Ministry of High Education,
Culture and Science City at Oct 6,
The High Institute of Computer Science & Information Systems

المعهد العالي لعلوم الحاسب ونظم المعلومات

Graduation Project:

Smart Home

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better every time.

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We are grateful for their constant support and help.

Project Objectives & summery

The main objective of home automation and security is to help handicapped and aged people that will enable them to control home appliances and alert them in critical situations. Home automation refers to handling and controlling home appliances by using micro-controller or computer technology or smartphone

One of the best things about home automation is that it’s easy to get started and doesn’t require any commitment or major changes to your home or lifestyle. This book shows you how others have applied simple techniques to enhance their families’ enjoyment of their homes. You can adopt just the ideas that match your vision of what a smart home should be, or you can become inspired by what’s possible and undertake great changes to create your very own home of the future.

By installing appliances in your house, such as a smart flashlight, you can now use apps on your mobile device to enjoy complete control of your home's functions from anywhere in the world. Did you leave your home and forget to turn your smart flashlight off? The air conditioner still running at home while you're on vacation. No need to stress. You can quickly and easily power off these appliances in seconds from the respective accompanying apps

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Chapter 1
Introduction

Introduction

Smart Home

technology, also often referred to as home automation or domotics from the Latin "Domus" meaning home, provides homeowners security, comfort, convenience, and energy efficiency by allowing them to control smart devices, often by a smart home app on their Smartphone or other networked devices

With the growth of the Internet, many homes usually have network connections as one of the mandatory things in daily life. Home equipment such as television sets, refrigerators, doors, light controllers, fans and air conditioners come with embedded network capabilities for creating home automation and connecting to other ubiquitous devices (e.g., digital camera, mobile phones). Once several appliances are connected, the solution to manage these devices is required to be effectively controlled. Generally, home automation is concerning on four main challenges [1]. These are (1) high cost of ownership, (2) inflexibility, (3) poor manageability and (4) difficulty achieving security. Several technologies are used to implement a home automation concept to solve home automation issues with different short-range communication technologies. The authors in [2] proposed to remote control home automation via Bluetooth network which is generally used for point to point communication. Their hardware and software are described to perform home automation via testbed. Remote and local controls are useful to support the elderly and disabled people. Another solution, a Zigbee-based home automation system [3], is integrated through a common home gateway that provides network interoperability. Zigbee and Bluetooth-based home automation systems have low installation and running costs. Cellular technology, however, such as SMS based home automation system [4] also has been used to implement home automation with various capabilities to monitor alarms (power, temperature,

Related work

Lighting system:

Features

Lighting system: -Intelligent lighting system for smart homes. the idea is to provide a controllable lighting system through an application that is loaded on phones. The application controls the colors and the intensity of the light generated by the device and thus helps to change the overall atmosphere of the places.

Camera system:

Features

Camera system: **-**Integrated surveillance systems are very effective for reassuring children by looking directly at what is happening. It can also send alerts to the mobile phone that I feel something to call suspicion**.**

.

Sensitive temperature :

Features

Sensitive temperature -It is sensitive to feel the temperature through which the Arduino can send a signal to the air conditioner or the heater to run one.

Smart Home App :

people have smartphonesall the time. So it makes sense to use these to control home appliances. Presented here is a home automation system using a simple Android app, which you can use to control electrical appliances with clicks Commands are sent via Bluetooth and wifi to Arduino

Smart homes allow you reducing energy consumption by powering off home devices not being used. Moreover, smart home your app provides individualized hints on how you can manage your energy more efficiently. Concurrent, they let you customize your home to your personal needs and lifestyle. Hence, it's just a simple app enables energy saving.

Smart home app allows turn off the power lights anytime you want through Bluetooth , it also allows control of opening and closing fan by pressing their own button , smart home app provide gas leak sensor which gives you safe inside your home , In addition, there is a temperature sensor, which we control from outside the house to know the temperature of the house and this is done using the Wi-Fi .

To access all these services - and more in upcoming releases - you will need to log in using your e-mail (username and password).

Our application smart home has numerous special features, which ranks it on the top of other applications providing similar services. the smart home has combined most of the features in other applications and applied it in a user-friendly manner.

