IOT Home Automation

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To my beloved father and mother

ABSTRACT

Internet-of-Things (IoT) is system that broadens the internet services. Applications of IoT are widening. Uses of new technologies in IoT environment are increasing rapidly.A smart home is also one of the applications of IoT. Rapid growth in technologies and improvements in architecture comes out many problems that how to manage and control the whole system, Security at the server, security in smart homes, etc. This project represents the many of IoT application. Smart homes are those where household devices/home appliances could monitor and control remotely. When these home's gadgets connect to the internet using proper network architecture and standard protocols, the whole system can be called as Smart Home in IoT environment or IoT based Smart Homes. Smart Homes ease out the home automation task. This project presents not only the problems and challenges come in IoT and Smart homes system using IoT but also some solutions that would help to overcome on some problems and challenges.The rapid advancement in technology and intelligent instrument can be taken as advantageous to make the home automation systemmore easy and efficient in terms of usage.Internet of Things (IOT) acts as the main core of this smart home system .

ABSTRAKT

Internet untuk segala (IOT) adalah sistem yang meluaskan perkhidmatan internet. Aplikasi IOT dan penggunaan teknologi baru dalam IOT semakin berkembang dengan maju. Rumah yang mempunyai sistem pintar juga merupakan salah satu aplikasi IOT. Pertumbuhan pesat dalam teknologi dan peningkatan dalam seni bina kini banyak memberi masalah dari segi pengurusan dan pengawalan keselamatan keseluruhan sistem. Projek ini mewakili banyak IOT aplikasi. Rumah pintar dapat memantau dan mengawal peranti rumah / peralatan rumah dari jauh. Keseluruhan sistem boleh dipanggil sebagai rumah pintar dalam persekitaran IOT atau Rumah Pintar berasaskan IOT, apabila alat ini menyambung ke internet yang menggunakan seni bina rangkaian yang betul dan protocol yang standard. Rumah pintar meringankan tugas dengan mengawal sistem rumah secara automatik. Projek ini bukan sahaja merupakan masalah sistem dan cabaran yang datang dengan menggunakan IOT tetapi juga memberi beberapa penyelesaian yang akan membantu untuk mengatasi pelbagai masalah dan cabaran. Perkembangan teknologi dan instrumen telah member kesempatan untuk membuat sistem automasi rumah lebih mudah dan cekap dari segi penggunaannya. IOT memainkan peranan yang pertama dalam sistem rumah pintar ini .

TABLE OF CONTENTS

II LITERATURE REVIEW

III METHODOLOGY

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

This chapter is introducing the project background, problem statement, objectives, scope, expected results and the report outline.

1.1 Project Background

Nowadays, the development is too rapid in technology in which everything is automatically operated .It is remarkable idea to involve the technology latest updated

equipment in designing an home automation system. Internet of thing (IOT)can be utilized to develop a smart home system. IOT can be referred as network of physical things interfaced together in the form of electronics, software, sensors and communication network to make up a good system based on the communication of these things.

1.2 Problem Statement

In commercial building, electricity has been one of the main contributors of energy consumption, hence reducing this energy consumption needs a lot of research and project. It has became one of the most important project in universities and electrical institution. The solution is control amount of energy used by monitoring the home's gadgets when needed. The main purpose of this project is to come up with a cost-effective home appliances control system.

1) Difficulties of controlling the home devices from far distance.
2) Waste the electrical energy if don't control the home devices.

1.3 Objectives

The main goal of this project is develop a smart home system based on IOT, hence the objective to be achieved in this project as follow:

1) To design a graphical user interface using hybrid programming for smart phones applications to control home appliances by using android application.

2) To improve home automation system to save energy.

1.4 Scope

The scope of this project includes developing a smart home automation system based on internet of things. The system aims to reduce the energy waste. The system implementation utilizes Intel Galileo to provide a control mechanism to the system. A Smartphone application is interfaced with Intel Galileo to enable the home automation system users to control and monitor their home gadgets conveniently via their smart phones. Sensors and other IOT objects are utilized in this project to make the home automation system much intelligent and energy saver.

Can limit the scope in:

1) Use Intel XDK to develop hybrid programming for smart phones.

2) Control home devices manually via hybrid programming application.

3) Control at anytime and anywhere when users are not able to access them physically.

4) Using hybrid programming application to control home automation system through wireless router.

1.5 Expected Outcomes

Upon the completion of this project it is expected to achieve these results:

1) Produce an implemented system that controls and monitors the house gadgets in different conditions.

