

بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of post Graduate Studies

Department of Electronic Engineering

Wireless Based Robot Control

التحكم اللاسلكي في الإنسان آلي

A.dissertation submitted in partial fulfillment of the requirement of Master

Degree M.Sc In

TELECOMMUNICATION ENGINEERING

Prepared By:

Hind Eltigani Mohamed

Supervised By :

Dr. Abd Alrasol Jabar Alzubaidy

November 2013

لَرْبِّكَ زِيْدُ

سورة طه الايه 114

This work is dedicated to:

To My Dear Parents,

To My Dear Husband,

To My Dear Girlie,

To My Dear Brothers,

To My Dear Sisters,

To All My Friends,

To Who Like the Learning,

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

In light of continued progress in the world of communications and new technologies that evolve day after day and that contributed to the evolution of human life, The evolution in the remote control field in the electronic devices become one of the most important techniques, Because the remote control allows us to perform some tasks without need , This saves us a lot of effort, time and risk in some cases.

The aim of this project is to design system for operating number of electronic appliances in the home or other remotely areas through the use of cellular system (GSM).

There are two key components to the project design :

- Remote unit This unit consists of cell phone which is present in the remote place.

- Local unit This contains one cell phone and a Local Control Section, Local Control Section consists of a DTMF Receiver (DTMF decoder), ULN2003 Darlington Driver , Micro Controller and the electronic devices .

The operating for the electronic devices done successfully via remote control unit through the cellular network (GSM).

مستخلص

في ظل التقدم المتواصل في عالم الإتصالات و التقنيات الحديثه التي تتطور يوم بعد يوم والتي أسهمت في تطور حياة الانسان يعد التطور في مجال التحكم عن بعد في الأجهزة الإلكترونية من أهم هذه التقنيات, حيث أن التحكم عن بعد يسمح لنا باداء بعض المهام دون الحاجة لوجودنا وذلك يوفر علينا الكثير من الجهد ,الزمن والمخاطر في بعض الاحيان .

الهدف من هذا المشروع هو تصميم نظام يقوم بتشغيل عدد من الاجهزة الالكترونية في المنازل او غيرها عن بعد وذلك من خلال إستخدام النظام الخليوي نظام (GSM) .

يتكون هذا النظام من جزئين أساسيين وهما:

- وحدة التحكم عن بعد (Remote unit) هذه الوحدة تتكون من الهاتف الخليوي
 - الوحدة المحلية (Local unit) هذه الوحدة تتكون من الهاتف الخليوي ووحدة التحكم المحلية والتي المحلية التي تحتوي علي مستقبل النغمة الثنائية متعددة الترددات (DTMF Receiver), (Micro Controller), (ULN2003 Darlington Driver) والاجهزة الالكترونية المراد التحكم بها .
- تم التحكم في الاجهزة الالكترونية بنجاح وذلك بتشغيلها عن طريق وحدة التحكم عن بعد من خلال شبكة الهاتف الخليوي (GSM) .

Table of Contents

Dedicated	III
Acknowledgement.....	IV
Abstract.....	V
Table of Contents.....	VII
List of Tables.....	X
List of Figures.....	XI
List of abbreviation.....	XII

Chapter one:

1. Introduction.....	
1.1. Background.....	1
1.2. problem statement	2
1.3. objectives	2
1.4. methodologies	2
1.5. Research outline	4

Chapter Two:

2. The BASIC Stamp Modules , DTMF & Robots	
2.1. Overview about Microcontroller	4
2.2. BASIC Stamp Modules.....	4
2.2.1 BASIC Stamp 1 model (BS1-IC)	5
2.2.2 BASIC Stamp 2 model (BS2 -IC)	5
2.2.3 BASIC Stamp 2e model (BS2E -IC)	5
2.2.4 BASIC Stamp 2sx model (BS2SX -IC).....	6
2.2.5 BASIC Stamp 2pe Module (BS2PE –IC)	6
2.2.6 BASIC Stamp 2px Module (BS2PX –IC)	7
2.2.7 BASIC Stamp Rev Dex model (27100)	7

2.2.8 BASIC Stamp specification	8
2.3 Robots	9
2.4 Advantage of Stepper Motor	10
2.5 DTMF	10

Chapter Three:

