

**DESIGN AND IMPLEMENTATION HOME SECURITY SYSTEM AND
MONITORING BY USING WIRELESS SENSOR NETWORKS
WSN/INTERNET OF THING IOT**

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DEDICATION

For my beloved father, mother, brothers, sisters, family

For my beloved IRAQ

For my beloved supervisor **Dr. LUKMAN HANIF BIM MUHAMMAD AUDAH**



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ABSTRACT

The proposed project is a protection of home security and can be monitored from anywhere in the world. Usually, we read on social media included newspapers regarding the theft and robbery cases at houses almost daily. This is also based on [[Numbeo website]] that provide a database to user every day about house robbery and theft cases. Not only that, accident such as cases of burning due to high temperatures or low humidity which cause the short circuit is increasingly happen too. These cases are one of the most serious problems that occur not only Malaysia, but other countries. It is not regarding the old cases happened, nowadays this accident increasing rapidly and frighteningly. Especially those who own money and jeweler at home to support their living expenses. Therefore, these problems must be solved and reduced by protecting the home by introducing technology for this purpose. Here, the idea of security of the home came to the design of home security system, which reduce the level of theft and alerts the user in case of emergency by sending a SMS when the users enter incorrect password in three times in row to the main door of the house or by using the RFID card that not registered in the system. In addition, the system also can detect gases that may cause death such as CO₂ and etc. The installed sensors and controllers able to detect these gases and give alarm when they are inside the area and monitor them inside out by serial monitor window [[under idea internet of thing (IOT)]]. On the other hand, the system design to detect people entering the house using the human sensors (PIR) where the camera moving directly by servo motor to the detected area and take image. The user can access the images from anywhere in the world via [[Team Viewer.]]

ABSTRAK

Projek yang dicadangkan adalah perlindungan keselamatan rumah dan boleh dipantau dari mana-mana sahaja di dunia. Biasanya, kita baca di media sosial termasuk surat khabar mengenai kecurian dan rompakan itu kes di rumah hampir setiap hari. Ini juga berdasarkan [[laman web Numbeo]] yang menyediakan pangkalan data kepada pengguna setiap hari mengenai kes samun rumah dan kecurian. Bukan itu sahaja, kemalangan seperti kes pembakaran disebabkan oleh suhu yang tinggi atau kelembapan yang rendah yang menyebabkan litar pintas semakin berlaku juga. Kes-kes ini adalah salah satu masalah yang paling serius yang berlaku bukan sahaja Malaysia, tetapi negara-negara lain. Ia tidak mengenai kes lama berlaku, pada masa kini kemalangan ini meningkat dengan cepat dan tampak. Terutama mereka yang memiliki wang dan perhiasan di rumah untuk menampung perbelanjaan hidup mereka. Oleh itu, masalah ini perlu diselesaikan dan dikurangkan dengan melindungi rumah dengan memperkenalkan teknologi untuk tujuan ini. Di sini, idea keselamatan rumah itu datang kepada reka bentuk sistem keselamatan rumah, yang mengurangkan tahap kecurian dan memberi amaran kepada pengguna dalam kes kecemasan dengan menghantar SMS apabila pengguna memasukkan kata laluan yang tidak betul tiga kali berturut-turut kepada utama pintu rumah atau dengan menggunakan kad RFID yang tidak didaftarkan di dalam sistem. Di samping itu, sistem ini juga boleh mengesan gas-gas yang boleh menyebabkan kematian seperti CO₂ dan lain-lain Sensor dipasang dan pengawal dapat mengesan gas-gas ini dan memberikan penggera apabila mereka berada di dalam kawasan itu dan memantau mereka dalam ke luar tingkap monitor siri [[bawah internet idea Perkara (IOT)]]]. Sebaliknya, reka bentuk sistem untuk mengesan orang yang memasuki rumah menggunakan sensor manusia (PIR) di mana kamera bergerak secara langsung dengan motor servo ke kawasan yang dikesan dan mengambil imej. Pengguna boleh mengakses imej dari mana-mana sahaja di dunia melalui [[Team Viewer.]]