2) Utilize an phone application that helps users to control and monitor their devices at home via mobile phones.

3) Produce a smart home system that efficiently reduces energy wastages.

1.6 Report Outline

This thesis includes of five chapters which are presented as follow:

Chapter 1: **Introduction**-This chapter introduces and demonstrates the goal of this project, discusses the problem fundamentals. As well as detail information regarding home automation system

Chapter 2: **Literature Review** - This chapter provides a detailed knowledge of home automation system and taking in the consideration the fundamental concepts of smart home automation system as well as the internet of things objects. It also provides comparison study in other previous related work has been done in smart home automation system.

Chapter 3: **Methodology**- This chapter presents the approaches and procedures used to build this project in sequence. As well as the project flow chart, provide specifications, components used and present the project flow

Chapter 4: **Result and discussion**- This chapter illustrates and analysis the result of this project and discusses the achieved results of the developed system.

Chapter 5: **Conclusion and recommendation**- This chapter provides a summary of the project. The strengths and advantages of the project will be discussed as well. Furthermore, some suggestions for future works will be offered.

CHAPTER 2

LITERATURE REVIEW

This chapter is briefing about the previews studies regarding IOT Home Automation.

2.1 Introduction

The IoTs which is also known as Internet of Things is a simple concept of connection between electronic devices such as smart-phones, Tabs, Internet TVs, computers

and actuators to the Internet. These devices are connected together in such a way that they will be enabling the user to perform new medium of communication between things and things, and also between people and things [1].

The field of IoTs has developed and improved vastly in the last few years due to the inventions and advancement in some related field such as information and communication technologies. Based on [2], a research the usage of devices connected to Internet has reached to almost 100.4 million in the year 2011 and is expected to grow up to about 2.1 billion by the year 2021, with an average grow rate of 36% per year. In 2011, 80 percent of machine to machine (M2M) connections were made over mobile networks such as 2G and 3G and it was expected that by the year 2021, this percentage would rise up and reach to 93%. The growth of the ration is simply because the cost related with M2M over mobile networks are generally cheaper than fixed networks as illustrated in Figure 1. Now everyone, from anytime and anywhere can stay connected for anything and it is expected that these connections will keep extending and create an entirely advanced dynamic network of IoTs.

The advancement of the Internet of Things will revolutionize a number of sectors, from automation, transportation, energy, healthcare, financial services to nanotechnology. IoTs concept can also be implied to create a new system and wide enhancement space for smart homes to provide smart, quality and to improve the quality of life.
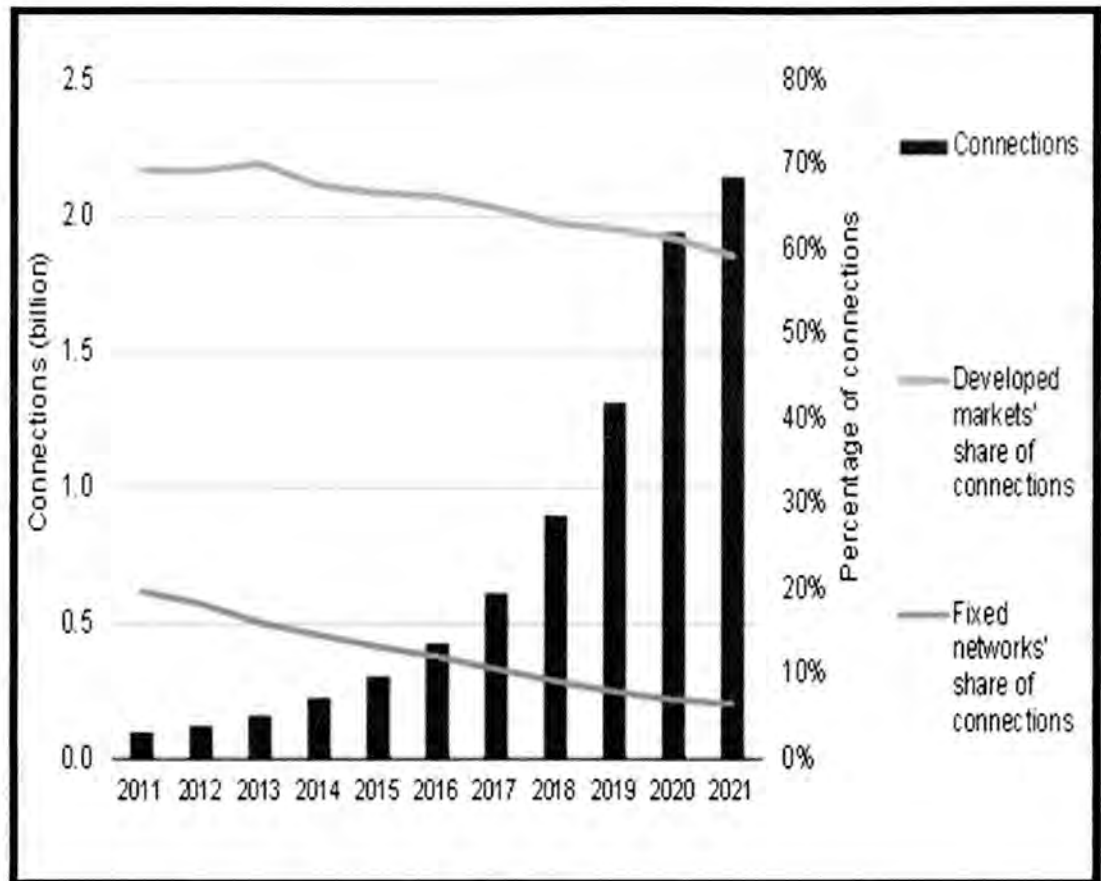
Figure 2.1 M2M device connections and future predictions [3]

