بسم الله الرحمن الرحيم

الآيـــــة

قال تعالي :

(وَمَا أُوتِيتُم مِّن العِلْمِ إِلاَّ قَلِيلاً)

صدق الله العظيم
الآيـة (85) سورة الإسراء

DEDICATION

I would like to dedicate this thesis for:

My family,

My teachers,

My friends,

My colleague,

Sudan Civil Aviation authority (SCAA),

Sudan Air navigation General Directorate (ANS)

Sudan Air Navigation Center (ANC),

Africans CAA & ANS Providers,

All people working to raise the Aviation industry in Africa.

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Finally, I dedicate this work to my friends, my parents and my family who have provided support and encouragement during my academic studies

Abstract

As air traffic increases, routes get more and more diverse and light and ultra light aircraft are becoming more and more popular, the classic system is beginning to show its weaknesses. The two main issues regarding classic radio communications are delay and the availability and reliability of network infrastructure related problems.

Today's dense air traffic and the worldwide move to Future Air Navigation System (FANS) concepts demand a high level of modern and reliable Air Traffic Control (ATC) network to accommodate customer requirements now and in the future.

This work tries to answer the questions that indicate the fact why a new air traffic control network generation based on higher speed terrestrial and VoIP (Voice over Internet Protocol) links has some essential comparative advantages related to the old circuit switched networks.

The purpose of this thesis is to provide two air traffic control network models for switching voice and data methods for pilot-air traffic controller communications using E1 Leased lines and IP VSAT links.

In the first model, the network is implemented using leased lines over fibre links reduce latency.

In the second model, the network is implemented using IP over VSAT mesh network as an improvement to the bandwidth saving and cost - effective

In these models, the network acts as a “two redundant network” main and standby

The main benefit of these networks is the increase safety, as communications were there are many network without redundancy. Other benefits are solving the problems of delay, packet loss and bad quality of voice and data.

The two proposed network models had to prove in the near future that they are ready to meet the requirements of more flexible, safer and cheaper way of air traffic management.

المستخلص

يشهد العالم حركة مطردة فى مجال النقل الجوي والحركة الجوية عموما هذا النمو يتطلب المزيد من اجراءات السلامة والمراقبة الجوية وهذا لا يتأتى الا بإتباع قواعد السلامة الجوية القياسية المنصوص عليها من قبل المنظمة الدولية للطيران المدنى.

من اهم هذه المتطلبات تطبيق نظام متطور لادارة الحركة الجوية والذي يشتمل على نقلة نوعية بالتحول الى نظام الملاحة المستقبلى والملاحة بواسطة الاقمار الاصطناعية بالاضافة الى الاستفادة من خدمات وامكانيات برتكول الانترنت فى نقل البيانات والصوت على السواء.

نسبة للزيادة المتسارعة فى حجم الحركة الجوية اليومية ، اصبحت شبكات ربط ونقل معلومات الحركة الجوية الكلاسيكية تعانى قصور فى الاداء متمثلة فى موثوقية هذه المعلومات ونسبة موجودية خدمة هذه الشبكات.

فى هذا البحث تم تطبيق نموزجان لهذه الشبكات باستخدام تقنية حديثة ومتطورة لمعالجة قصور اداء الشبكات التقليدية .

تم تطبيق النموذج باستخدام السعات العريضة عبر خطوط الالياف الضوئية

ونتج عن هذا التطبيق الاتى :

- استخدام الربط بواسطة السعات العريضة عبر الالياف الضوئية يضمن ضمان نقل حجم معلومات اكبر وبسرعة فائقة وعدم التداخل مع المؤثرات الخارجية مع قلة التكلفة نسبيا
- ضمان جودة عالية فى الصوت وهو اهم تطبيقات الحركة الجوية
- ضمان نقل كافة انواع البيانات الملاحية ويذيد من موثوقية وفعالية خدمات الحركة الجوية

تم تطبيق النموذج الثانى باستخدم شبكة اقمار اصطناعية (فيسات)

ونتج عن هذا التطبيق الاتى:

- يوفر خدمة موثوقة تستخدم فى نقل بيانات الصوت والرادار عبر استخدام برتكول الانترنت وميزات تفضلية فى التغطية الواسعة وسهولة التركيب
- استخدام برتكول الانترنت يقلل التكلفة الكلية وذلك باستخدام اجهزة ومعدات الشبكات بمواصفات جيدة ومتوفرة فى السوق
- تقليل تكلفة ايجار المساحة القمرية ياستخدام تقنيات ضغط البيانات وبرتكولات التسريع

❋ استخدام النموذجان معا يقلل من تكلفة التشغيل والصيانة ويضمن نسبة عالية لموجودية الشبكة والخدمات المنقوله عبرها من المحطات الى المركز الرئيسى.

Contents

List of Tables

List of Figures

Abbreviations

A/D	Analog –to- Digital
ACELP	Algebraic Code Exited Linear Prediction
AIS	Alarm Indication Signal
ATC	Air Traffic Control
ATM	Asynchronous Transfer Mode
ATM	Air Traffic Management
BECN	Backward Explicit Congestion Notification
BOD	Bandwidth On Demand
BSC	Binary Synchronous communications
CAA	Civil Aviation Authority
CAS	Channel Associated Signalling
CCS	Common Channel Signalling
CES	Circuit Emulation Services
CN	Comfort Noise
CS	Conjugate Structure
CRC	Cyclic Redundancy Check
DAMA	Dynamic Assigned Multiple Access
DCE	Data Communication Equipment
DLCI	Data Link Connection Indicator
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
DSP	Digital Signal Processing
EBCDI	Extended Binary Code Decimal Interchange
E&M	Ear and Mouth signalling
FAS	Frame Alignment Signal
FECN	Forward Explicit Congestion Notification
FR	Frame Relay
FRAD	Frame Relay Access Device
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station
GSM	Global System Mobile
HDB3	High Density Bipolar -3zeros
HDLC	High Level Data Link Control
IP	Internet Protocol

IPX	Internetwork Packet Exchange
ISDN	Integrated Service Digital Network
LAN	Local Area Network
LDC	line Delay Compensate
LDCD	Low Delay Codec
LMI	Local Management Interface
MAPC	Multiple Address Per Carrier
MSC	Mobile Switch Centre
PAMA	Permanently Assigned Multiple Access
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PSTN	Public Switched Telecommunication Network
PTT	Push –TO-Talk
PVC	Permanent Virtual Connection
PVCR	Programmable Variable Cell Relay
QoS	Quality of Service
RAI	Remote Alarm Indication
R-ASYNC	Reliable Asynchronous mode
SAP	Service Advertising Protocol
SDLC	Synchronous Data Link Control
SNA	System Network Architecture
SS7	Signalling System No.7
SVC	Switched Virtual Connection
T-ASYNC	Transparent Asynchronous mode
TDMA	Time Division Multiple Access
UNI	User/Network Interface
USASCII	United States of America Standard Code
VHF	Very High Frequency
VCCS	Voice Communication Control System
VoIP	Voice over IP
VSAT	Very Small Aperture Terminal
WAN	Wide Area Network