CONTENTS

	TITLE	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	CONTENTS	vii
	LIST OF FIGURES	x
CHAPTER	INTRODUCTION	1
1		
	1.0 Chapter overview	1
	1.1 Introduction	1
	1.2 Problem statements	4
	1.3 Project objectives	6
	1.4 Scopes of Project	6
	1.5 Project Achievement	7
	1.6 Thesis Outline	7
CHAPTER	LITERATURE REVIEW	
2		
	2.0 chapter overview	8
	2.1 Introduction	8
	2.2 Types of home security systems and devices	9
	2.3 Wireless Sensor Networks	9
	2.4 Internet of Things	10
	2.5 Related Work	10
	2.5.1 Design of Small Smart Home System Based on Arduino	11
	2.5.2 Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor	11

2.5.3	A Survey based on Smart Homes System Using Internet-of-Things	12
2.5.4	IoT based Smart Home Design using Power and Security Management	12
2.5.5	IoT Based Monitoring and Control of Appliances for Smart Home	13
2.5.6	Design and Implementation of a Wi-Fi Based HomeAutomation System	14
2.5.7	IoT based Monitoring and Control System for HomeAutomation	14
2.6	Proposed the system home security	16
2.7	Summary	16

CHAPTER 3

METHODOLOGY

3.1	Chapter overview	17
3.2	Flowchart of research methodology	17
3.3	Wireless Sensor Network (WSN)	18
3.4	Internet of Things (IOT)	19
3.5	Microcontroller (Arduino)	20
3.5.1	Arduino Hardware	20
3.5.2	Arduino Software	21
3.6	Raspberry pi	23
3.7	Spark Photon	24
3.8	RFID System	27
3.9	Sensors	28
3.9.1	PIR sensor	29
3.9.2	DHT 11 sensor	30
3.9.3	MQ-135 sensor	31
3.9.4	Flame sensor	31
3.10	NRF24L01 Transceiver	32
3.11	16x2 LCD	33
3.12	Keypad	34
3.13	IF THAN THAT THIS (IFTTT)	35
3.14	System Flow chart	36
3.15	Block diagram of the Home security system	37
3.16	Circuit Design	39
3.16.1	Password lock system	39
3.16.2	RFID SYSTEM	40
3.16.3	wireless sensors network	42
3.16.4	Motion detector system	43
3.16	Summary	44

CHAPTER	RESULTE AND ANALYSIS	
4		
4.1	Chapter overview	45
4.2	Practical Results	45
4.2.1	Implementation Motion Detection System	47
4.2.2	Implementation RFID system	50
4.2.3	Implementation password lock system for the door	51
4.2.4	SMS alarm system using photon	52
4.2.5	Implementation Wireless Sensors system	54
4.3	Summary	56
CHAPTER	CONCLUSION AND FUTURE WORK	
5		
5.1	Chapter Overview	57
5.2	Conclusion	57
5.3	Recommendation	58
	REFERENCES	59
	APPENDIXES	65



LIST OF FIGURES

Figure 1.1	. Internet of Things Communication	2
Figure 1.2	The crime rates in Malaysia	5
Figure 3.1	Flowchart of research methodology	18
Figure 3.2	Arduino UNO microcontroller	21
Figure 3.3	Model B of Raspberry Pi 3 unit	23
Figure 3.4	The Spark Photon	24
Figure 3.5	the Spark Web IDE	26
Figure 3.6	RFID sensing module	27
Figure 3.7	List different types of sensors	28
Figure 3.8	PIR Sensor	29
Figure 3.9	DHT 11sensor	30
Figure 3.10	MQ-135sensor	31
Figure 3.11	Flame detector	32
Figure 3.12	NRF24L01 transceiver	33
Figure 3.13	16x2 LCD	34
Figure 3.14	4x4 Matrix Keypad	34
Figure 3.15	if than that this application	35
Figure 3.16	Flow chart of the Home Security System Project	36
Figure 3.17	block diagram of home security system	38
Figure 3.18	circuit diagram for Password lock system	39
Figure 3.19	Circuit Diagram for RFID System	40
Figure 3.20	circuit diagram of photon particle	41
Figure 3.21	circuit diagram of wireless sensors network	42
Figure 3.22	circuit diagram of Motion detector system	43