Different devices and the appliances in the home such as lightings, air condition, home security and entertainment systems are connected to Internet to make use of the automated system whereby things can be controlled remotely using the Smart phones or Tablets. Not only devices can be controlled, but home environment can also be continuously monitored for maintaining certain desired temperature or monitoring amount of energy consumption [3]. Hence, this will contribute to overall cost reduction and energy saving which is one of the main concerns of today [4].

2.2 Home Automation

Smart Homes (domotic) can be briefed as introduction of technology within the home environment to provide comfortable, quality , security and energy efficiency to its occupants[5]. Having intelligence to home systems can basically increase quality of life for the elderly and disabled people who might face difficulties otherwise require caregivers or institutional care.

There is a significant rise in home automation in recent years due to higher affordability and advancement in Smart phones and tablets which allows vast connectivity. With the implementation of the Internet of Things, the research and implementation of home automation are getting more demands [6].

Much of the research attention has been given in academia. Various wireless technologies that can support some form of remote data transfer, sensing and control such as Bluetooth, Wi-Fi, RFID, and cellular networks have been utilized to embed various levels of intelligence in the home [7].

The studies in [4, 8-14] have presented Bluetooth based home automation systems using Smart phones without the Internet controllability. The devices are physically connected to a Bluetooth sub-controller which is then accessed and controlled by the Smart phone using built-in Bluetooth connectivity. However, due to limited range of operation (maximum up to 100 m) the system is unable to cope with mobility and can only be controlled.

Past researchers have also attempted to give network interoperability and remote access to control devices and appliances at home using home gateways.

[15] introduced a Wi-Fi based home control system using PC based web server which manages the connected home devices. Similar designs have also been presented in [16-19] where a dedicated web server, database and a web page have been developed to interconnect and manage the devices with the Internet. The disadvantages of these systems are twofold.

Firstly, a high end personal computer has been utilized which not only increases the cost of installation but also increases the energy consumption. Secondly, development and hosting of web pages which also add to the cost.

A GSM based communication and control for home appliances has also been presented by [20] where different AT commands are sent to the Home Mobile for controlling different appliances. The drawback of this system is that users are not provided with a graphical user interface and users have to remember different AT commands to control the connected devices. [21] proposed mobile IP based architecture and its potential applications in Smart homes security and automation without any actual deployment and testing.

Lately few researchers have also presented use of Web services, Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) as an interoperable application layer to remotely access home automation systems.

[22] introduced an intelligent home management method over the Ethernet network based on XML SOAP standards. The drawback of using SOAP based Web a service is that it is complex and adds overhead to the client and server when parsing the message, resulting in slower operation and higher Bandwidth.

REST [23] has already presented as a Web-based interaction for controlling household appliances using Web techniques such as HTTP caching and push messaging. Also a Web-based GUI has been developed to manage the home devices. Home automation using Cloud computing has also been proposed by [24, 25] where users were able to control various lights and appliances within their home.

The mentioned systems have made significant contributions to the design and development of home automation systems.

