Sudan University of Science and Technology

College of Engineering

School of Electronics Engineering

Design and Overview of Oceanic Aircraft Communications

تصميم و نظرة عامة للاتصال بين الطائرات في المحيطات

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بسم الله الرحمن الرحيم

قال تعالى:

(إِنَّ فِي خَلْقِ السَّمَاوَاتِ وَالْأَرْضِ وَاخْتِلَافِ اللَّيْلِ وَالنَّهَارِ وَالْفُلْكِ الَّتِي تَجْرِي فِي الْبَحْرِ بِمَا يَنْفَعُ النَّاسَ وَمَا أَنْزَلَ اللَّهُ مِنَ السَّمَاءِ مِنْ مَاءٍ فَأَحْيَا بِهِ الْأَرْضَ بَعْدَ مَوْتِهَا وَبَثَّ فِيهَا مِنْ كُلِّ دَابَّةٍ وَتَصْرِيفِ الرِّيَاحِ وَالسَّحَابِ الْمُسَخَّرِ بَيْنَ السَّمَاءِ وَالْأَرْضِ لَآيَاتٍ لِقَوْمٍ يَعْقِلُونَ)

البقرة: 164

DEDICATION

You held my hand to steady me

Till I was ready to make a stand

On my own two feet

You were there to show me

How to truly believe

In the miracle of creation

In the good and the bad

When my head was down you prayed for me

To my caring parents *Aldaw Ali* **&***Awatif Ahmed*,

Beloved sisters *Nisreen,Shaza,Shireen,Alaa* **&**

*Eman*and to my beautiful nieces *Leen &Tala*

I dedicate this humble work.

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(واشكروا نعمة الله إن كنتم إياه تعبدون)

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ABSTRACT

Every day the sky carries about 8million people flew on nearly 100,000flights, thus It is very important to coordinate the movement of air traffic to makeairplanes stay a safe distance apart in order to avoid collision, and keep an eye on aircraft during it flight time, The limitation of conventional radar technology, relatively lowaccuracy and the fact that radars are only placed on land, make it difficultor even impossible to track airplanes when they are flying over oceans. The mainobjective of this research is to highlight surveillance technologies and give a simplified method to track aircrafts in non radar areas, simple scenarios were simulated using system tool kit software which is a tool designed for simulating airspace,25 aircrafts paths were selected from 2524 real routes and modeled with simple link budget calculation .

المــــستـــخلـــص

السفر بالطيران غير مسار العالم تماما, و سهل على الناس السفر حيث أتاح امكانية الانتقالحول العالم بكل سهولة و يسر و في فترات زمنية قصيرة. كل يوم تشهد السماء حوالي 100 ألف رحلة جوية تحمل حوالي 8 مليون نسمة .لذلك من المهم تنظيم حركة الطائرات لتبقى في حدود مسافة معقولة منعا للتصادم ولاجراءات السلامة , قصور و عدم دقة اجهزة الرادار التقليدية و لحقيقة ان الرادارات تُنشأ على اليابسة فقط, تصعب عملية تتبع الطائرات عندما تحلق فوق المحيطات الشاسعة . الهدف الاساسي من هذا البحث هو تسليط الضوء على اجهزة المراقبة والاستطلاع المستخدمة من قبل المراقبة الجوية واعطاء مفهوم مبسطلتتبع الطائرات عبر المحيطات حيث لا توجد تغطية بأجهزة الرادار , أيضاً تمت محاكاة التصميم المقترح باستخدام برنامج مجموعة أدوات النظام و هو برنامج مصمم خصيصاً لمحاكاة الفضاء , 25 مسار من أصل 2524 مسار حقيقي للطائرات اختير لتبسيط المحاكاة ,كما تم حساب مؤشرات لجودة الرابط المقترح.

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ABBREVIATION

AANET   Aeronautical Ad hoc NETwork

ACC   Area Control Center

ADS-B   Automatic Dependent Surveillance Broadcast

AeroRP   Aeronautical Routing Protocol

AMM   Aircraft Mission Modeler

ASN   Aviation Safety Network

ATC   Air Traffic Control

ATM   Air Traffic Management

AWOS   Automatic Weather Observing Station

CDTI   Cockpit Display of Traffic Information

FAA   Federal Administration for Aviation

FCM   Fuzzy C Means

FIS-B   Flight Information Service Broadcast

GLSR   Geographic Load Sharing Routing

GNSS   Global Navigation   Satellite System

GPS   Global Positioning System

GPSR   Geographical Position-Based Routing

GRAA   Geographic Routing protocol for Aircraft Ad hoc

GUI	Graphical User Interface
HAP	Higher Altitude Platform
ICAO	International Civil Aviation Organization
LOS	Line Of Sight
MANET	Mobile Ad hoc NETwork
MFD	Multi-Function Displaying
NAS	National Airspace System
NATs	North Atlantic Tracks
OTS	Organized Track System
PSR	Primary Surveillance Radar
RADAR	RAdio Detection And Ranging
RCS	Radar Cross Section
RF	Radio Frequency
RGR	Reactive Greedy Reactive
SNR	Signal to Noise Ratio
SSR	Secondary Surveillance Radar
STK	System Tool Kit
TCAS	Traffic Collision Alerting and Avoidance
TCP/IP	Transmission Control Protocol/Internet Protocol
TDMA	Time Division Multiple Access
TDOA	Time Difference Of Arrival
TIS-B	Traffic Information Service Broadcast
UAANET	Unmanned Aeronautical Ad hoc NETwork

UAV	Unmanned Aerial Vehicle
USPR	Universal Software Radio Peripheral
VHF	Very High Frequency
WAM	Wide Area Multilateration