Figure 4.1	Design Prototype of home security system	46
Figure 4.2	Motion Detection system	47
Figure 4.3	Team viewer software and desktop of raspberry bi	48
Figure 4.4	camera take photo to the detectable event	48
Figure 4.5	photo capturer program in python language	49
Figure 4.6	Implementation RFID System	50
Figure 4.7	Implementation the door lock system	51
Figure 4.8	The applications of IFTTT software	52
Figure 4.9	SMS alarm system using photon	53
Figure 4.10	SMS alarm message	53
Figure 4.11	Implementation Wireless Sensors system	54
Figure 4.12	wireless received data	55
Figure 4.13	arduino software in raspberry PI	55



CHAPTER 1

INTRODUCTION

1.0 CHAPTER OVERVIEW

This chapter provides a general introduction to the research, which includes basic explanations of the problem statements, objectives, and finally the scope of the research.

1.1 Introduction

The smart home concept is the ultimate comfort and luxury for contemporary people based on smart phone and tablet applications. Comfort and convenience are not the only advantage of such smart systems, as they also reduce energy consumption and environmental conservation.

Home automation is to connect various devices and systems in the house together so that they can be controlled from anywhere. The intelligent system controls the following: lighting, heating, ventilation and air conditioning, security and safety, energy saving, remote control by application. There are devices that depend on the system of smart homes, including smart switches that replace traditional switches and smart sensors and others.

When thinking of a home protection system, there is an important issue you need to consider first. Do you want to discover the intruder or thief inside or outside your home? If you want to discover it is still outside your home then you will need to consider an perimeter protection system. If you prefer to detect the thief inside the house, it seems that an internal protection system will work. Some wanted to use a combination of two types of protection systems. You may want to protect certain areas or doors remotely, and at the same time you want to protect some of the interior area, which is called the Hybrids protection system.

Nowadays, embedded system is designed to provide security due to tremendous improvement in microcontroller unit and widespread applications [1]. One of these microcontrollers that can be used is Arduino. The history of Arduino began in 2005, when the founders Massimo Banzì and David Cuartielles wanted to make a device that would be easy to program by non-experts, so that their students in design could build projects that used microcontrollers [2].

Arduino has become more than just a development platform; it has become a culture built around the idea of open source and open hardware, and one that is reimagining computer science and education. Arduino has opened hardware development by making the starting skills easy to obtain, but retaining the complexities of real-world application. This combination makes Arduino a perfect environment for school students, seasoned developers, and designers [3]. The use of the Arduino controller and other types is a good option to automate the houses and make them smart and secure homes. With the introduction of Internet technologies, which means that devices are communicating with each other and receiving some orders through the Internet, there is also a tendency to develop smart homes by introducing this important and modern technology. The Internet of Things is a global network of computers, sensors, and actuators connected through Internet protocols. A most basic example is a PC that communicates over the Internet with a small device, where the device has a sensor attached (e.g., a temperature sensor) [4]. Figure 1-1 shows how a typical IoT device built interact with the Internet.