3. Global System for Mobile Communication (GSM).....	
3.1 History of GSM.....	13
3.2 GSM Network Components.....	14
3.2.1 Switching System (SS) Components.....	15
3.2.1.1 Mobile services Switching Center (MSC)...	15
3.2.1.2 Home Location Register (HLR)	15
3.2.1.3 Visitor Location Register (VLR)	15
3.2.1.4 Authentication Center (AUC)	16
3.2.1.5 Equipment Identity Register (EIR)	16
3.2.2 Base Station Subsystem (BSS) Components	16
3.2.2.1 Base Station Controller (BSC)	16
3.2.2.2 Base Transceiver Station (BTS)	16
3.2.2.3 Mobile Station (MS)	17
3.2.3 Operation & Support System (OSS)	17
3.2.3.1 Operation and Maintenance Center (OMC) ...	17
3.3 GSM Frequency Band.....	17
3.3.1 GSM 900.....	18
3.3.2 GSM 1800	18
3.3.3 GSM 1900	18
3.4 Radio link aspects	19
3.5 Multiple access and channel structure	19

Chapter Four:

4	System design	
	4.1 The Remote part	21
	4.2 The Local part	21
	4.2.1 DTMF Receiver	21
	4.2.2 BASIC Stamp	23
	4.2.3 ULN2003 Darlington Driver	27
	4.3 Hardware Design circuit	28
	4.3.1 Steps of Design	28
	4.3.2 Diagram of the Design	30

Chapter Five:

5	Software	
	5.1 PBASIC languages	31
	5.2 Flow chart of the program	31
	5.3 The program	33

Chapter Six:

6	Results and Discussions	
	6.1. Results.....	35
	6.2. Discussions.....	36

Chapter Seven:

7.	Conclusion and Recommendation	
	7.1. Conclusion.....	37
	7.2. Recommendation	38

References.....	39
------------------------	-----------

Appendices	40
-------------------------	-----------

List of Tables

Table (2.1)	BS2-IC specification
Table (2.2)	DTMF frequencies (CCITT)
Table (4.1)	shows Connection of the DTMF receiver to BS2 –IC
Table (4.2)	shows Connection of the BS2 –IC to ULN2003
Table (4.3)	shows Connection of the ULN2003 to Robot
Appendix (A.1)	shows the specification for model (BS1-IC & Rev .D& BS2-IC)
Appendix (A.2)	shows the specification for model (BS2e-IC& BS2sx-IC)
Appendix (A.3)	Table (A-3) shows the specification for model (BS2p24-IC & BS2p40-IC)
Appendix (A.4)	Table (A-4) shows the specification for model (BS2pe-IC & BS2px-IC)

List of Figures

Figure (2.1)	BS1-IC
Figure (2.2)	BS2 –IC
Figure (2.3)	BS2E –IC
Figure (2.4)	BS2SX –IC
Figure (2.5)	BS2PE –IC
Figure (2.6)	BS2PX –IC
Figure (2.7)	BASIC Stamp Rev Dex model (27100)
Figure (3.1)	System Model
Figure (3.2)	GSM frequency bands
Figure (4.1)	DTMF Receiver Functional Block Diagram
Figure (4.2)	DTMF Receiver Single-Ended Input Configuration
Figure (4.3)	Pin 1 Indicators BS2-IC
Figure (4.4)	Additional Examples of Pin 1 Indicators
Figure (4.5)	Programming Connections for all BS2 models
Figure (4.6)	BS2-IC and Board of Education
Figure (4.7)	shows BS2-IC internal component and signal configuration
Figure (4.8)	ULN2003 Block Diagram & Pin configuration
Figure (4.9)	Block diagram of the design
Figure (5.1)	Show flow chart of the program

List of abbreviations

AMPS	Advance mobile phone System
ADC	Analog-to-digital converter
AUC	Authentication Center
BS	Base Station
USB	Universal Serial Bus
PDA	personal data assistant
VCA	Video cassette recorder
VR	Variable-reluctance
DC	Direct Current
PM	Permanent Magnet
BSC	Base Station Controller
BSS	Base Station Subsystem
DTMF	Dual-tone multi-frequency
BTS	Base Transceiver Station
HB	Hybrid
CEPT	Conference of European Posts and Telegraphs
CGI	Cell Global Identity
CI	Cell Identity
EDGE	Enhanced Data rates for GSM Evolution
EEPROM	Electrically Erasable Programmable Read-Only Memory
EIR	Equipment Identity Register
FCC	Federal Communications Committee
FDMA	Frequency Division Multiple Access
GSM	Global System for Mobile Communication
HLR	Home Location Register
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union- Telecommunication sector
LA	Location Area
LAI	Location Area Identity
LCS	Location Services
LED	Light-emitting diode

MS	Mobile Station
MSC	Mobile services Switching Center
NMC	Network Management Center
NSS	Switching Sub-System
OMC	Operation and Maintenance Center
OSS	Operation & Support System
EMF	Electro-Magnetic Force
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
SIM	Subscriber Identity Module
SS	Switching System
TACS	Total Access Communication System
TDMA	Time Division Multiple Access
UMTS	Universal Mobile Telecommunication Services
VLR	Visitor Location Register