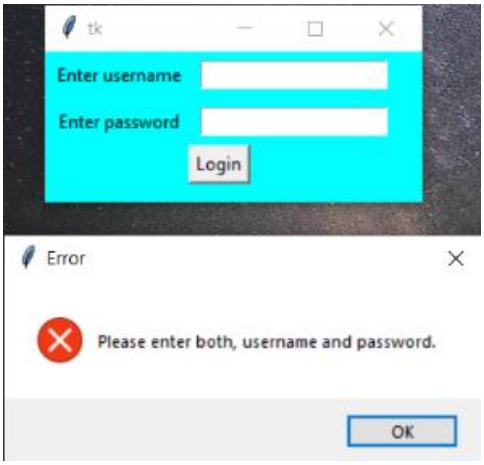
Splash Screen



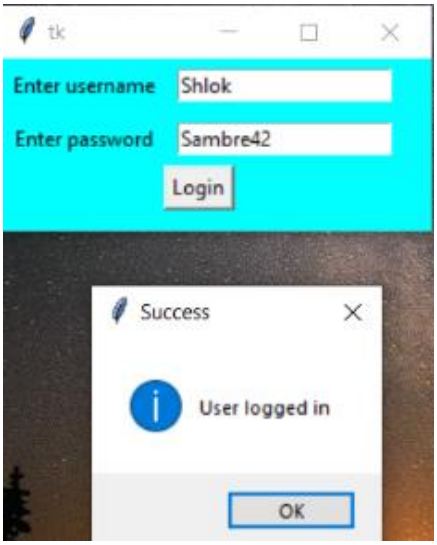
Login Screen



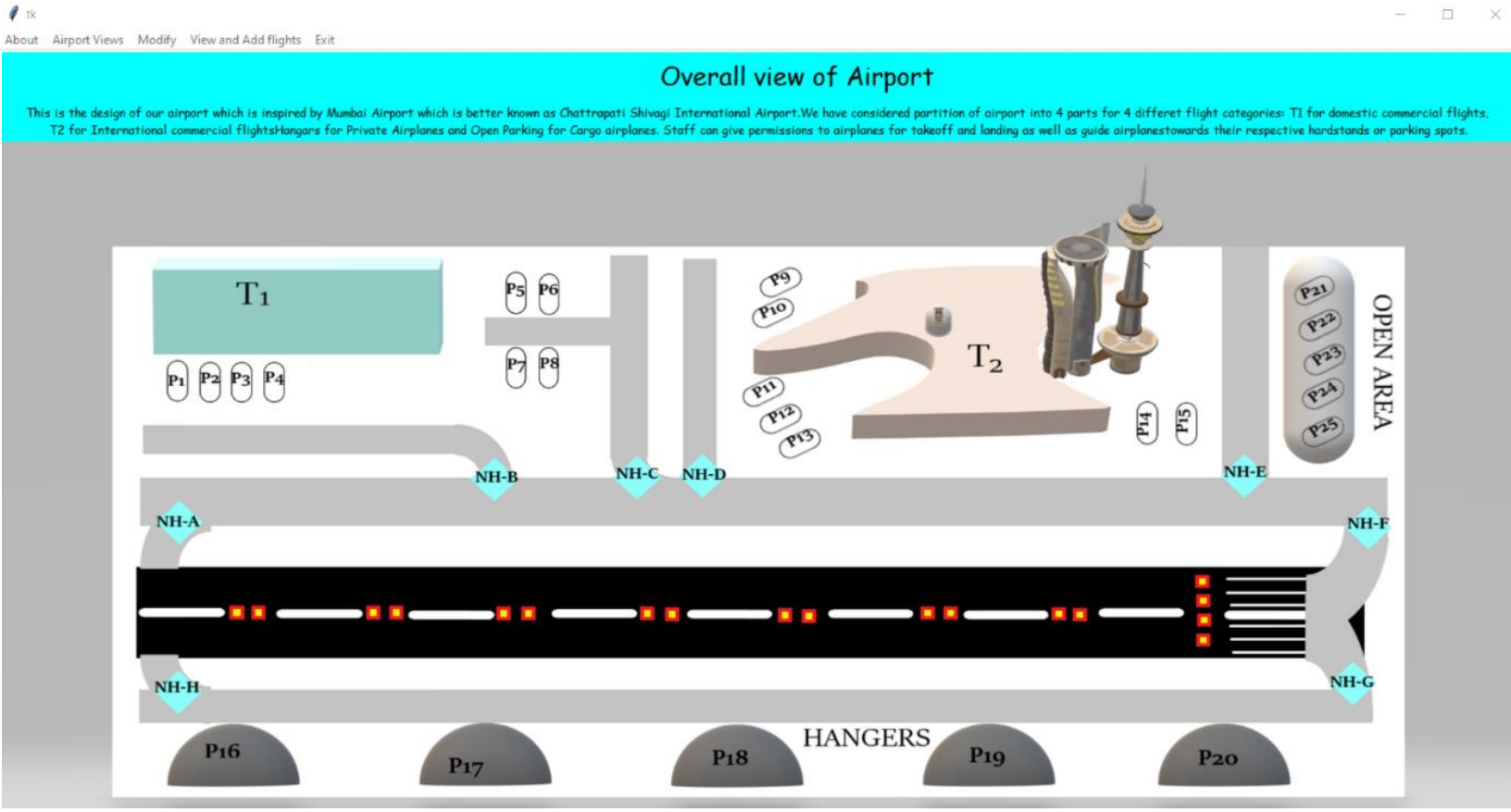
Error handling for incorrect entry details