However, the existing works were mainly focused on switching and controlling home appliances or connected devices rather than remotely monitoring of home environment.
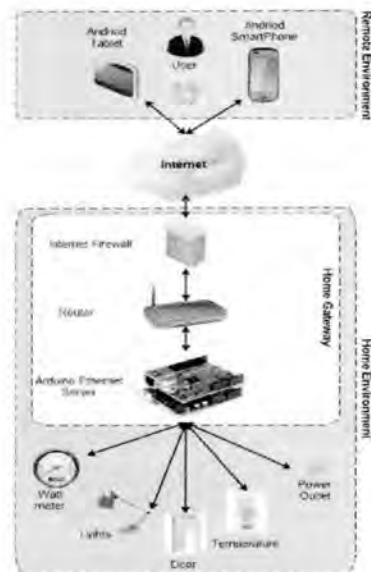
Figure 2.2 Over all home automation system [34]

As Figure 2.2 shows, most of the home automation systems consist of three main layers. Namely: Home Environment, which is the first layer, Home Gateway, which is the middle layer, and the last layer, which is the Remote Environment.

2.3 Smart Home, Smart Building and Infrastructure

The importance of Wi-Fi's keep increasing because home automation has primarily come about due to the networked nature of deployed electronics where electronic devices (TVs and AV receivers, mobile devices, etc.) have started becoming part of the home IP network and due the increasing rate of adoption of mobile computing devices (smart-phones, tablets, etc.), see Figure 2.3.
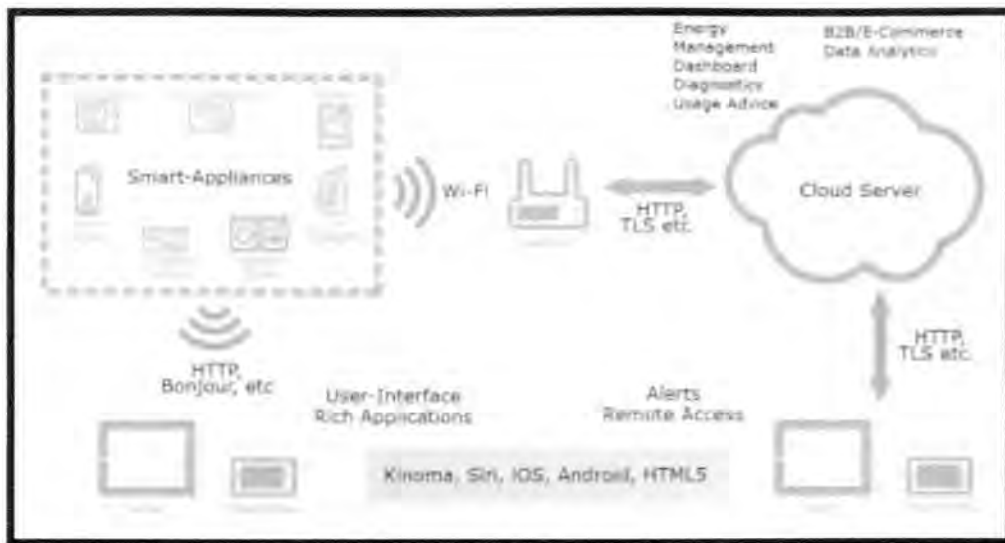
Figure 2.3 Smart home platform [35]

The networking aspects are bringing online streaming services or network playback, while becoming a way of controlling of the device functionality over the network. At the same time mobile devices ensure that consumers have authority to a mobile 'controller' for the electronics connected to network.

Both types of devices can be used as gateways for IoT applications. In this context many companies are considering building platforms that integrate the building automation with entertainment, healthcare monitor, energy monitor and wireless sensor monitor in the house and building environment [26].

IoT applications using sensor to obtain data on operating conditions combined with cloud hosted analytics software that analyze disparate data points will help facility managers become far more proactive about managing buildings at maximum efficiency. Issues of building ownership (i.e., building owner, manager, or occupants) challenge integration with questions such as who pays initial system cost and who collects the benefits over time. A lack of collaboration between the subsectors of the building industry slows new technology adoption and can prevent new buildings from achieving energy, economic and environmental performance targets.

Figure 2.4 Internet of things and smart home concept [36].

2.4 Cloud Computing

The meaning of cloud computing is a highly discussed topic. The U.S. National Institute of standards and Technology (NIST) have stated cloud computing and their publications are generally accepted. Therefore their definition has been adopted by this study. NIST Definition of Cloud is (Mell, P., &Grance, 2011):

"Cloud Computing a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage,