

Sudan University of Science and Technology

Faculty of Engineering and Technology

College of post Graduate Studies

Department of Electronic Engineering

**In collaborative with
Centre of Engineer and Technical Studies (CETS)**

Spectrum Monitoring System Simulation

محاكاة نظام مراقبة الطيف الضوئي

Report submitted in partial fulfillment of the requirement for the degree of

M.Sc

In

TELECOMMUNICATION ENGINEERING

By:

Adel Ali Abbass Ali

Under the Supervision of

Dr. Abd Alrasol Jabar Alzubaidy

February 2014

This work is dedicated to:

My Parents,

Brothers,

Sisters,

Relatives,

Friends,

And colleagues.

Who are looking forward

To see this work in light

ACKNOWLEDGEMENT

Firstly, all praise and my great thanks to my Glory God, ALLAH, for everything in my life, and for giving me the power and assisting me to complete this work.

I am profoundly grateful to **Dr.Abd Alrasol Jabar Alzubaidy**, (my supervisor) whose detailed criticisms of earlier drafts, valuable suggestions and wise counsel, have proved most invaluable to me. It has been a most rewarding learning experience to work under his guidance.

I thank all individuals who sacrificed their time to speak to me during the work. I wish to acknowledge with great appreciation all the encouragement from my friends; your advice were soul searching.

ABSTRACT

With rapid development of communication industry, the kinds of communication service vary, according to the increasing use of radio waves, the intelligent and effective radio monitoring system needs to be developed, which is replaced for previous radio monitoring system. Next-Generation Intelligent Radio Monitoring System based on ITU-R, Rule of wireless facilities, and Radio Waves Act is used, and which can accurately and effectively function as effective radio monitoring system through spectrum analysis of channel power, frequency deviation, offset, and an occupied frequency bandwidth, about the analog and digital signal in On-Air of V/UHF bandwidth. In this paper, we proposes method of radio measurement and radio management through the radio quality measurement, unwanted electromagnetic signals(spurious, harmonic) measurement, high-speed spectrum measurement, frequency usage efficiency investigation, illegal radio exploration.

The objective of this project was to design a system to allow monitoring for electro morganatic waves or radio waves remotely via computer without the presence of man and to reduce the time factor.

There are two key components to the project design,

1-Remote unit

This unit consists of computer is present in the remote place.

2-Local unit

This contains of computer and a Local Control Section, Local Control Section consists of a DTMF Receiver (DTMF decoder), BASIC Stamp 2-IC, ULN2003 Darlington Driver and the radio waves

The remote unit (computer) was detected successfully the illegal random waves.

مستخلص

في ظل التقدم و التطور السريع في صناعة الإتصالات و التقنيات الحديثه يتغير تبعاً لذلك نوع الخدمة التي تقدم المراقبة الافضل لهذا التطور. وذلك نسبة لزيادة استخدام الموجات الراديوية. عليه يجب تحسين وتطوير نظام المراقبة لهذه الموجات بنظام اكثر حساسية ودقة من النظم السابقة. مع الاخذ بالاعتبار القواعد و اللوائح التقق عليها من قبل النظام العالمي (ITU-R). مما يسمح لنا بمراقبة ومتابعة كيفية عمل الاطيفاف الموجية مما يضمن حفظ حقوق مستخدميها.

الهدف من هذا المشروع كان تصميم نظام يقوم بالتحكم في الاجهزة الإلكترونية عن بعد وذلك بتشغيلها او إيقافها من خلال إستخدام النظام الخلوي نظام (GSM) .

يتكون هذا النظام من جزئين أساسين وهما

1. وحدة التحكم عن بعد (Remote unit)

هذه الوحدة تتكون من جهاز كمبيوتر

2. الوحدة المحلية (Local unit)

هذه الوحدة تتكون من جهاز كمبيوتر ووحدة التحكم المحلية والتي تحتوي (DTMF)

(Receiver), (BASIC Stamp 2-IC), (ULN2003 Darlington Driver) و الحزم الطيفية المراد مراقبتها.

بعد التشغيل تم عن طريق وحدة التحكم كشف الموجات الغير قانونية التي لم يتم ترخيصها من قبل الهيئة القومية للاتصالات.

List of Tables

Table (2.1)	BS2-IC specification
Table (4.1)	Opeartor's service frquency in sudan

List of Figures

Figure (1.1)	Block diagram of the design
Figure (2.1)	Procedures and Consultation for Frequency Assignment
Figure (2.2)	Coaxial Cable Distribution Systems
Figure (3.1)	BASIC Stamp Rev Dex model (27100)
Figure (3.2)	BS1-IC
Figure (3.3)	BS2-IC
Figure (3.4)	BS2E –IC
Figure (3.5)	BS2SX –IC
Figure (3.6)	BS 2p 24
Figure (3.7)	BS2p 40
Figure (3.8)	BS2pex
Figure (3.9)	BASIC Stamp 1 Carrier Board (Rev. E)
Figure (3.10)	BASIC Stamp 2 Carrier Board (Rev. B)
Figure (3.11)	BASIC Stamp Super Carrier Board (Rev. A)
Figure (3.12)	BASIC Stamp Activity Board (Rev. C)
Figure (4.1)	Show flow chart of the program

