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Air Traffic Control and Management System

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***Abstract*— Traditional "Air traffic control system " is working on the ideas of DBS(Distance Based Separation) and TBS (Time Based Separation) which leads to some minor issues regarding collisions. But here I want to design a new system to make technology highly efficient by managing the air traffic and managing the routes for flights so that they fly in different lanes. Also, it manages the free slots in the runway. There are multiple stations available in the space in which flight can travel from one station to another via multiple routes, the selection of two stations from which the flight can depart and can land so that it would not obstruct the other flight routes and no two flight would crash and maximum number of passengers can travel from one station to another . Along with that, my second primary objective is to almost choose the optimal path between the source and destination Prim's algorithm is being used in order to calculate the shortest path between the stations and after among the different shortest path the selection of optimal path is being done, so that the overall cost would be minimum.The result would show the different path among various different station so that the maximum number of passengers can travel from one place to another (source and destination) and all that paths would represent the optimal path between the stations.**

Index Terms—Air Traffic, Air control, Traffic control, Flight management.

I. Introduction

The project aims to manage the air traffic and manages the routes for flights so that they fly in different lanes. Also, it manages the free slots in the runway. More specifically, this system is designed to allow a manager to manage and communicate with a group of manager present at the different air station including all domains the software will facilitate communication between clients, manager, and the admin via E-Mail. Pre-formatted reply forms are used in every stage of the articles' progress through the system to provide a uniform review process; the location of these forms is configurable via the application's maintenance options.

This software system will be an Air traffic control System for our client from different parts of the world. This system will be designed to maximize the editor's productivity by providing tools to assist in automating the traffic system and publishing process, which would otherwise have to be performed manually. By maximizing the editor's work efficiency and production the system will meet the editor's needs while remaining easy to understand and use.

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The software is basically designed for that one who really need it, we have taken case of recent Chennai flood incident where people wasn't able to travel acres the Chennai due to bad result of airport and railway station but some of the flights from Chennai was being diverted to some other airports like Bangalore and some nearby airports but the people wasn't getting enough information regarding the updating of flight routes and was in trouble a lot. So our product will help in this situation where all another system if get crashed and people won't be able to retrieve information it will be a great help for those and can get all their desired information through our program because when we are designing our product we kept this thing in mind that our system won't get crashed in between the process and for that we are providing enough configuration in terms of both software and hardware to our system.

II. LITERATURE SURVEY

GENG Rui et al. (2009) presents a network flow-based DARA model that satisfies the shortest opening time constraint and the indegree and outdegree constraints which have not been considered in previous models. A two-step heuristic algorithm was developed to efficiently solve the DARA problem with the computational results compared with a commercial solver based on a real data set from the Beijing ATC region. This analysis is also used to analyze the sensitivities of some important coefficients in the DARA model.

Airport and airspace planners for decades have used discrete-event simulation for studying system capacity in the air and on the ground. The airport and airspace modeling tool, SIMMOD, created in Simscript for the United States Federal Aviation Administration (FAA, 1989), has been used worldwide to estimate airport runway and terminal capacities (Gilbo, 1993, Fishburn et al.,1995; Wei and Siyuan, 2010; Bobalo and Daduna, 2011). It has also been used to study specific airport operations such as de-icing services during snowstorms (Bertino and Boyajian, 2011). SIMMOD represents airspace and airports as two-dimensional networks of activity where entities move among nodes in the network along links which can be tailored to the special characteristics of the aircraft and their environments (e.g., allowing or restricting passing on taxiways and enforcing separation standards in the air that depend on the size of aircraft).

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Additional realism in representing altitude is achieved in the widely used Total Airspace and Airport Modeller (TAAM) developed by a Boeing subsidiary (see Offerman, 2001; Odoni et al., 1997). These simulators (SIMMOD and TAAM) provide very realistic depictions and visualizations of simulated aircraft movements from gate to runway to a destination with consideration of all traffic, individual aircraft characteristics, separation requirements, wind and weather conditions and detailed flight plans. They are excellent resources for observing detailed aircraft movements and testing the feasibility of simulated aircraft activity under particular scenarios in a specific time period with microscopic detail, but they carry a great deal of overhead for studies with a more strategic focus.