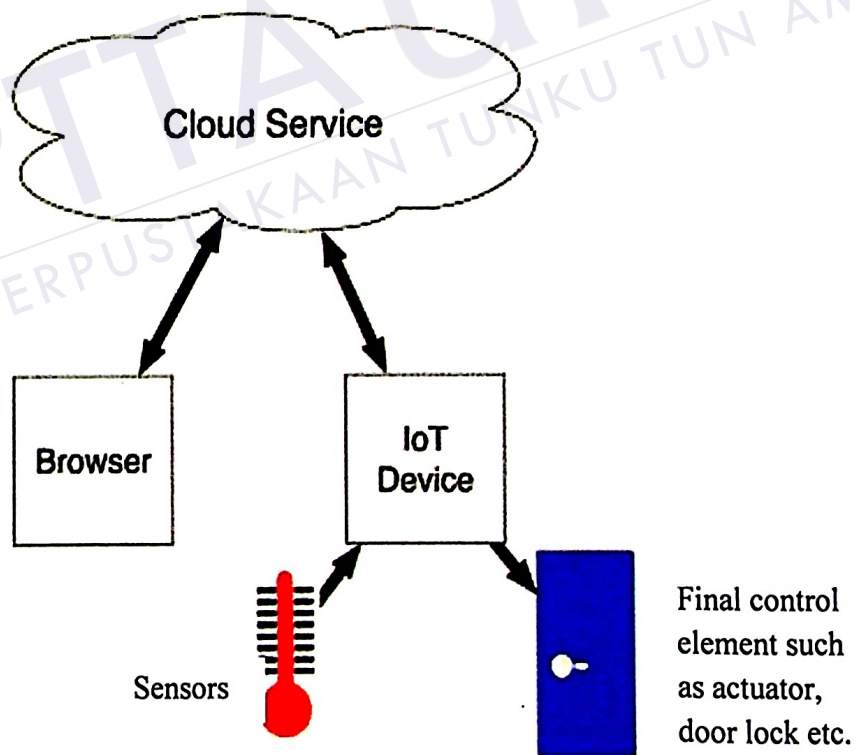


Figure 1-1. Internet of Things Communication

In fact the single most used platform for IoT development is the Arduino microcontroller board, the Raspberry Pi single-board computer, and Spark Photon. The Raspberry Pi are both single-board computers, about the size of a credit card, that run the Linux operating system. They have USB ports and HDMI video output, so you can set them up with a keyboard, mouse and monitor and use them just like a regular computer. The Raspberry Pi boards can use low-cost USB WiFi adaptors and have I/O pins to control electronics an interface with sensors making them quite suitable for IoT projects [5].

Particle's Photon, is a tiny Wi-Fi development kit for creating connected projects and products for the Internet of Things (IoT). It is easy to use, powerful and connected to the cloud. Particle combines a powerful ARM Cortex M3 microcontroller with a Broadcom Wi-Fi chip in a tiny thumbnail-size module called the P0 (P-Zero).

Wireless Sensor Network (WSN) can also be used with IoT in one integrated control system. The Wireless Sensor Network is a set of sensors that are used to transport or track a specific physical or chemical phenomenon (such as heat, humidity, vibration, light, etc.) and then transmit information about the phenomenon wirelessly to a treatment data center to benefit from without the need for the presence of human in the place of physical phenomenon. Wireless sensor network is an important way to study and interact with the physical world. The sensor network usually consists of a large number of small sensor nodes. Each sensor node has one or more sensor components to sense ambient conditions (eg temperature, humidity, pressure) and a component for processing and communication to perform some simple operations on the data and communicate with neighboring nodes. The sensor contract is normally deployed extensively and is communicated to each other via wireless nodes that control and processes the collected data from the sensor nodes, and connects the network to a conventional wired network. Normally the sensor nodes are spread randomly in a custom way to do certain tasks. There is usually no support for sensor network infrastructure.