Error handling for no entry fillled



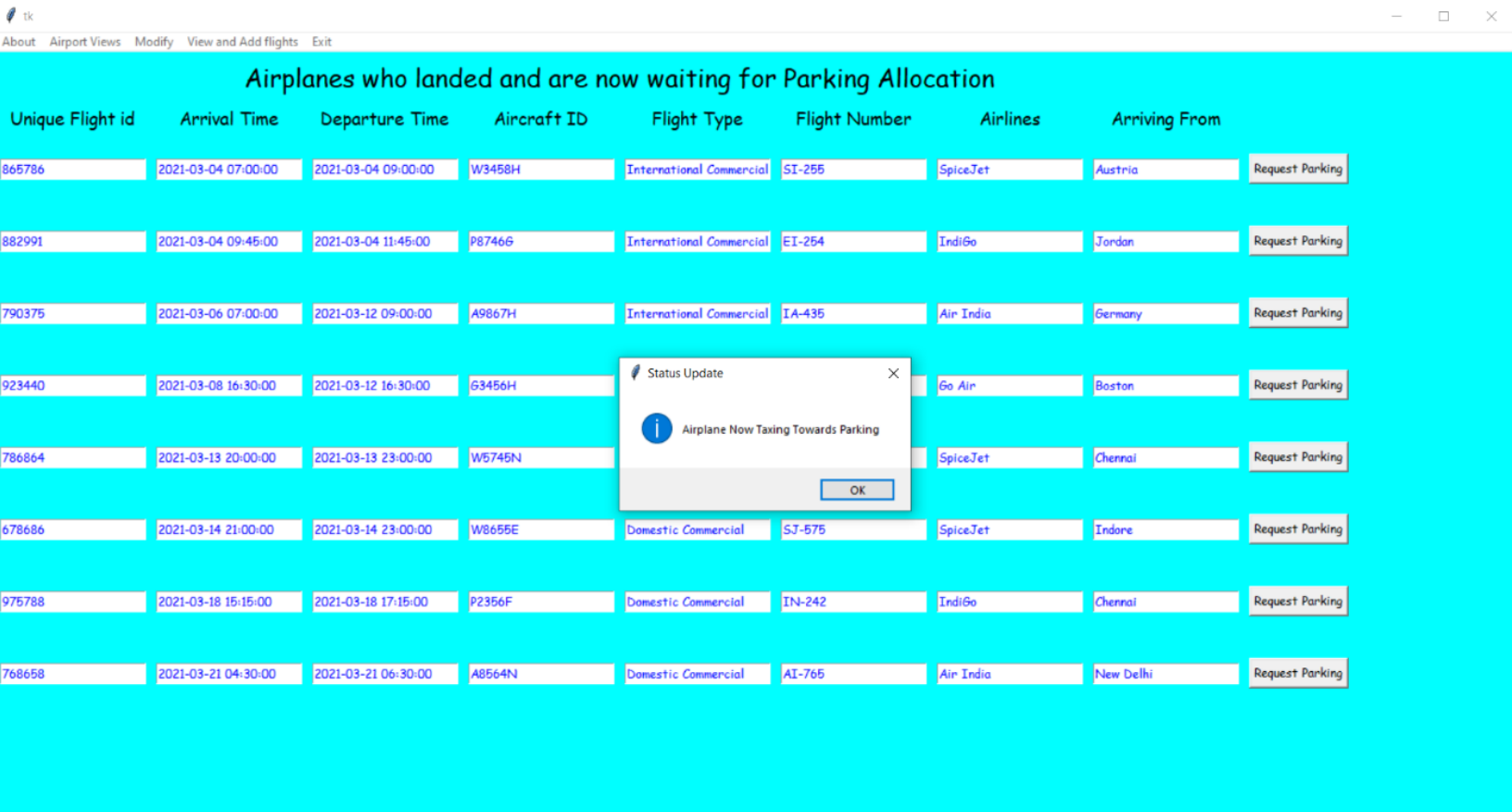
Login Successful



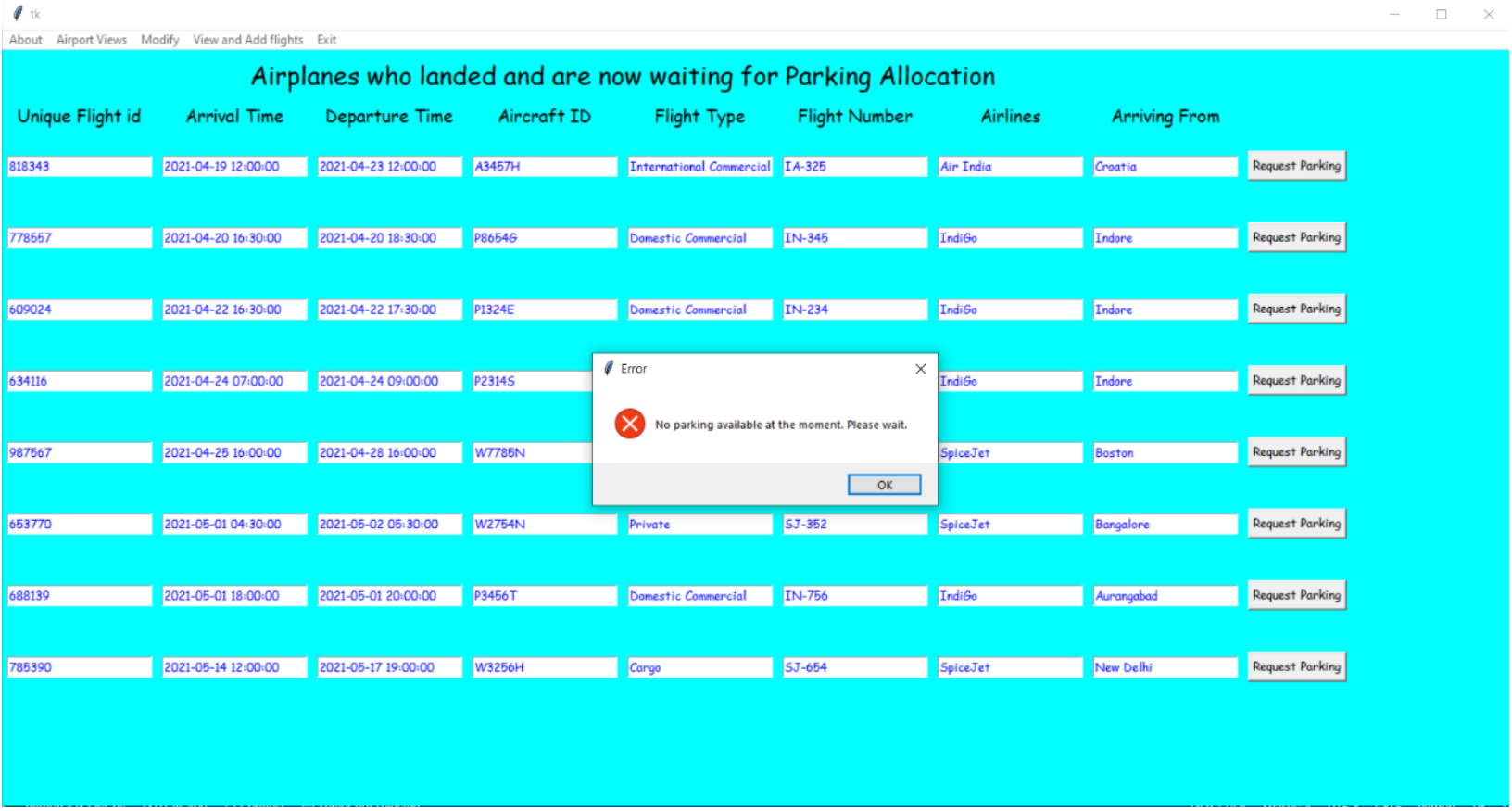
About Page

Airplanes coming to land