The causes that led us to think about the project:

- Inspired by our study during the past academic period that helped us to think about this project, which we benefited from so much so we took care of the most important problems and difficulties we faced, including :
- Difficulty accessing home In case of disasters
- Protect the home from damaging the gas leak
- Difficulty securing the house and controlling the devices from the outside.

Description and objectives of the application:

- Description and objectives of the application:

  The application is designed to make it easier to control the home from anywhere in the world
- The application aims to achieve the following objectives:
- It helps to control lights off from home via Wi-Fi or phone data.
- Easy to control any device outside and inside the home by application
- Easy home temperature control from outside and indoors
- Easy to control gas valve closure to prevent leakage.

Chapter2
Theoretical Background & tools

Technical Background

A technical backgroundis required to understand how the framework works. Home automation concept is introduced following by several required major components such as Raspberry PI, Responsive Web design and a notification system

The home automation concept has been described in many definitions from many researchers. However, the main idea of home automation is to automate home devices, house works or activities. Home automation may include control of light, air conditioner, fan, and appliances, etc. This will provide energy management efficiency, convenience, and security. Presently, research and development in the context of home automation is the trend since ubiquitous devices are increasingly quick and cheap. There are many proposed research concepts in home automation e.g., a framework for cloud-based smart home [5] in order to control home appliances through web services and links with the cloud system which is easy to control them. The authors in [6] propose an intelligent self-adjusting sensor to provide smart home services based on Zigbee communications. Moreover, IEEE 802.15.4 and Zigbee are proposed in [7] to create a smart home energy management system.

Raspberry PI Interfacing Raspberry PI [8] is a single-board computer that is chosen for the system since it is cheap, small, and has a good performance compared to cost ratio and large supported communities. Linux operating system is used in Raspberry PI with ARM CPU operates at 700 Mhz and LAN connectivity. The peak power requirements are low: 700 mA at 5V. Raspberry PI has GPIO (General-Purpose Input/Output) to interface with various sensors. It is able to provide a web server and a database server like a computer desktop which is easier to deploy and also consumes less energy. Raspberry PI has been recently used in many types of research as experimental testbed e.g., interface with secure sensor node for elderly people [9], remote control of domestic appliances to balance demand in the context of smart grid [10] and data integrity for energy management of sensor nodes as home services [11].

Notification System Notification system is a method to notify users of some predefined events. There are many methods that have been used for notification such as SMS, Email, Social network, etc. Most notification systems are used in the context of health care or monitoring patients. e.g., XMPP protocol is used to implement instant notification system in heterogeneous sensor network [12]. However, they are rarely implemented with social network capability. In our experimental scenario, we will implement it with a social network that can be reached to related users immediately.

System Architecture The proposed system is designed, developed and tested, to evaluate the prototype system. The experiment of a circuit part has been set up and connected between home devices and Raspberry PI in order to control home devices e.g., an air conditioner, a fan, and a microwave oven, etc. from mobile phones or tablets anytime and anywhere. This framework is a proof of concept and has been tested at home and the laboratory of the Department of Computer Engineering, Prince of Songkla University, Phuket Campus. Figure 1 shows the home automation architecture framework. It consists of 3 parts: (1) a device control, (2) a notification system (Cacti project [13] and Facebook integration) and (3) a user control.