1.2 Problem Statement

In the past years ago, house robbery is one of the major crimes that are happening in Malaysia and even the whole world. Reducing theft and crime is an important part of Malaysia's plans to become a fully developed country. Crime and the fear of crime effect people's quality of life, sometimes with devastating effect. The high rate of homes theft, needs more effective ways to reduce them,. Waves of house robbery are usually affected by several factors, and although night is the right time for intruders, in some areas, in other areas, house theft is also increasing in midday. In the night some intruders start their activities, after families leave the home and travel to enjoy in holiday, Without taking precautions, the robbers come to theft the contents of the houses after breaking doors or taking off the windows. Based on Numbeo web site that provide database of user contributed data about cities and countries worldwide, the crime rates in Malaysia (last update in November 2017) are shown in figure 1-2 below. security at home is: the protection of the home from several risks you may face, by doing some procedures at home to reduce those risks. As it is clear from above statistics, it is necessary to increase security and protection techniques in a way that reduces or limits theft and crime. It is necessary to follow up and monitor all the things that concern the human and therefore requires the introduction of techniques that meet this purpose. Secure the doors and windows and monitoring the home using mobile cameras and use the sensors to detect any Intruder movement inside the home is the basis for the design of a house able to provide a safe environment and protected in time of detecting the risks of theft or accidents . Hence here comes the idea to proposing a system of security and protection from the dangers of theft and crime within the concept of the home security. We will take into account the most important risks facing the homes and address them through the expansion of the monitoring process and introduce the concept of smart treatment to get quick alarm response. Some of the procedures and laws (tips) that provide smart home security, and if most of them can be assessed as a home financially secure by providing the home some security equipment that plays the role of observer and detector through the addition of different sensors types and functions as well as a mobile camera system. Smart home security is a connect between the various monitoring devices in the house together so that they can be controlled from anywhere, and interact and communicate with each other, by sending and receiving data without human intervention, using several technologies, including the wireless sensor network (WSN), And RFID definition/ identification. It can also be controlled, the home by Internet web or some

applications for smartphones or tablets using Internet Of Things, a sophisticated Internet concept where all objects and devices in our lives have access to the Internet or to each other to send and receive data to perform functions Specific through the network. It is a vastly growing network of physical objects connected to the Internet with an IP address dedicated to it like all the traditional devices we use in everyday life, such as laptops and smartphones.