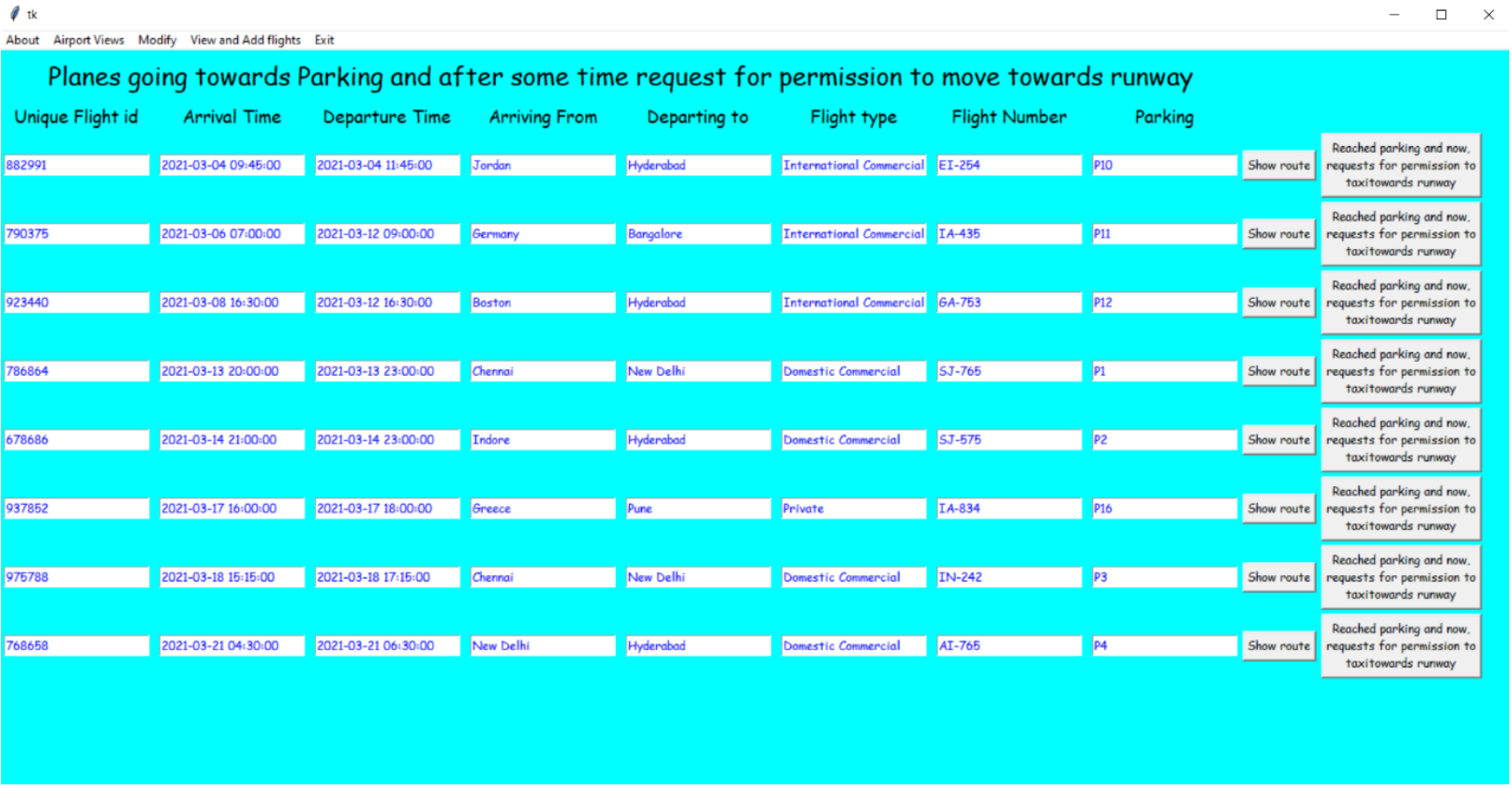
Plane landed updatation dialog



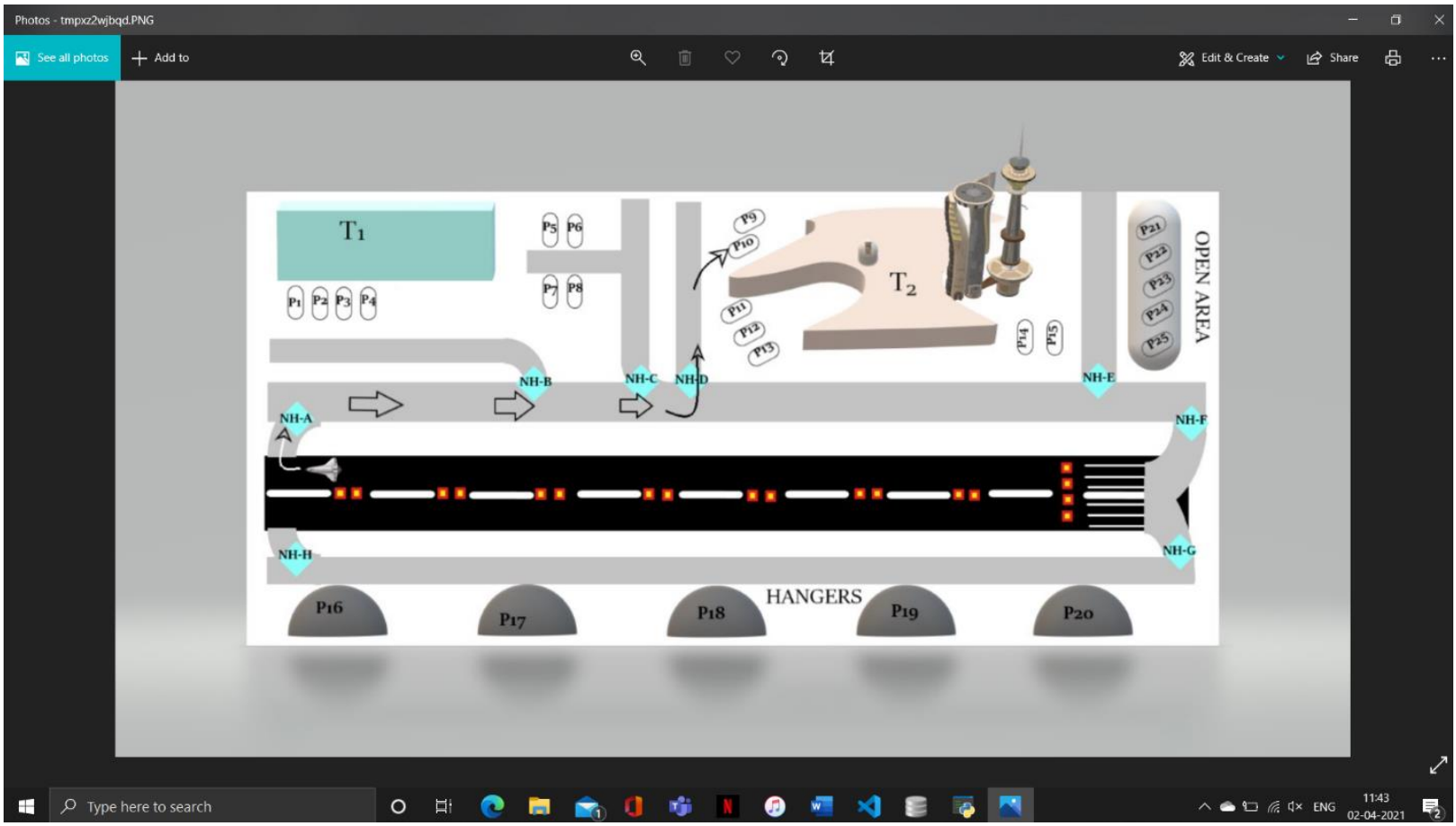
Airplanes who landed and are now requesting for parking allocation along with updation diaolog



