الآيـــــــة

قال تعالى

(وما الحياة الدنيا إلاَ لعب ولهو وللدَار الآخرة خير للذين يتَقون أفلا تعقلون)

صدق الله العظيم

(سورة الأنعام , الآية 32)

DEDICATION

I dedicate this project to my beloved Mom , who's been holding my back straight while I walk through life , who's always been by my side without asking , My dad who taught me the necessary skills for living and fulfilling , My precious family who rained me with patience and sacrifice through my years of study preparing for my future .

I dedicate it to my siblings and good friends , for life has no taste without their company , Through joy and grief , Hardship and ease , those have been the individuals who make it possible to make the most of life .

ACKNOWLEDGEMENT

First , I praise and give thanks to the God ,the Almighty and Compassionate for his blessings throughout my life and specifically throughout my research work to be completed successfully .

I would like to express my deep and sincere gratitude to my research supervisor , Jalal Abd-alrahman Mohammed teacher at school of Electrical Engineering , Sudan University of science and technology ,for giving me the opportunity to do research and provided me with guidance throughout his research .

I am extremely grateful to my comrades , for without them ,this research would've never seen the light ,I am grateful to their enthusiastic collaboration and hard-working ,and I pray for a bright future for each and every one of us .

ABSTRACT

The industrial revolution 4.0 is considered one of the most attractive topics in the world of today's technology , for it can change the world as we know it , and the most important technology it contributes with is the Internet of Things , The Internet of things has grown to be one of the most developing technologies which interconnect many Engineering fields , and its estimated to be a vital part of our everyday life in the close future .

This technology offers Things or Objects we use in our everyday life like tools and electrical devices the ability to think and connect to the Internet , and that to push its limits and be more useful to mankind , for that the Internet of Things is drawing attention from engineers and researchers for its going to make Humans life easier and more safe , and for the new horizons it can open.

Developers of this technology seek to embed it with large fields such as Agriculture for it can automate the operation and take good care of crops and even harvesting , also protecting the fields from fire and environmental catastrophes . In the medical field this technology can help observing the state of patience in real time , as well as providing health care without the need to stay in hospital , and keep listed record of his data to better study con give a healthy advise .

The (IoT) is already being implemented in the Industrial field and smart homes providing automation and connectivity between all of its different branches , security from external threats, as well as safety from theft and field accidents .

المستخلص

تعتبر الثورة الصناعية الرابعة أهم القضايا التكنولوجية في هذا اليوم ، حيث يمكنها تغيير العالم الذي نعرفه اليوم ، وأهم التكنولوجيا التي تضيفها هذه الثورة هي إنترنت الأشياء ، حيث نمت هذه التقنية لتصبح أكثر المجالات العصرية تطورا والتي تربط عدة تخصصات هندسية ، وما هو متوقع أن تصبح هذه التقنية جزء طبيعي من حياتنا اليومية في المستقبل القريب .

تعطي هذه التقنية الأشياء أو الجمادات التي تتمثل في المعدات والأدوات والأجهزة التي نتعامل معها بشكل يومي نسبة من الذكاء والقدرة على الاتصال بالإنترنت وذلك لتجاوز حدودها المعتادة ورفع مستوى الاستفادة منها للإنسان ،ولذلك تصبح مركز اهتمام المهندسين والباحثين لما فيها من تسهيل لحياة الأنسان وتأمين لحياته وممتلكاته بالإضافة إلى الأفاق التي يمكنها فتحها .

يسعى مطورو هذه التقنية إلى دمجها في المجالات التي تعد الأكثر أهمية في حياتنا ، حيث يمكن تطبيقها في المجال الزراعي وذلك لأتمتة الزراعة والرعاية والري أو حتى الحصاد مع تحقيق انتاجية وجودة عالية للمحصول ، بالإضافة إلى تأمين المحاصيل من الحرائق والكوارث الطبيعية ، أما في المجال الطبي فيمكن مراقبة حالة المريض عن بعد دون الحاجة لبقائه في المشفى ،وتسجيل بياناته المرضية لتوفير رعاية أفضل .

بالنسبة للمجال الصناعي فقد بدأ تطبيق التقنية بالفعل في المصانع الحديثة حيث توفر الأتمتة الكاملة للآلات والحماية من السرقات والتواصل مع الأفرع المختلفة من المنشأة الصناعية والذي بدوره يزيد من السرعة والكفاءة في الأداء . وأخيرا يعتبر تطبيق إنترنت الأشياء في المنازل الأكثر جاذبية حيث يوفر الأمن ضد اللصوص والكوارث المتوقعة مع أتمتة الأجهزة الكهربائية وإمكانية التحكم بها عن بعد حتى بعيدا عن المنزل ، كما ترفع من مستوى الخصوصية وذلك عبر التشفير الإلكتروني للمعلومات والاتصال .