Various modeling approaches and techniques have been used for studying aspects of airport operations in support of strategic planning. Norin et al. (2009) describe the interplay of airline operations, air traffic control, and airport operations and the various commercial simulation packages available for modeling and analysis of "airside operations". They illustrate the use of a mathematical programming model for scheduling de-icing operations and integrating it into a simulation model for airport ground operations. For passenger services in and around the airport terminal, Snowdon et al. (2000) use ARENA to simulate the movement of passengers and baggage through ticketing, check-in, boarding, and loading. Horstmeier and de Haan (2001) used an ARENA model to simulate functions in turning around the Airbus A380 and found opportunities to reduce times by changing aircraft configurations and processes for food catering and passenger disembarkation. To pursue "optimal" solutions for a broader aspect of gate activity (the assignment of aircraft to gates) and test them in a stochastic environment, Yan et al. (2002) employ a mathematical programming model, heuristics and rudimentary simulation using Fortran 90 to consider stochastic effects. Ravizza et al. (2013) present an algorithm that determines optimal taxi routes (and sequences of movements) for repositioning aircraft (as with arrivals and departures) with consideration of fuel time required to complete all scheduled movements. Zografos and Midas (2006) discuss how collections of models with individual strengths, harmonized databases of relevant information, and domain-specific analytical tools can be integrated with the help of a human-machine interface to serve as a decision support system (DSS) for airport planning and performance studies.

In the air traffic control system, arrivals are sequenced dynamically by air traffic controllers who stage arrivals as necessary at holding points and funnel them through final approach fixes for the active runways, generally using the first-come-first-served (FCFS) principle but with some adjustments to adjust for current pressure on the system. The airspace planning models and studies go to great lengths to consider the detailed interplay of aviation activities and adjust for the effects of individual aircraft characteristics and conditions when determining the times and delays associated with aircraft movements. They generally operate on an FCFS basis relative to schedule (as when pushing back from gates) or when approaching a node in the simulated network (e.g., at an arrival fix or a departure runway). Doing so, the models emulate the behavior of airline dispatchers and air traffic controllers to the extent possible (though with less flexibility). They adjust the times and flight paths to enforce aircraft separation standards.

In a different transportation context, Smith et al. (2011) showed that a heuristic scheduling procedure for staged queues (with priority-shifting mechanisms to ensure equity) could be used to improve performance over FCFS at locks in a river transportation system. Staged queues have the characteristic of one or more members' being designated as ready to be selected for service and therefore being in a subset that may be removed next from the queue when a resource becomes available or a signal occurs. This attribute has particular relevance in transportation and logistics, as physical restrictions often limit the mobility of queued entities. In the waterway environment, improved efficiency overall could be realized without imposing great hardship on any class of vessel. Depending on the tightness of the time intervals at which priority shifting occurs, the burden of delays, however, shifted from one class of user to another.

III. METHODOLOGY

A. *Overview*

The product perspective of a product again being classified into 4 group, the different groups tells the different kinds of people will use our product and is in basically classified into 4 groups the first group contains the pilot the pilot will use our product in order to get the overall light updating from the manager has been controlling the flight at the different service station present The pilot will get all the information regarding the different flight routes between source and destination and if there is a clash between two flights flying in the air they will be divergence of the routes Perspective for the manager is to control the different flight routes and to carry on the information to the pilot flying the plane, so the manager able to see all the information regarding the flight on our software so he can use our software in order to ensure that the overall air traffic control system would work properly. Product prospective for the admin is to maintain the overall software and to remove all the bugs and problems present in the system so he can basically maintain the software instead of using if and make it usable for all another category of people who can really use it and the advantage of our product. The main category of people who can really take advantage of our product for their personal usage by using our product so that they can easily see all the information of the flight regarding the flight status and flight route between source and destination. The user who are using our products they can also see the flight delay if there is a delay due to some internal problem of the air control system.