Error handling while allocation of parking while no parking is available.

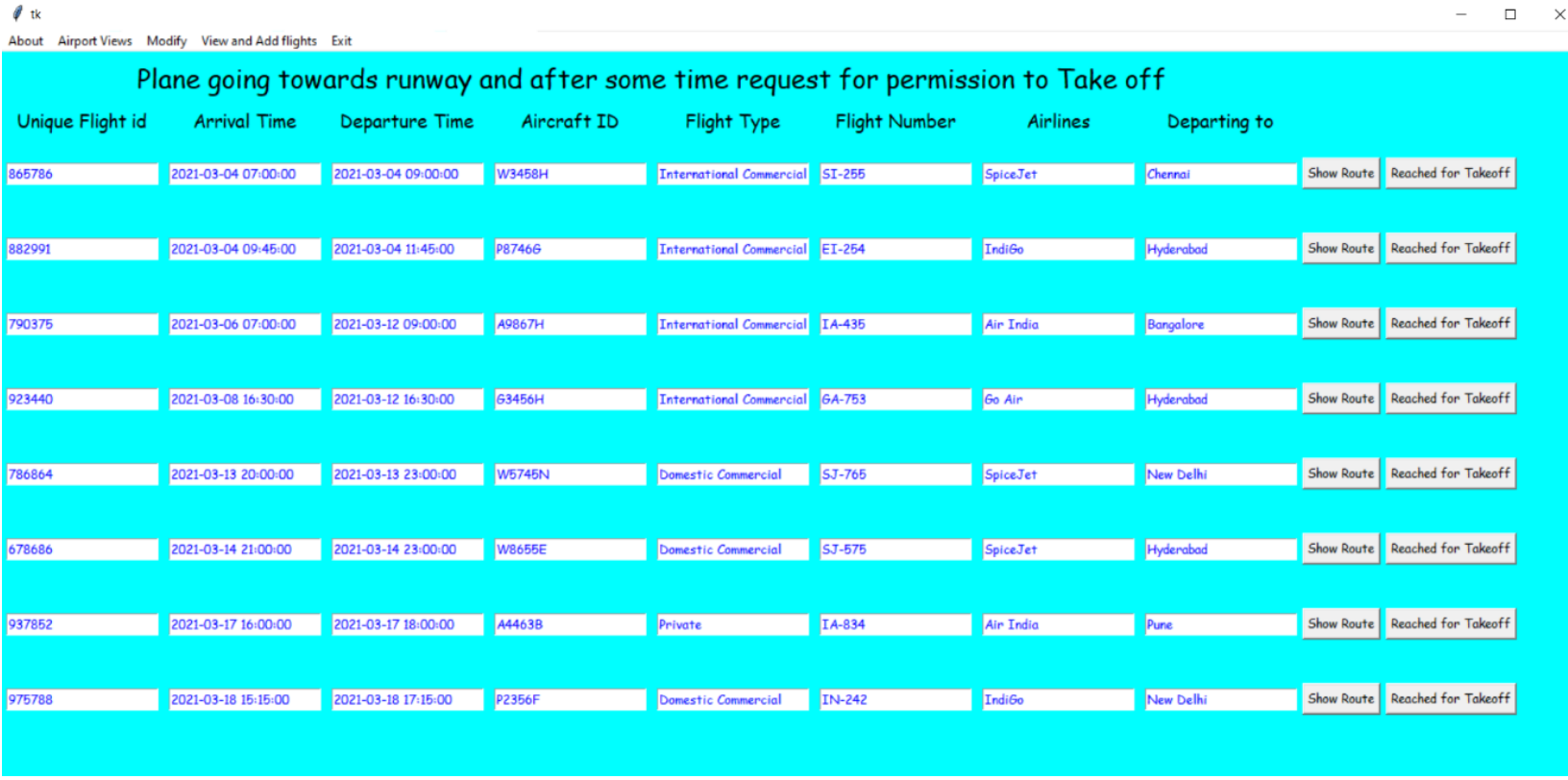


Airplanes who landed and are taxing towards parking or are parked.