TABLE OF CONTENTS

	page
الآية	I
DEDICATION	II
ACKNOWLEDGEMENT	III
ABSTRACTION	IV
مستخلص	V
TABLE OF CONTENTS	VI
LIST OF FIGURES	VIII
LIST OF ABBREVIATIONS	IX
CHAPTER ONE INTTRODUCTION	
1.1 General Overview	1
1.2 Problem Statement	1
1.3 Objectives	2
1.4 Methodology	2
1.5 Project Outlines	2
CHAPTER TWO LETRATURE REVIEW	
2.1 Industrial Revolutions	3
2.2 The Internet of Things	6
2.2.1 Applications of IoT	7
2.2.2 Architecture of IoT	8
2.3 Internet of Things Platform	9
2.3.1 Smart Homes and Smart Buildings	11
2.3.2 Smart Factories and Manufacturing	11
2.3.3 Smart Agriculture	12
2.4 Microcontrollers overview	13
2.4.1 Microcontrollers components	14
2.4.2 Microcontrollers applications	14
CHAPTER TREE HARDWARE AND SOFTWARE	
3.1 Introduction	15
3.2 Hardware Component	15
3.2.1 The Raspberrypi	15
3.2.2 The ESP8266	18
3.2.3 The Node MCU	18

3.2.4 Motion Detector	19
3.2.5 Smock Detector	20
3.2.6 Wireless Router	21
3.2.7 IC L293D Motor Driver	22
3.2.8 Servo Motor	23
3.2.9 Other components	23
3.3 Programming Languages and protocols	24
3.3.1 Python Programming Language	24
3.3.2 Arduino C and Arduino IDE	25
3.3.3 Hyper Text Markup Language	26
3.3.4 Cascading Style Sheets	26
3.3.5 The HTTP Protocol	27
3.3.6 The MQTT Protocol	28
3.4 Block Diagram of The System	29
CHAPTER FOUR IMPLEMENTATION AND TESTING	
4.1 Introduction	30
4.2 Building the circuits	30
4.2.1 Smart home circuit	30
4.2.2 Smart manufacturing circuit	31
4.2.3 Smart farming (irrigation) circuit	32
4.2.4 Emergency room circuit	33
4.3 Installation of servers and framework	34
4.3.1 Apache2 server	34
4.3.2 MQTT server installation	35
4.3.3 Framework (Flask)	37
4.4 Testing the system	38
CHAPTER FIVE CONCLUSION AND RECOMMENDATIONS	
5.1 Conclusion	42
5.2 Recommendations	42
Reference	44
Appendix	45

LIST OF FIGURES

Figure No	Title	Page No
2.1	Building blocks of Industry 4.0	5
2.2	Examples of smart products	6
3.1	The Raspberrypi 3 model B	16
3.2	The ESP8266–01	18
3.3	ESP8266-01 Pin out	18
3.4	The NodeMCU – ESP-12	19
3.5	Infrared sensor chip	20
3.6	Smock sensor chip	21
3.7	L293D pinout and interior connection	22
3.8	Servo Motor	23
3.9	Arduino Genuino IDE	26
3.10	Block diagram of the system	29
4.1	The smart home circuit	31
4.2	The Smart Factory Circuit	32
4.3	The Smart Irrigation circuit	32
4.4	The Emergency room circuit	33
4.5	Installation of Apache2 web server	34
4.6	Test page showing completion of installation	35
4.7	Installation of MQTT server	36
4.8	testing the MQTT server	36
4.9	Status test for the MQTT server	37
4.10	Installation of Flask framework	37
4.11	The graphical user interface working perfectly	38
4.12	MQTT server at work	39
4.13	Emergency room receiving alert	39
4.14	Motor working after receiving order	40
4.15	Servo motor acting as pivot irrigation	40
4.16	The platform embedded within the facilities	41

LIST OF ABRIVIATIONS

IoT	Internet of Things
IT	Information Technology
ICT	Information Communication Technology
AI	Artificial Intelligence
GE	Global Economy
ITU	The International Telecommunication Union
MIT	Massachusetts Institute of Technology
RFID	Radio Frequency Identification
LAN	Local Area Network
M2M	Machine to Machine
WSN	wireless sensor networks
GPS	Global Positioning System
CPU	Central Processing Unit
GPU	Graphical Processing Unit
SoC	System on Chip
RAM	Random Access Memory
OS	Operating System
IEEE	Institution of Electrical and Electronics Engineering
DIP	Doul In-line Package
IDE	Integrated Development Environment
FACP	Fire Alarm Control Panels
PIR	Passive Infrared
PID	Proportional Integral Differential
HTML	Hyper Text Markup Language
CSS	Cascading Style Sheets
MQTT	MQ telemetry transfer
HTTP	Hyper Text Transfer Protocol