List of abbreviations

WRC	World Radio Conference
ITU	International Telecommunication Union
RR	Radio Regulations
RRC	Regional Radio communications Conference
BS	Broadcasting Services
BSS	Broadcasting Satellite Services
BS1-2C	BASIC Stamp 2 Integrated Circuit
BS1-IC	BASIC Stamp 1 Integrated Circuit
S-DAB	Satellite Digital Audio Broadcasting
FS	Fixed Service
FSS	Fixed Satellite Services
T-DAB	Terrestrial Digital Audio Broadcasting
PMR	Private Mobile Radio Service
PMRS	Public Mobile Radio Service
PCN	Personal Communications Network
MS	Mobile Services
MSS	Mobile Satellite Services
OFTA	Office of the Telecommunications Authority
ISS	Inter-satellite service
FDMA	Frequency Division Multiple Access
GSM	Global System for Mobile Communication
ISL	Inter-satellite Links
MPCS	Mobile Personal Communications by Satellite
BAT	Basic Agreement on Telecommunications
ITA	International Technology Agreement
RMU	Radio Monitoring Unit
RSAC	Radio Spectrum Advisory Committee
TSAC	Technical Standards Advisory Committee

Table of Contents

Dedicated	II
Acknowledgement.....	III
Abstract.....	IV
List of Tables.....	VI
List of Figures.....	VI
List of abbreviation	VII
Table of Contents	VIII

Chapter one:

1. Introduction.....	1
1.1. Background.....	1
1.2. problem statement	2
1.3. objectives	2
1.4. methodology.....	2
1.5. Research plan	3

Chapter Two:

2. Electromagnetic Waves and Spectrum Management.....	4
2.1 Overview of Electromagnetic Waves	4
2.1.1 Electromagnetic spectrum	4
2.1.2 Characteristics of electromagnetic waves	5
2.1.3 Creation and detection	6
2.2 Spectrum Management	7
2.2.1 Radio Services	7
2.2.2 Frequency Bands.....	8
2.2.3 WRC Regional Frequency Allocations.....	8
2.2.4 Radio Regulations	9

2.2.5 Licensing of Spectrum Use	12
2.2.6 Spectrum Planning	12
2.2.7 Frequency Coordination	13
2.2.8 Spectrum Management and EMC	13
2.2.9 Public Mobile Radio Services	13
2.2.10 Private Radio Mobile Services	13
2.2.11 Re-assignment of Spectrum	14
2.2.12 (3G) generation mobile networks.....	14
2.2.13 New Licenses and Services	14
2.2.14 Health and Safety	14
2.2.15 License Fees and Spectrum Pricing	14
2.2.16 Spectrum Fees	14
2.2.17 Broadband and Convergence	15
2.2.18 Third Generation (3G) Public Mobile Radio Services...	16

Chapter Three:

3. Basic stamp microcontroller	16
3.1 Overview about basic stamp microcontroller	16
3.2 basic stamp applications	16
3.3 BASIC Stamp Modules	17
3.3.1 BASIC Stamp Rev Dex model (27100).....	17
3.3.2 BASIC Stamp 1 model (BS1-IC)	18
3.3.3 BASIC Stamp 2 model (BS2 -IC).....	18
3.3.4 BASIC Stamp 2e model (BS2E -IC).....	19
3.3.5 BASIC Stamp 2sx model (BS2SX -IC).....	19
3.3.6 BASIC Stamp 2p 24 models	19
3.3.7 BASIC Stamp 2p 40 models	20
3.3.8 BASIC Stamp 2pex Module.....	20
3.4 BASIC Stamp Boards.....	20
3.4.1 BASIC Stamp 1 Carrier Board (Rev. E).....	20
3.4.2 BASIC Stamp 2 Carrier Board (Rev. B).....	21

3.4.3 BASIC Stamp Super Carrier (Rev. A).....	22
3.4.4 Board of Education (Rev. B).....	23
3.4.5 BASIC Stamp Activity Board (Rev. C).....	24
3.5 BASIC Stamp specification.....	25
3.6 DTMF Receiver	26
3.6.1 MT8870D/MT8870D-1.....	26
3.6.2 DTMF Receiver Functional Block Diagram	26
3.6.2 Single-Ended Input Configuration.....	27

Chapter Four:

4. Software	29
4.1 Turbo C++ Over view	29
4.2 System Algorithm and Flow Chart	30
4.2.1 System Algorithm	30
4.2.2 System Flowchart	31
4.3 The program	31

Chapter Five:

5. Results and Discussion.....	37
5.1 Results	37
5.2 Discussion	38

Chapter Six:

6. Conclusion and Recommendations.....	39
6.1. Conclusion	39
6.2. Recommendations	40
References.....	41