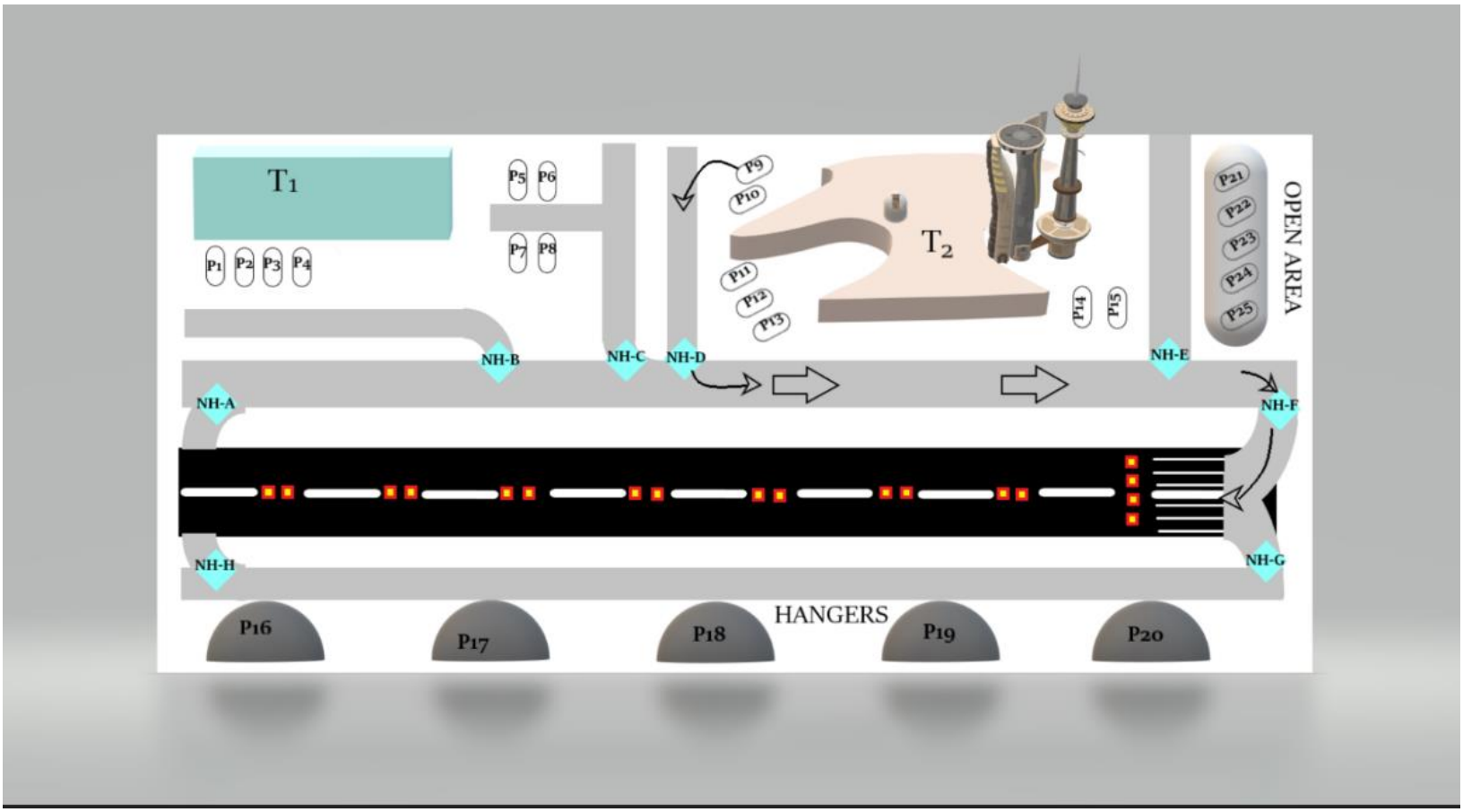


Route from runway to parking for airplanes

Plane taxing towards runway with updation diaolog

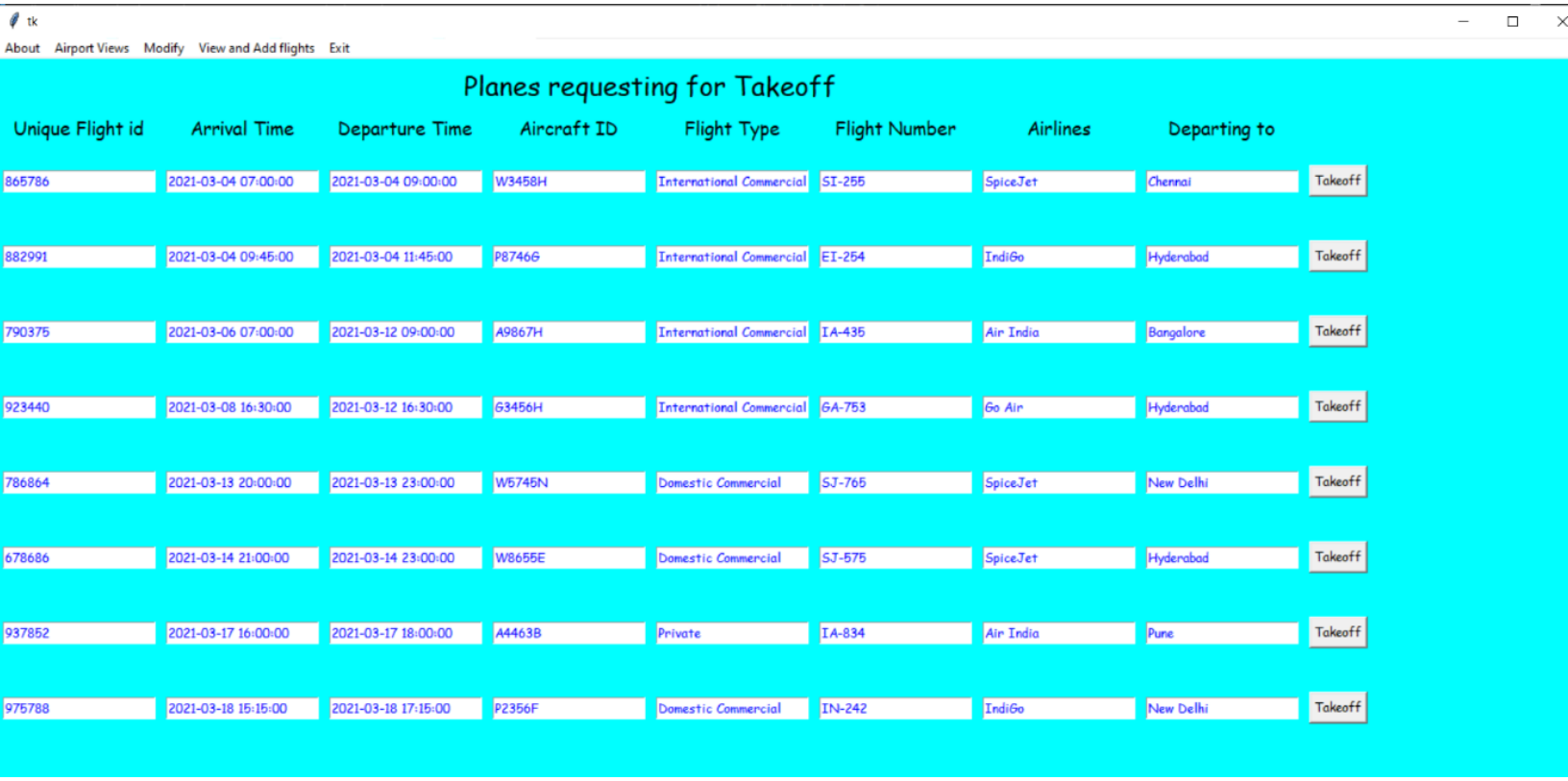


Planes taxing towards runway

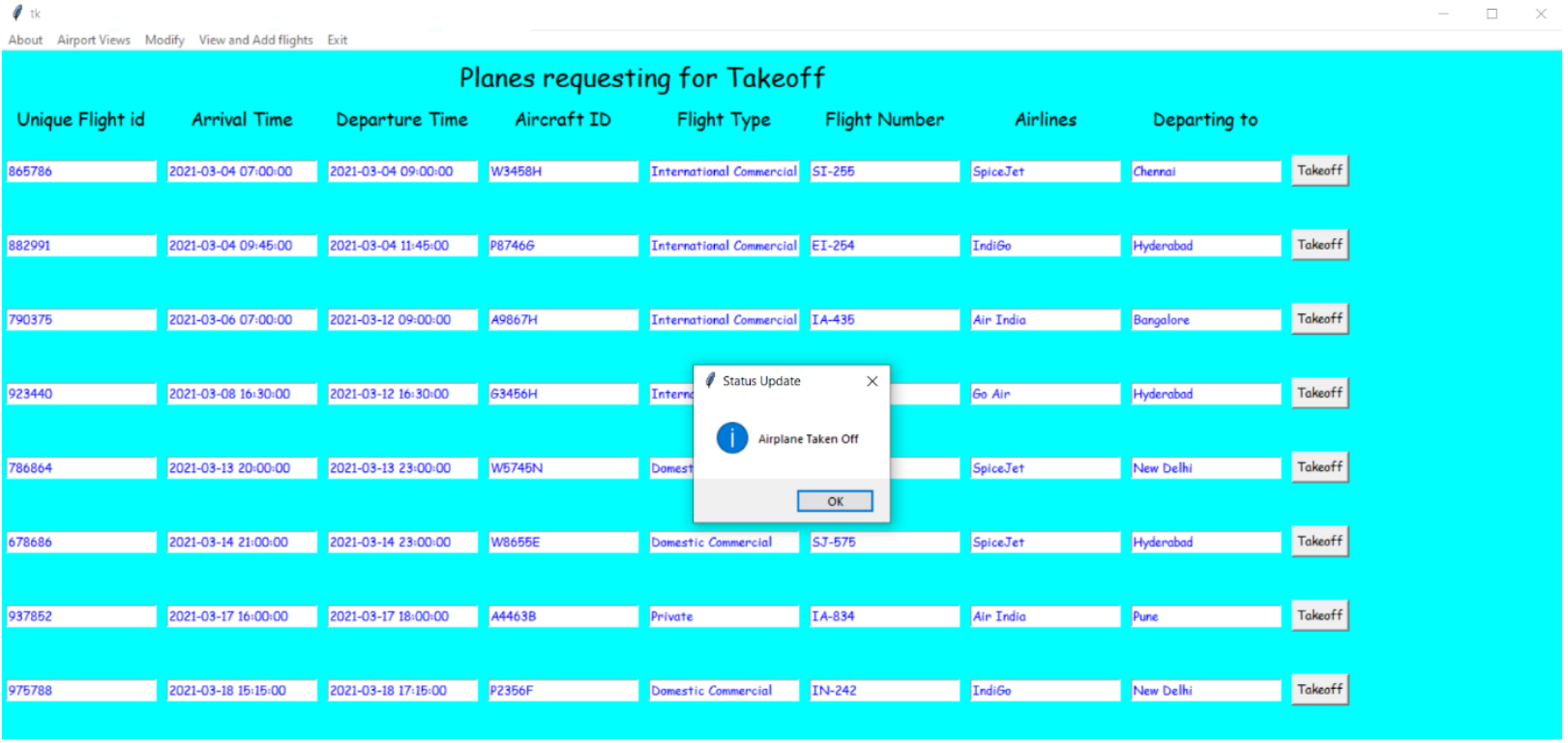


Route for airplanes from parking to runway

Airplane ready to takeoff dialog box

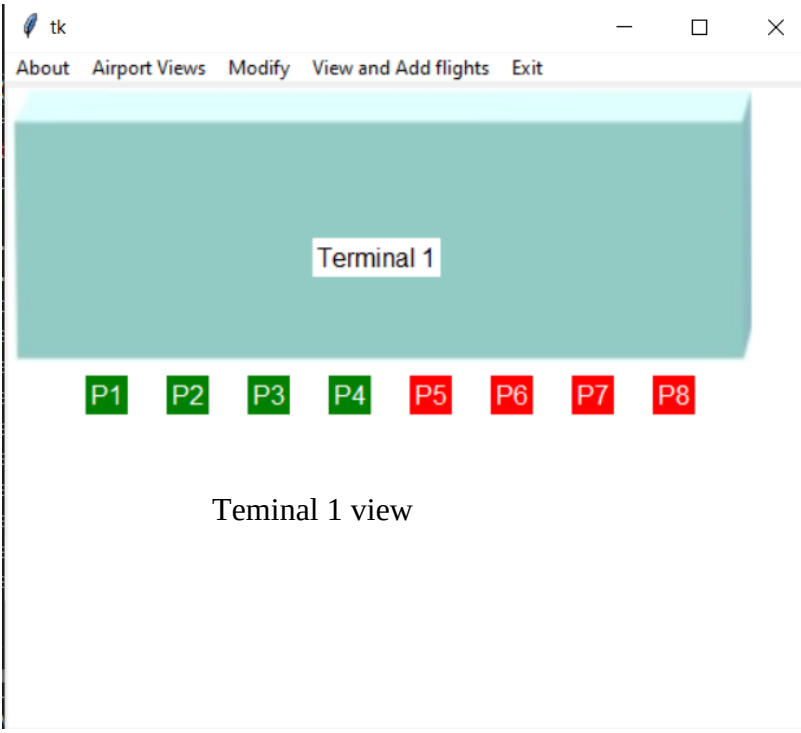


Airplanes which are requesting for takeoff permission

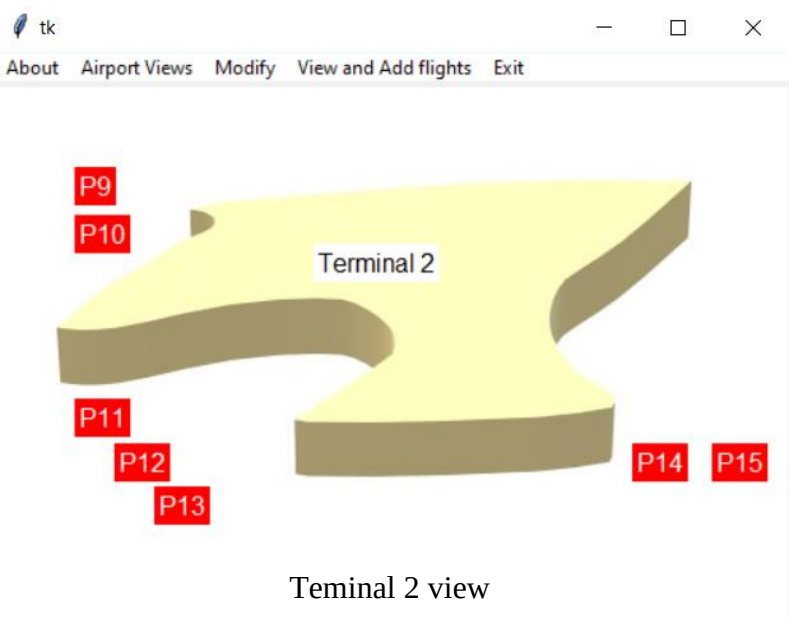


Airplane taken off updation dialog

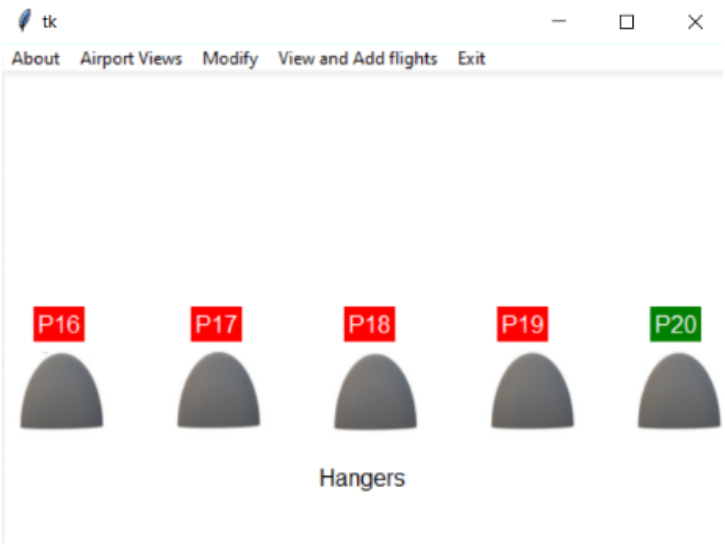
Flight history screen



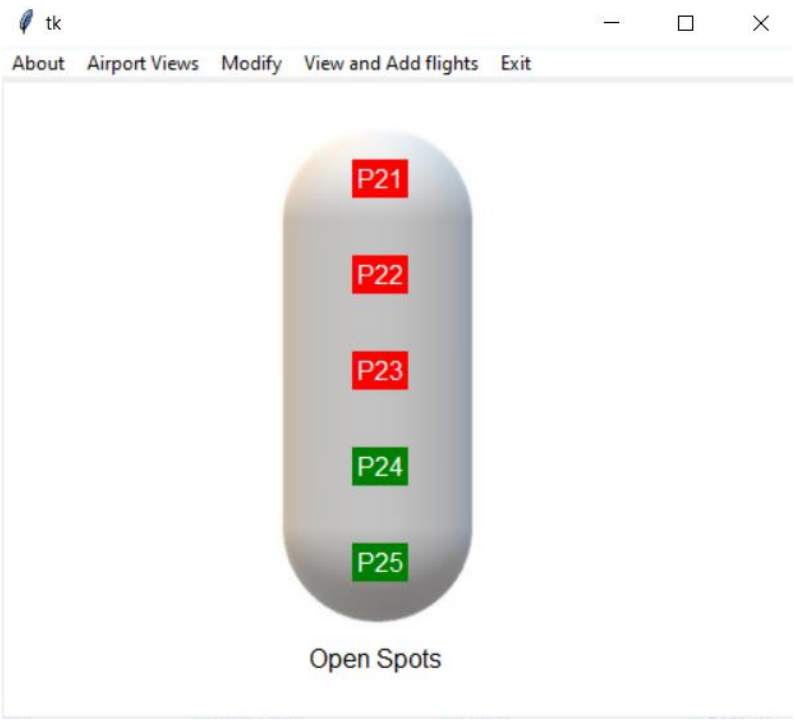
Teminal 1 view



Teminal 2 view



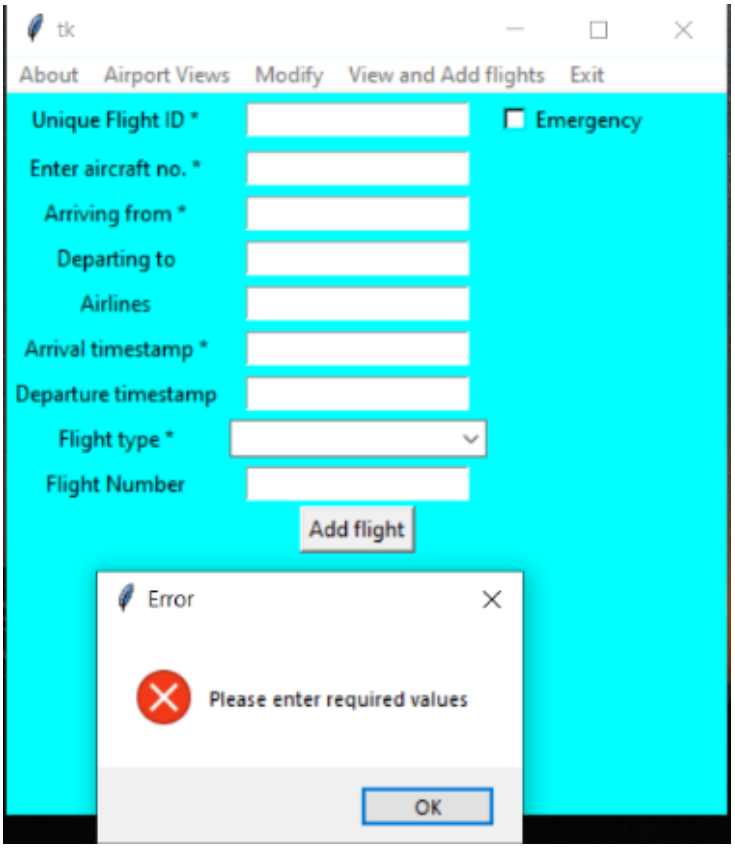
Hangars view



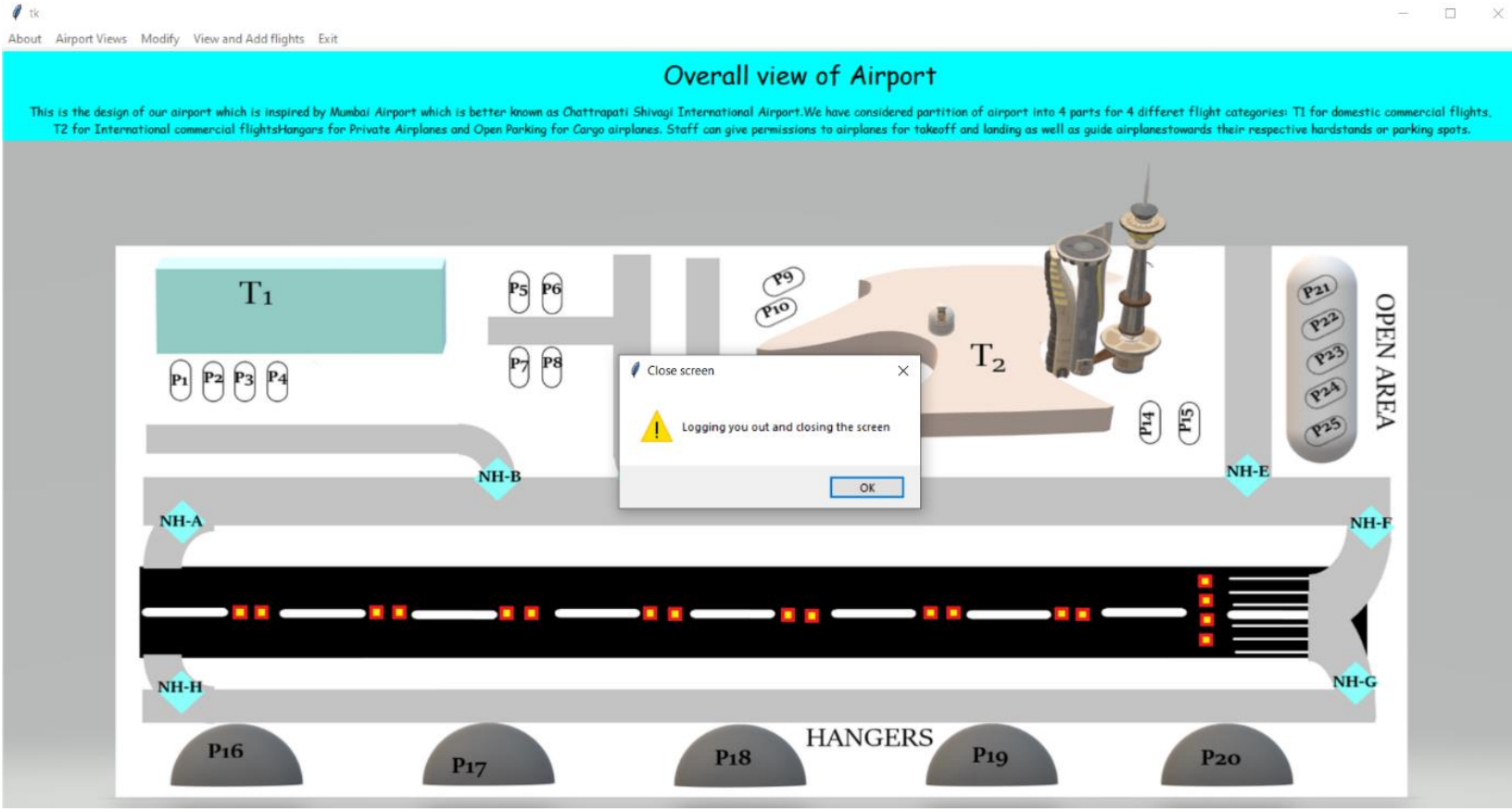
Open spots view

Add flight screen with success dialog

Add emergency flight screen with success dialog



Error handling for incomplete details



Logging out dialog box on click of exit button

Chapter 5: Conclusion and Future Scope

