

# Sanjay – Air Mission Planner

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**Abstract – Project Sanjay is a virtual eye to the battlefield strategy and planning. It has two major components:**

- 1. Graphically Visualize all flights (commercial/military) currently flying above Indian subcontinent in real time with detailed information about the flights.**
- 2. A air battle simulator which can be used**
  - a) As a tool for collaborative battle field planning by simulating operations in a certain area.**
  - b) For training purposes.**

**Index Terms – Computer Graphics, Airplanes, defence, 3d , games , simulator**

## I. INTRODUCTION

*“A game is an activity with rules where two or more independent decision makers try to achieve some objective.”*

The advanced technological abilities of computer games to provide realistic settings have led to use of games as a useful tool in many fields for purposes other than entertainment. Those applications are known as “serious games”.

Serious games are primarily designed for use of game technology in fields other than entertainment i.e. to solve a problem. They are mostly used in defence, education, city planning, scientific exploration. The main purpose of these games is to train , simulate , investigate. Military officers have been using war games to train strategic skills for a long time. U.S army has been using games for training from a long time nearly from 2004 after release of games like American Army which helped U.S. military reduce their training time and budget and now is an integral part of military training in U.S.

Traditional simulators are usually too costly and require specialized hardware for deployment. On the other hand using computer games technology can help create these simulations really quickly. Also such simulations can run from low end computers, DVD's or a web browser making the hardware cost negligible.

BAE systems, a British aerospace contractor company has calculated that a \$500 NVIDIA graphics card can replace the \$30,000 worth of other computing equipment used for engineering simulations. <sup>[1]</sup>

Also U.S army has linked up 2,200 PS3 consoles to build a supercomputer for research use and for development of high definition imaging system for radar. It has cost one-tenth of a conventional supercomputer.

**Flight Tracking** - Flight tracking information is used for air traffic control and co-ordination of flights with each other and with the base station. Flights tracking can only be done if we receive radar data. Each radar has only a certain range ex: 150km<sup>2</sup>. Hence there is a need for radars at regular intervals. Aircrafts take path information to their next destination from the base station. Hence the routes of the commercial airlines are already fixed. For any military operation the air force planes fly on a separate altitude and do not cross the flight zones of the commercial planes. Hence there is no need for flight tracking in the current scenario for air traffic management. It is only required for any military operation planning if any.

In near future the radars are going to be replaced by GPS based air traffic system. Indian government is working on developing a satellite based navigation system named Project Gagan<sup>[2]</sup>. U.S government has already implemented the satellite based system under name NextGen<sup>[3]</sup>. These systems will make less dependency on human personnel and will help

save time and money by reducing path (planes can fly on optimized paths instead of paths following radar base stations.) System would be able to make optimal use of air corridor and parallel routes can be followed. Also the system would be helpful in bad weather conditions. The flight tracking system will be really helpful in this scenario.

## II. PROBLEM STATEMENT

1) If defence forces want to do some air operation in a certain area, they need to know the status of currently flying commercial / government and private planes/helicopters in that area for purpose of safety constraints.

They receive the status (longitude/latitude/altitude) of the vehicles from radars. But radars give data in analog format i.e. the data is in a tabular format which makes it difficult to visualize the exact location of the flights.

The Project Sanjay builds a system which can interactively visualize the status of air borne vehicles in a particular area.

2) Utilizing computer game technology we can create simulations which can be used for training purposes i.e. training new personnel about aircraft details or training about mission planning in a group. Also it can be used for the purpose of simulating the exact battle scenario before trying it in battle field and making strategies based on the simulation results.

Such simulators do exist in place but they are hardware based hence pretty expensive and take long time for development. As such updates to them are not so frequent. Today the average graphics cards and the technology games provide can achieve a better quality simulation for much less cost and with better results. Also the applications can be modified quite readily. This would both save time and money. The amount of detail and complexity of the application can also be increased tremendously because of the computational power games technology provides.

## III. INTERVIEWS

During the progress of the project I was in constant touch with Air Force Wing Commander Mr. Sudeep Malhotra. I met him personally for information collection, technological discussion

and project requirements at the beginning of the project i.e. December and feedback near the end of the project i.e. April.

## IV. PROJECT SCOPE

Project investigates use of game technology for defence purposes. There are two parts of the project. Both parts of the project have tremendous scope individually.

- 1) Flights positioning system can be used by
  - a) Defence especially air force for planning out their operations.
  - b) Air traffic Controllers for info while managing air traffic.
  - c) Airports for knowing traffic details.
- 2) The simulator system can be used by defence for
  - a) Training new personnel.
  - b) Simulating a battle scenario
  - c) Testing new strategies without human loss.

Such solutions are prevalently in use by forces across the world especially U.S army. This project tries to focus needs of Indian Air force in particular.

## V. IMPLEMENTATION

**The Flights Visualization** – This part of the project is implemented as a web based application using Asp.net. The terrain information is taken into the project from Google earth using google earth API. Project uses a client-server model. Server Side coding is done in C#. Javascript is used to access the google earth API on the client side. Data is accessed from MySQL database using SQL queries. Currently we don't have real radar data hence we have simulated the data by putting some proxy data in the database which can be later replaced by linking database with real radar data.