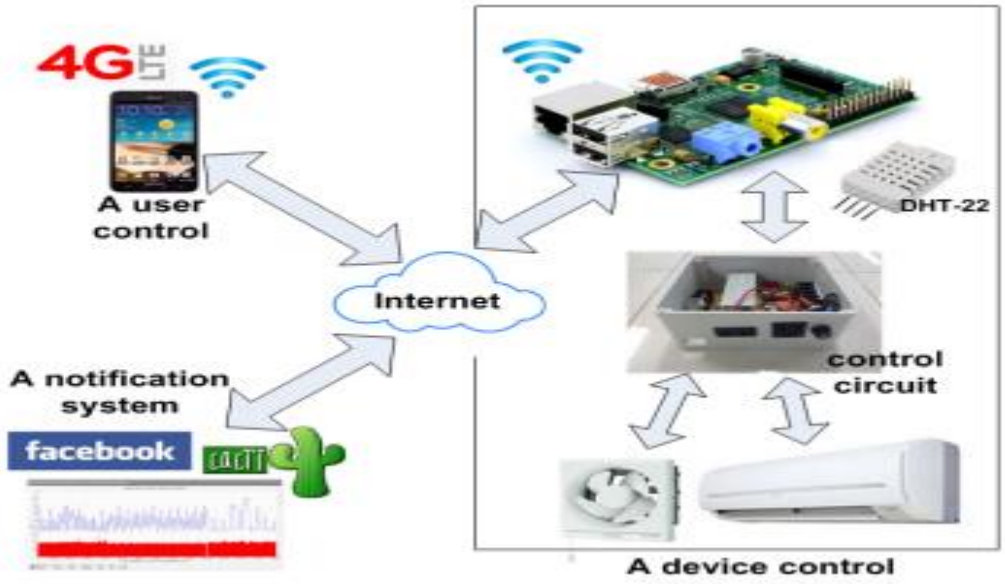

Figure 1. The Home Automation Architecture Framework

A Device Control This part can be divided into 3 sub-parts: • Raspberry PI: It is a microcontroller to interface with various sensors and home devices via our control circuit. Raspberry PI uses GPIO to read various sensor data (e.g., temperature and humidity sensor: DHT-22) and sends control status to command connected sensors or home devices. These processes are implemented by Python programming language. In addition, Raspberry PI stores sensor data in the database (e.g., MySQL) periodically. Figure 2 (as implemented on the responsive web-based) shows that the temperature in a server room is recorded in every 5-10 minutes (this value can be reconfigured). In the case that temperature is higher than a pre-defined threshold, the system will automatically trigger a notification system in part 2. Moreover, Raspberry PI provides WiFi/LAN to connect to the Internet. It is always connected to related users. • Control circuit: It is a circuit that helps to handle home devices with low or high current by connecting between Raspberry PI and home devices as shown in Figure 3. It consists of several electronic components e.g., transistors, options, relays, varistors, and resistors, etc. The control circuit is designed with high flexibility. Various home appliances are supported to associate with it. • Home devices: These are common electrical devices or home appliances that are needed to manage effectively.

A Notification System A notification system runs on Raspberry PI by the Cacti project. Cacti is a front-end RRDtool that gets the data from a database server and generates graphs of temperature or ping latency as shown in Figure 4. This data can be used to help a system administrator to monitor the devices and link to any social network (e.g., Facebook or Twitter). In our testbed, Facebook is
chosen as a notification system since Facebook allows us to create a custom group and adds responsible members to receive alert or notification

Conclusion and future work In this paper, we introduced the concept of home automation through the real-life experiment. The proposed system is designed to manage and monitor home devices over a network in a home or an office environment. The main benefit of the system is a way of managing home devices more effectively. This leads to many advantages (1) energy-saving since there are rare cases that home devices are running without the need, and (2) protecting the device from damages since a system administrator is notified by the social network and the problem can be handled rapidly. Furthermore, the system is flexible and low cost. The total price of the system is less than 100U$. Additional home appliances can be integrated into the system. In future work, this system will mainly be improved in the security issue since home devices at homes or offices directly affect privacy and people life.

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Performance Evaluation of Smart Home System