Air traffic in this world has been increasing day by day and so as the demand for air travel. Increased number of flights mean increased number of air traffic, which in turn means increase in ruckus created at airports as many flights come and go from airport, so each flight needs to be given a route, parking allocation, permissions for takeoff and landing and several other ground-based tasks.

This all makes the job of staff of Air Traffic Control difficult and time consuming. Hence, for better execution of all the tasks at airport, a proper management system is necessary. So, we came up with the Air traffic ground-based management system for better running of airport as well as less load on Air Traffic Control.

Our application provides a simple UI which enables the staff of ATC to smoothly run all ground based air traffic commands so that the job of them is easier, as well as the movement of all the flights are smooth and fast to increase the effectiveness of the airport. We hope that the airport can be as most effective as it can so that the number of flights going from and coming to airport increases which will also help in raising economy.

We know that there are some other various high tech softwares which the ATC uses at the airport for performing all of these, but those softwares also include some other features which makes it difficult to manage ground based operations, so we propose this for only ground based operations.

There are some features that we would like to work upon in our program so we can try to make it into an application which all staff of the ATC can use all together and will share the resources of the database and UI. Also, we would like to enable the share of the route in airplane cockpit as soon as the plane has landed so that plane can move by itself to its allocated parking spot and the staff of ATC can manage other flights. Also, we would also want that before giving permission to airplanes to takeoff and land, there should be a check to see it the runway is empty or not. And, at last, there should be a option for multiple runways which is present in various airports of the world which increases effectiveness of the airports.

Chapter 6: Societal Application

Our application provides a simple UI which enables the staff of ATC to smoothly run all ground based air traffic commands so that the job of them is easier, as well as the movement of all the flights are smooth and fast to increase the effectiveness of the airport. We hope that the airport can be as most effective as it can so that the number of flights going from and coming to airport increases which will also help in raising economy. Which in turn, will result in development of our proud nation.

Also, as the airplanes will take less time for all of it's movement in the airport, hence, fuel will be saved, hence, our project also thinks about the green environment also as fossil fuel resources are depleting day by day and it is important for all of us to save fuel.

Also, with the option for emergency landing, we are also caring about the importance of human life and we don't want any accident our mishap to happen and we care about the life of people on board and the priority is always for life of people.