NETWORK BASED LANDING SYSTEM: AN ALTERNATIVE OF LANDING SYSTEM

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Abstract

As information technology particularly network convergence into IP (Internet Protocol) network, new kinds of application emerge. Applications cover a wide range of area from education, health, government, etc. Transportations are not excluded. Information technology could provide services related to aircraft positions, flight condition, emergency status, including information for landing system. Network based landing system is a new concept of providing information to airmen on how an aircraft correlated within the designated or nearby airport. This covers spatial data of certain airports; their weather condition, runway length, airport capabilities, and pathways for en route and landing. These information are also paired with GPS (Global Positioning System) for data crosschecking. Data from GPS are correlated with spatial data thus giving knowledge such as how an aircraft on final approach satisfies minimum glide slope. For the first step, we establish a spatial database in a form of geo-map for case study. Further development will be expanded into database layers related to location based service (LBS) for aerial services.

Keyword: IP Network, Geo-map Database, Database Layers, Location Based Service (LBS).

1. Introduction

Information technology has brought a new era of aeronautical or aerospace engineering. By using the internet, not only people could access information almost anytime, anywhere, and anything but also data transaction among computing devices.

One of the utilization of information and communication technology (ICT) for aeronautics is how ICT could provide information access with relatively low operational cost, reliable, and sustainable. These factors could also optimize the utility of air transportation monitoring system and provision of landing aids for approacing aircrafts. In air transportation monitoring system, aircrafts could be monitored by both radar and ADS-B (Automatic Dependent Surveilance Broadcast) which use GPS as its positionings. For landing aids, aircrafts which are within the airspace of certain terminal could use information given from ground control such as weather condition, runway length, airport capabilities, and pathway as their landing aids.

This research aim is to establish a network based landing system as tools for giving information on landing on certain airports and aircraft communication in the future.

2. Computer Network

In computer network, sets of routers and servers handle wide area network (WAN) which connect client computers from one network to another. The main advantage of using IP network are it can deliver multimedia data.[1]

Client computers send request to obtain data from their designated clients or servers. This communication is conducted via IP network where all packet data flow within a shared medium channel as depicted in Figure. 1. In order to maintain a reliable network connection, servers and routers must have mechanism to control packet flow so there will be no congestion which leads to significant delay rate, router overload, and system halt. This might be dangerous for air transportation monitoring because system halt would dismiss any aircrafts state previously monitored.
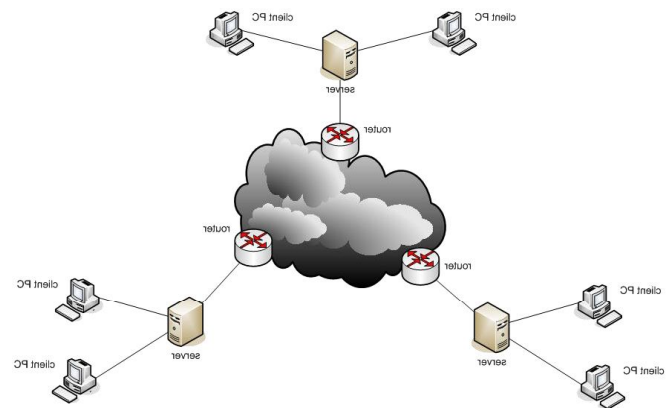
Figure. 1 Computer Network

If a client requests data retrieval from remote host, server relays this request to routers which also communicate with other routers and eventually the request arrives on the host a client requested earlier.

3. Integrating Network Augmentation

Previous methods on aeronautics like WAAS (Wide Area Augmentation System) and LAAS (Local Area Augmentation System) have proven to be adequate in giving accurate position fix.

WAAS use three layers; space segment, ground segment, and user segment. Space segment consists constellation of satellites which broadcast correction messages from ground segment for user segment reception. Ground segment composed by wide area reference stations (WRS) collects GPS information and send the information to wide area master stations (WMS) providing data integration.[2] WAAS concept is shown in Figure. 2.
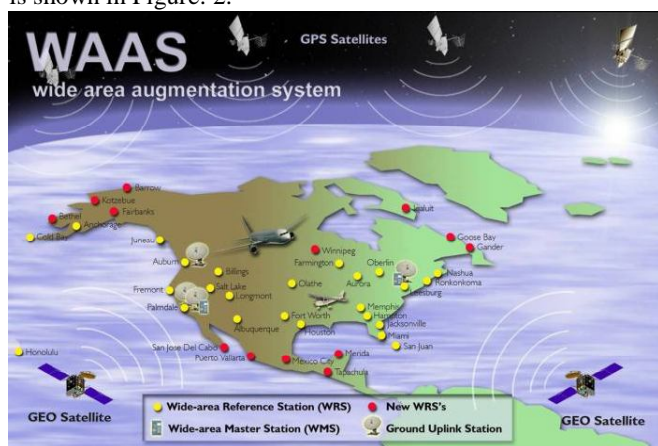