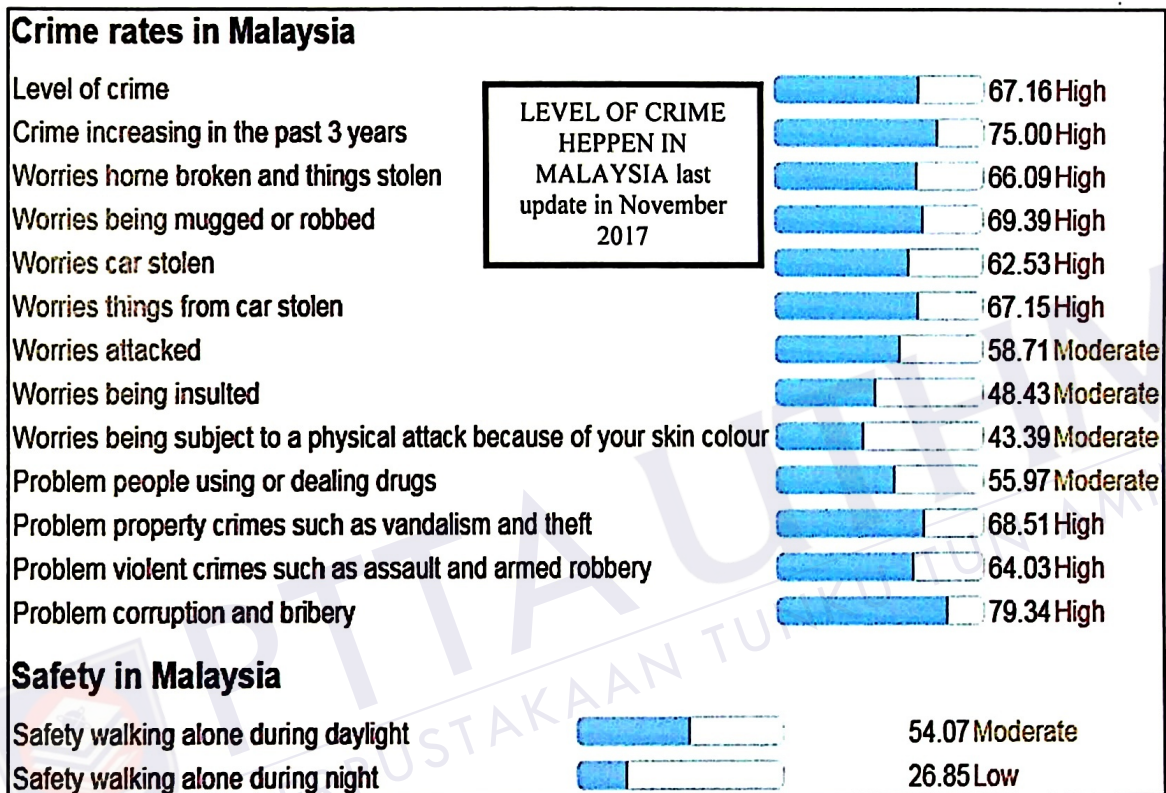


Figure 1-2. The crime rates in Malaysia

1.3 Objective

The objectives of this research project are as follows:

- 1- To design a smart home security system that is able to provide a safe environment in terms of detecting the risks of theft or accidents.
- 2- To develop a prototype of home security system based on concept and of internet of thing (IoT), Arduino microcontroller, sensors and mobile application.
- 3- To evaluate the efficiency of the developed prototype to monitor in real time and control the home security system remotely.

1.4 Scope

To find the practical results required, this thesis will focus on the following:

- 1- Several types of sensors will be used for security and remote monitoring purposes, such as temperature and humidity sensors, PIR sensor, gas sensor, as well as identification devices for individuals entering the home such as RFID and the system of entering the secret code using the keyboard. A mobile camera will also be used.
- 2- Both Arduino, Raspberry pi and Photon will be adopted together as an integrated control panel and introduce modern programs based on electronic remote management such as team viewer to achieve the best efficiency and performance of the proposed security system.
- 3- The final implemented system can be used as an initial model (prototype) for future development and marketing.

1.5 Project Achievement

This project has produce the following list of achievements:

1- Design and implementation home security system and monitoring by using WSN/IOT

The project was successfully implemented and we obtained the required results for which the project was proposed

2- A technical paper which will be submitted to an IEEE indexed journal.

1.6 Thesis Outline

The structure of the thesis starts with the acknowledgement for the project followed by the abstract and continued by the table of contents, list of figure and also the appendices. The thesis consist of 5 chapters, first is the Introduction. Inside this chapter it consists of chapter overview, introduction, problem statement, project objective, scope of the project, Project Achievement and the thesis Outline. The second chapter is literature review, which explains about multifunctional security system and the previously related work that has been done. Methodology is the third chapter which includes the process of research methodology. The software and hardware tools are explained in this chapter. Furthermore, the flowchart and block diagram explanation is included in this chapter. In chapter 4, the result and the analysis of the project have been discussed practically. The final chapter which is chapter 5 concludes the overall conclusion of the project and future recommendations that can be done to improve this project. The final part of the thesis is included with the references list and appendix .

CHAPTER 2

LITERATURE REVIEW

2.0 Chapter overview

This chapter summarizes the related previous work on home security system based on IoT and WSNs and covers types of home security and devices, the related topologies, proposed the system home security. These reviews are based on materials from journals, conference and books.

2.1 Introduction

Feeling safe at home and worrying about it when empty of the main concerns, especially when the house is separated, hidden from the eyes of neighbors or away from other buildings. Nice looking, new home to become a lure of thieves. Because of these risks, many people resign from building the house, and decide that residential complexes gives a greater sense of security.

Security systems can protect people and their needs from intruders. Smart homes can also warn homeowners if there is any emergency, and teach them how to take care of themselves in a natural disaster by associating with the town alarm systems. In the case of fire, for example, the alarm bells wake up the family, the

doors open immediately, the lights light up for safety. Smart House You can control various devices throughout the house from one location as a complete unified system. We can "tell" the house now to open its lids, start a dinner, or turn off the heat at a certain time.