B. Architecture

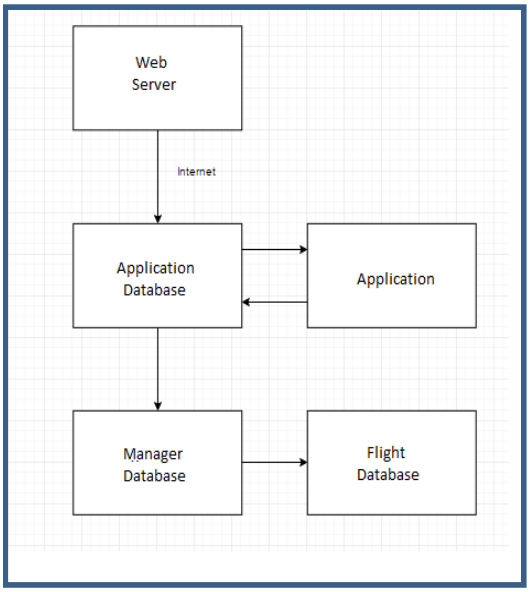

Fig 1

The above architecture gives the brief view of how the whole process takes place.The below diagram describes the signal system in a brief:

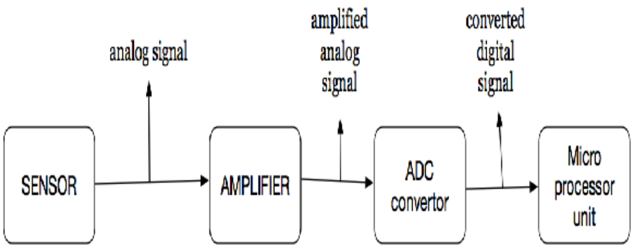

Fig 2

C. Algorithm

We are designing our project using Java and PHP language. Building a software that would control the air traffic control system and will guide the different flight routes for the different flights flying from the source to destination and the list of constraint that we are applying for our project are:

1. Prim'algorithm
2. Kruskal's algorithm

Use of prims algorithm:

The use of this algorithm is basically done in order to calculate the shortest distance between the source and the destination, and by calculating the shortest path between the station we can now finally find out the overall distance between the source and destination.

We are using PHP language in order to make the HTTP domain website program so that users from parts of the world can access our product and can retrieve all the information about the flights they wanted to. By using PHP language we are also maintaining the main admin pl-SQL database in which all the essential information regarding flights and general information will get stored.

IV. RESULT

As a result, a well-organized system will exist so that there will not have any kind of malfunctions during landing or takeoff. This creates the shortest path as well by using the prim's algorithm.Below are some of the forms in the program. After firing up the program, the login screen will appear. If the users enter the right username with the matching password, it will immediately take them to the main interface.

Table 1: Login

Table name: - Login

Description: - To store Login Information of Admin

Field	**Data Type**	**Constraint**	**Description**
Username	varchar	Primary Key	Username
Password	varchar	Not Null	Password

Table 2: Item

Table Name: - Flight

Description: - To store flight Information

Field	**Data Type**	**Constraint**
Flight_no	number	Primary Key
Flight_name	number	Not Null
Start_date	date time	Not Null
End_date	date time	Not Null
rate	number	Not Null
from	varchar	Not null
to	varchar	Check
capacity	number	Not Null

Table 3: Supplier

Table Name :- Manager

Description: To store manager Information

Field Name	**Data Type**	**Constraint**
Manager_id	Number	Primary key
password	Varchar	Not null
Airport_id	Number	Not null
Airport_name	Varchar	Not null
Address	Varchar	Not null
Mobile No	Varchar	Not null

Table 4: Passenger information

Table Name: Passenger

Description : To store Passenger Information

Field Name	Data Type	Constraint
Passenger_id	number	Primary Key
Passenger_name	varchar	Not null
Mobile_no	number	Not null
password	varchar	Not null
Gender	varchar	Not null
Age	number	Not null

Table 5: Booking information

Table Name : Booking

Description : To store Booking Information

Field Name	Data Type	Constraint
Passenger_id	number	Primary Key
Flight_no	number	Foreign Key
Transaction_id	number	Foreign Key
Purchase_date	Date	Not Null

V. Conclusion

In this paper, we are presenting a system that is known as Air traffic control System (ATCS) for our client from different parts of the world. This system will be designed to maximize the editor's productivity by providing tools to assist in automating the traffic system and publishing process, which would otherwise have to be performed manually. By maximising the editor's work efficiency and production the system will meet the editor's needs while remaining easy to understand and use.and in a brief it allows a manager to manage and communicate with a group of manager present at the different air station including all domains the software will facilitate communication between clients, manager, and the admin via E-Mail. Pre-formatted reply forms are used in every stage of the articles' progress through the system to provide a uniform review process; the location of these forms is configurable via the application's maintenance options.

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