Figure. 2 WAAS

LAAS is composed by sets of reference GPS receivers located in surveyed area around the airport which send their information to ground facility relaying to aircrafts.[3] This concept provides ILS-type aid to aircrafts as seen in Figure. 3.
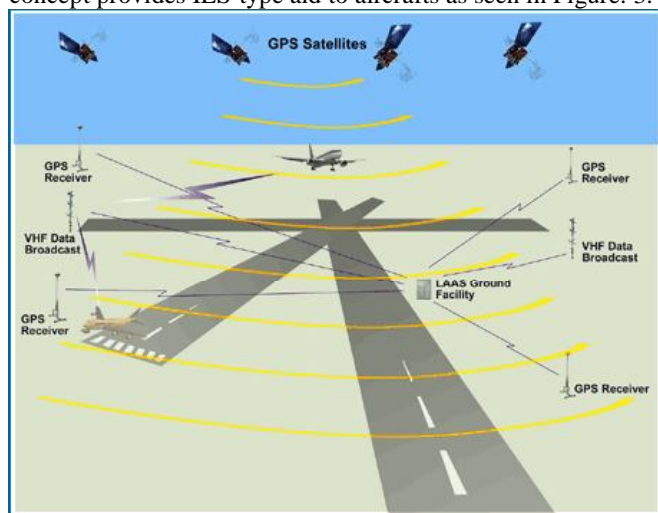

Figure. 3 LAAS

This research combines WAAS/LAAS concept with new features for navigational aids particularly for landing phase. Additional database support provides several features transmitted to aircrafts via radio link. These features cover glideslope information, precise location, aircraft emergency, weather report, and geographical information system (GIS) for spatial data provision.[4] Detail description on network based landing system is as seen in Figure. 4.
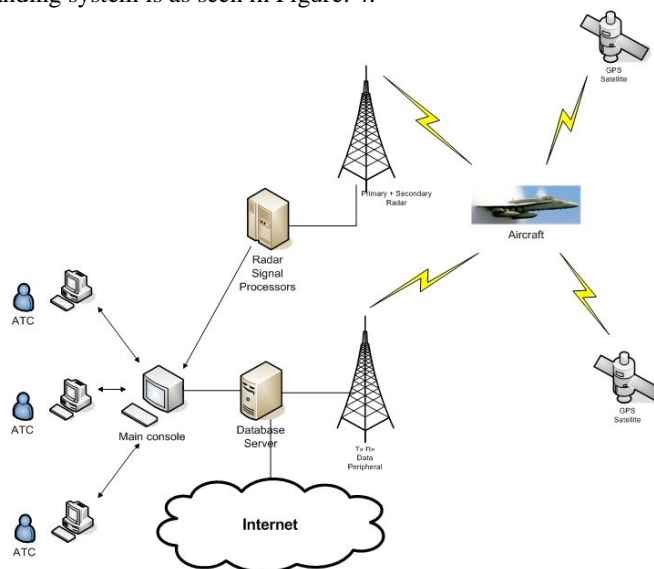

Figure.4 Network based landing system

There are added features in developing database support for network based landing system:

- Geo-location Information Service
  - Terrestrial contour for final approach
  - "ILS-like" precision approach
  - Realtime weather update report
  - Provides contextual information

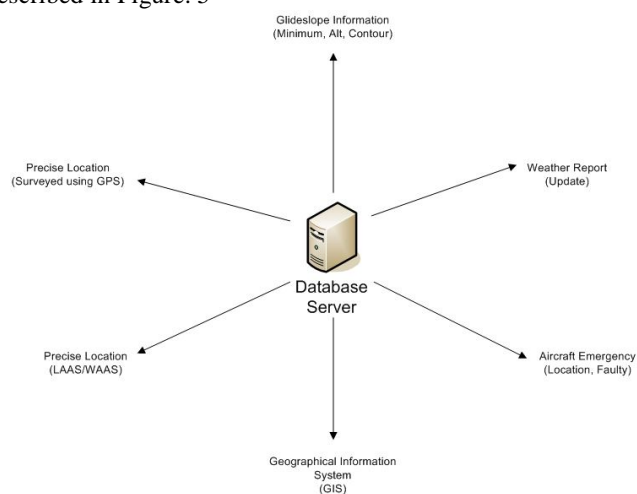Description of contextual database for our research is described in Figure. 5

Figure. 5 Database Description

4. 3-Tier Model

Adopting from client-server architecture model, 3-tier model involves three layers of architecture; Data layer, Logic layer, and Application layer.

Data layer consists sets of databases which store data or file system to be processed and passed to logical layer. Logical layer consists sets of protocols, functions, and calculations in order to bridge data layer with application layer. In this research, our 3-tier model is formed by defining application layer as airports. Details of 3-tier architecture for this research is in Figure. 5.
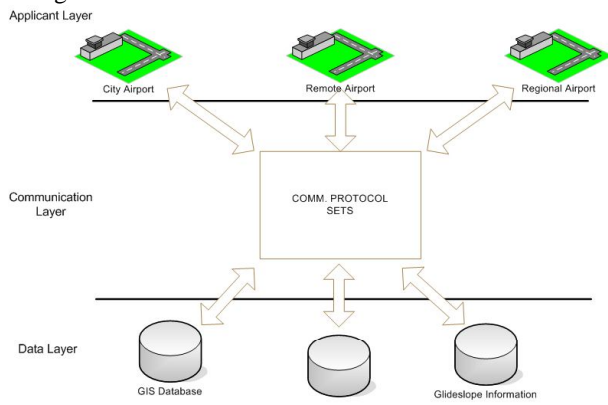

Figure. 5. 3-Tier Model

In this method, we expect an interaction between database layer with airports as clients so that clients could access important information regarding the navigational aids which eventually relayed to aircrafts.

Our present research focused on establishing the spatial (GIS) database positioning and forming communication layer which lies in logical layer with accessible through web, or mobile computing devices ability.

5. Conclusion

Network based landing system by utilizing spatial database is possible due to its capability to provide both support for ground control and aircrafts. Another thing is computer network with geo-location information system is adequate for landing system.

Acknowledgment

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