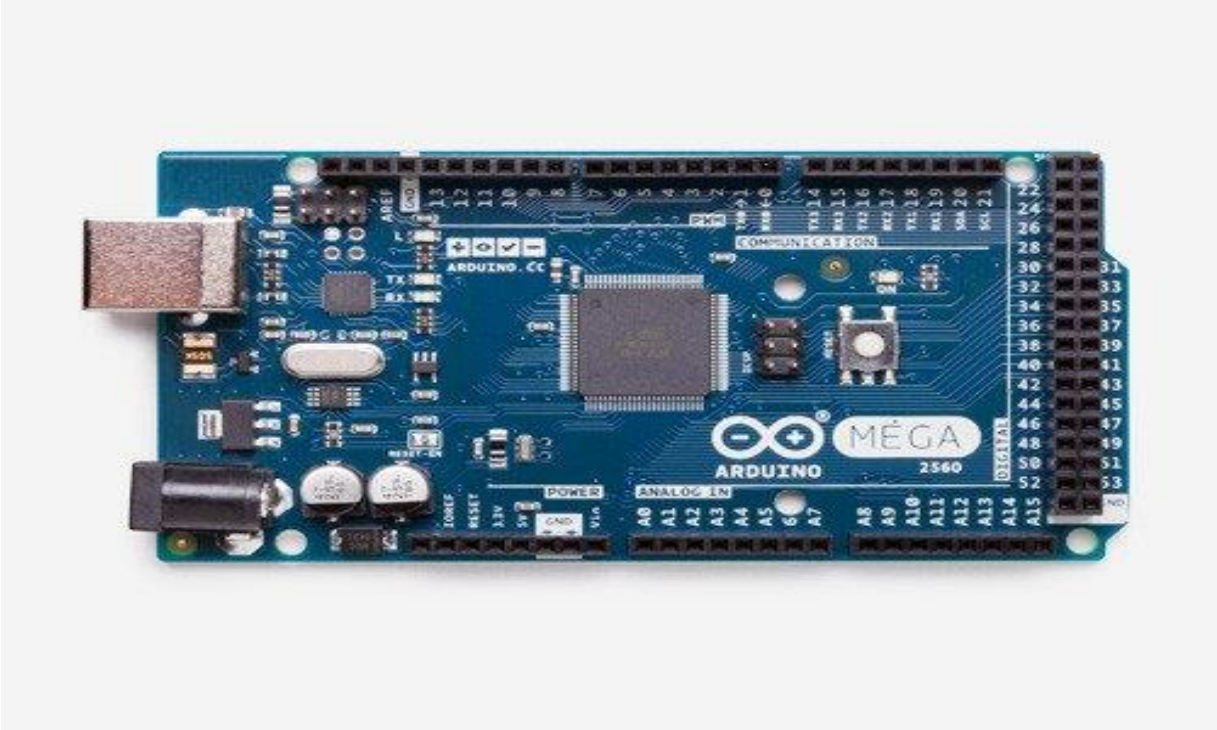
Evaluation evidence will assist in planning for the smart technology set-up as well as training and support services necessary to accompany the provision of new devices and systems.

many researchers have been conducted on smart home. Smart home control system (SHCS) can be integrated into an existing home appliances to reduce the need for
human intervention, increase security and energy efficiency. We have proposed a smart
home system using internet of things and four types of sensors, including PIR, temperature,
ultrasonic, and smoke gas sensor for automatic environmental control and intrustion
detection. In this paper, the performance of the previously developed prototype of smart

Smart homes equipped with ambient intelligence technology institute a promising direction to enable the growing number of elderly to continue to live in their own home as long as possible. However, these calls for technological solutions that suit their specific needs and capabilities. The Sweet-Home project aims at developing a new user friendly technology for home automation based on voice command. This paper reports a user evaluation assessing the acceptance and fear of this new technology. Eight healthy persons between 71 and 88years old, 7 relatives (child, grandchild or friend) and 3 professional carers participating in a user evaluation. During about 45 min, the persons were questioned in co-discovery in the Domus smart home alternating between interview and wizard of Oz periods followed by a debriefing. The experience aimed at testing four important aspects of the project: voice command, communication with the outside world, domotics system interfering a person's activity, and electronic agenda. Voice interface appeared to have a great potential to ease daily living for older and frail persons and would be better accepted than more intrusive solutions. By considering still healthy and independent elderly people in the user evaluation, an interesting finding that came up is their overall acceptance provided the system does not drive them to a lazy lifestyle by taking control of everything. This particular fear must be addressed for the development of smart homes that support daily living by giving them more ability to control rather than putting them away from the daily routine. Keywords Voice interface-Smart home-Ubiquitous computing-User evaluation-Gerontechnology