The main features of project are:

- Login & New Registration system
- Displaying all flights visually which keep on updating in real time
- Searching for a specific flight
- Navigating to a place and viewing all flights in that area

**Simulator system** - The second part of the project is done using a existing flight simulator “**Free Falcon 4.0**”. Free Falcon is a project which is under development since 1983 and went open source in 2004 after its source code leaked. Falcon simulates aircrafts in a nearly realistic manner. And it contains a battle scenario between South Korea and North Korea. Here we are considering the probability for customizing it for Indian scenario and adding India-china or India-Pakistan flight combat campaign to the project. The project provides a mission planner which is used to create custom missions. The source of the project has been modified to fit the project needs. The 3D models of aircrafts, tanks, terrain used are in fbx format which is an open source format. Custom missions are created using C++. The main rendering technology behind the simulation is Opengl.

## VI. OWN CONTRIBUTION

The project was extremely new and I had no prior knowledge in this field. Hence a lot of time has been spent on reading about stuff and discussing topics on various technology forums. I contacted the free falcon development team for project feasibility and information. <sup>[6]</sup>

The flight visualizer application is created completely by me. Although the terrain information is taken from Google earth. The other Combat simulator application is a extension of the open source project free falcon. I have created the India vs. China campaign in the game along with trying to simulate the airplanes with each side.

## VII. CHALLENGES AND ISSUES

The biggest challenge is the non-availability of the information due to high security constraints. Precise information schema of the radars is still not available.

The defence departments all over the world have been known for passing on technology to the common people while these days defence is adopting the technology from computer games. Hence a radical shift from the norm. Therefore it would take time to be accepted.

The defence area is completely new and unexplored to me hence a lot of research work and reading. Also the area is very huge requiring

knowledge from GIS, 3D graphics, game engines and hardware aspect too.

Also very little open source stuff is available for reference. Most of the related projects are sponsored projects done by companies for U.S defence and their information is not available free to the public.

Combat simulator requires a mandatory graphics card and fails to run without it. Hence the reach of system becomes limited as it won't be able to run on low end computers.

“Falcon 4.0” Source Code is available to general public while current version is 5.5. Hence some additional features available in 5.5 are missing.

## VIII. FUTURE SCOPE

Project currently addresses the needs of the air force only. The system can be extended to include the ground forces and naval forces as well. Adding these two will require additional simulation of

- Tanks
- Human personnel
- Human Crowds
- Artillery
- Vehicles
- Naval Ships

Also the flights visualization system can be extended to include the landing and takeoff safety measures at an airport. Aspects such as minimum separation time between the flights, distance between any two flights and tracking aircrafts safely away from runway can be included in the project.

Also both the projects currently depend on Google for terrain information which can be problematic considering the defence requirements. There are many open source terrain information solutions available which can be used for the system.

## IX. USER FEEDBACK

The feedback I received for the first part of the project i.e. flights visualization from Mr. Malhotra

*“This solves the purpose.”*

The next part of the project is still to be shown to him.

## X. PROJECT SCREENSHOTS

### 1. Flights visualizer



Fig. 4 Login System

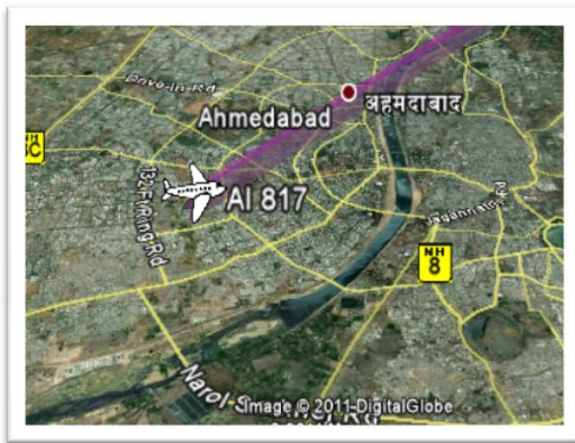


Fig. 1 Top View of Flights in a region.



Fig. 2 Flight showing depth and path

### 2. Combat Simulator



Fig. 5 Screenshot from free Falcon – Take Off<sup>[5]</sup>

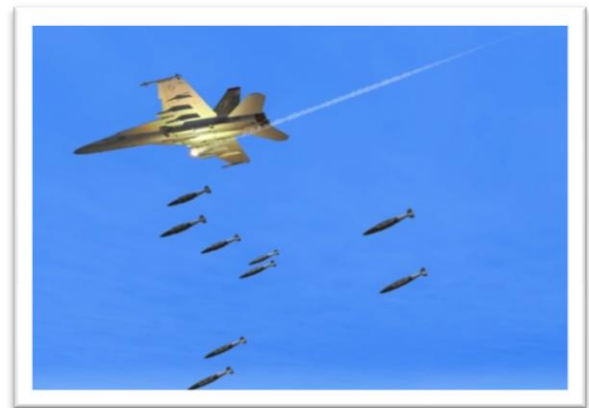


Fig. 6 Screenshot from free Falcon – Combat<sup>[5]</sup>

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