A smart home with monitoring and security for the future will be especially easy for older people. He will be able to tell the inhabitant that it is time to take his medicine and call for help in an emergency. The house will also turn off the lights when not in use, plug the running water and turn off the hot cook. The safe house will work the surrounding environment more easily for the disabled.

2.2 Types of home security systems and devices

There are many systems that are used in the protection and control of homes, whether domestic protection systems or external perimeter protection systems and of course for each type uses devices suitable for the nature of work and function. In general, the devices or sensors used in these systems are commonly used as sensors for people and sensors, as well as sensors for fire, rain and others, as well as the protection of circuit breakers or rooms with a secret code known as identification devices. These systems and sensors have been integrated with Internet technology and remote control and thus it is possible to monitor the house from anywhere in the world.

2.3 Wireless Sensor Networks

While many sensors connect to controllers and processing stations directly (e.g., using local area networks), an increasing number of sensors communicate the collected data wirelessly to a centralized processing station. a wireless sensor has not only a sensing component, but also on-board processing, communication, and storage capabilities. With these enhancements, a sensor node is often not only responsible for data collection, but also for in-network analysis, correlation, and fusion of its own sensor data and data from other sensor

nodes. When many sensors cooperatively monitor large physical environments, they form a wireless sensor network (WSN). Sensor nodes communicate not only with each other but also with a base station (BS) using their wireless radios, allowing them to disseminate their sensor data to remote processing, visualization, analysis, and storage systems [6].

2.4 Internet of Things

The Internet of Things IoT is an emerging global Internet-based information architecture facilitating the exchange of goods and services. The IoT has the purpose of providing an IT-infrastructure facilitating the exchange of “things” in a secure and reliable manner, i.e. Its function is to overcome the gap between objects in the physical world and their representation in information systems. The IoT will serve to increase transparency and enhance the efficiency of global supply chain networks [7].

The essence of the IoT is simply interconnected devices that generate and exchange data from observations, facts, and other data, making it available to anyone. While there seems to be some marketing efforts attempting to make anything connected to the Internet an IoT solution or device (not unlike the shameless labeling of everything “cloud”), IoT solutions are designed to make our knowledge of the world around us more timely and relevant by making it possible to get data about anything from anywhere at any time [8].

2.5 Related Work

There are many projects that have been done before. These projects or researchers is similar with safety and security system project in motion detection camera detected, Microcontroller and microcomputer.

2.5.1 Design of Small Smart Home System Based on Arduino

This project has been developed by Andi Adriansyah and Akhmad Wahyu Dani (2014). Design of Small Smart Home System Based on Arduino [9]. The objective of this paper is to offer a Small Smart Home System designed and created by utilizing WLAN network based on Arduino microcontroller. The system is able to monitor and control lights, room temperature, alarms and other household appliances. The system show proper control and control monitoring functions can be performed from a device connected to a network that supports HTML5.

This smart home system need more security methods such as RFID system and camera for surveillance purposes.

2.5.2 Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor

Another project done by Sanjana Prasad, P.Mahalakshmi, A.John Clement Sunder and R.Swathi (2014). Smart Surveillance Monitoring System Using Raspberry PI and PIR Sensor [10]. This paper deals with the design and implementation of Smart surveillance monitoring system using Raspberry pi and PIR sensor for mobile devices. It increases the usage of mobile technology to provide essential security to our homes and for other control applications. The proposed home security system captures information and transmits it via a 3G Dongle to a Smart phone using web application. Raspberry pi operates and controls motion detectors and video cameras for remote sensing and surveillance, streams live video and records it for future playback. It can also find the number of persons located with the help of the Infrared sensor. For example, when motion is detected, the cameras automatically initiate recording and the Raspberry pi device alerts the owner of the possible intrusion having a smart phone. Raspberry- Pi has two main components interacting with each other: one is the Web Application that executes on the mobile device's browser

and server-side scripts that run in a cloud which will be operated by the Raspberry Pi Hardware tool component.

This security system lacks other things that increase its effectiveness, such as the system of fire predicting and the RFID system. Although the camera records and transmits images through a VNC program, it is not designed to move left or right to track the extraneous objects. This system is limited in application and has not entered the concept of connecting parts with wireless network sensor method to increase its flexibility and performance.

2.5.3 A Survey based on Smart Homes System Using Internet-of-Things

A project that is designed by Mr. Pranay P. Gaikad, Mrs. Jyotsna P. Gabhane and Mrs. Snehal S. Golait (2015). This paper presents A Survey based on Smart Homes System Using Internet-of-Things [11]. This paper 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. As stated above, the research did not implement the solutions put forward, in other words, it did not design them in practice to be invested and marketed to reduce the operations of security threats to homes or companies and thus provide a safe environment.

2.5.4 IoT based Smart Home Design using Power and Security Management

This project has been developed by Jasmeet Chhabra and Punit Gupta (2016). This paper presents the design and implementation of an Ethernet-based Smart Home intelligent system for monitoring the electrical energy consumption based upon the real time tracking of the devices at home an INTEL GALILEO 2ND generation development board, which can be used in homes and societies [12]. The proposed system works on real time monitoring and voice control, so that

the electrical devices and switches can be remotely controlled and monitored with or without an

Android based app. It uses various sensors to not only monitor the real time device tracking but also maintaining the security of your house. It is monitored and controlled remotely from an android app using the Internet or the Intranet connectivity.

This research work focused on one side, the control of the home using the application of Android in mobile phones only and did not discuss or apply control of the house from anywhere in the world using Internet things. It also lacks more security and monitoring. It did not use the identification system or the mobile camera system to connect it with other sensors with a central control system that automatically manages the security of the house

2.5.5 IoT Based Monitoring and Control of Appliances for Smart Home

This work has been developed by Praveen Kumar (2016). This purposed home automation technology provides smart monitoring and control of the home appliances as well as door permission system for interaction between the visitor and home/office owner [13]. The control and monitoring the status (ON/OFF of the appliances) have been implemented using multiple ways such as The Internet, electrical switch, and Graphical User Interface (GUI) interface. The system has low-cost design, user-friendly interface,

and easy installation in home or multi-purpose building. Using this technology, the consumer can reduce the wastage of electrical power by regular monitoring of home appliances or the proper ON/OFF scheduling of the devices.

As noted in the research above, it did not use remote desktop such as VNC or team viewer software, which facilitates the process of management and communication from anywhere in the world and not employ Arduino to work

with Raspberry pi together for more benefits. It also did not integrate wireless sensor network with Internet of things for more reliability.

2.5.6 Design and Implementation of a Wi-Fi Based Home Automation System

A project that is designed by Ahmed ElShafee, Karim Alaa Hamed (2012) this paper presents a design and prototype implementation of new home automation system that uses WiFi technology as a network infrastructure connecting its parts. The proposed system consists of two main components; the first part is the server (web server), which presents system core that manages, controls, and monitors users' home. Users and system administrator can locally (LAN) or remotely (internet) manage and control system code. Second part is hardware interface module, which provides appropriate interface to sensors and actuator of home automation system. Unlike most of available home automation system in the market the proposed system is scalable that one server can manage many hardware interface modules as long as it exists on WiFi network coverage. System supports a wide range of home automation devices like power management components, and security components. The proposed system is better from the scalability and flexibility point of view than the commercially available home automation systems [14]

2.5.7 IoT based Monitoring and Control System for Home Automation

This project has been done by Pavithra.D and Ranjith Balakrishnan (2015), This project proposes an efficient implementation of IoT (Internet of Things) used to monitor and control home appliances via the World Wide Web. The home automation system uses a portable device as a user interface. It is possible to communicate with the Internet connection network using low power communication protocols such as ZigBee, Wi-Fi, etc. With the Wi-Fi as the

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