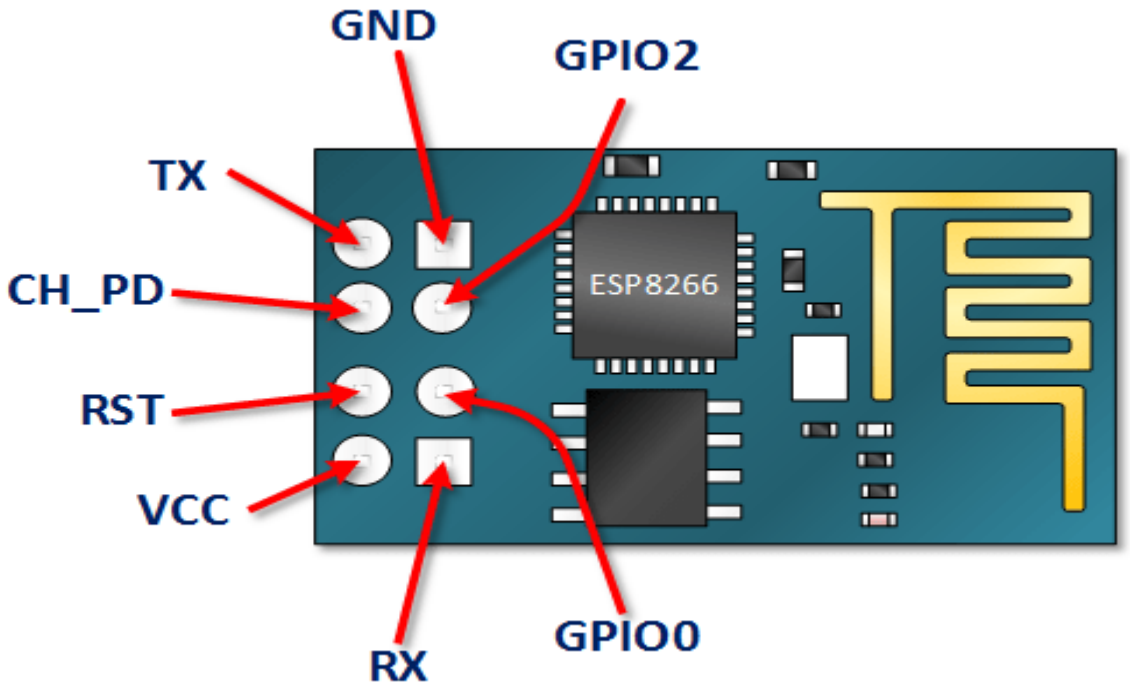
Tools

Arduino Mega:



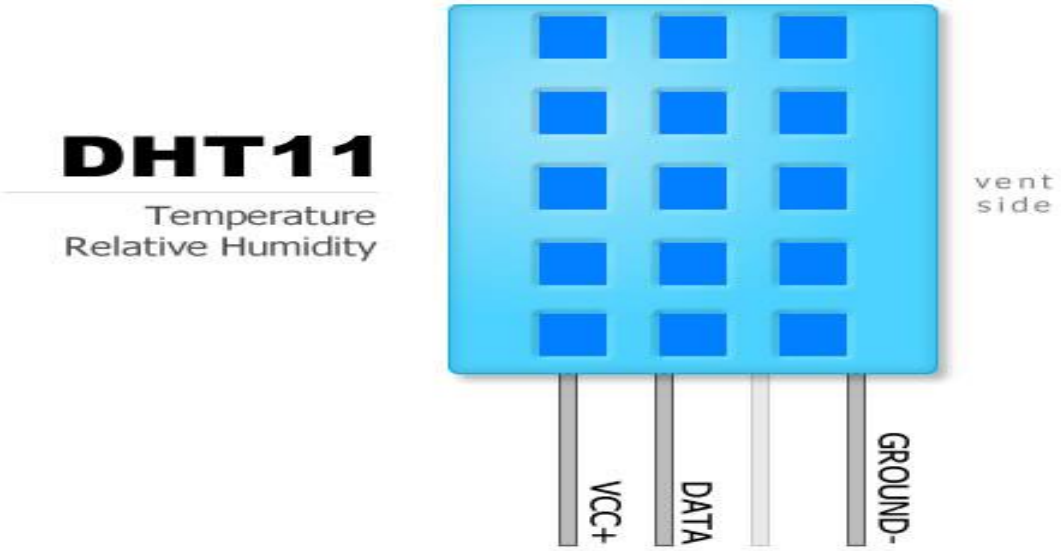
The Mega is Adriano's first ARM-based Arduino development board. This board is based on a powerful 32bit CortexM3 ARM microcontroller made programmable through the familiar Arduino IDE. It increases the computing power available to Arduino users keeping the language as compatible as possible so that many programs will be migrated in a matter of minutes!
The Arduino Mega has 54 digital input/output pins (of which 12 can be used as PWM outputs), 12 analog inputs, 4 UARTs (hardware serial ports), an 84 MHz clock, a USB-OTG capable connection, 2 DAC (digital to analog), 2 TWI, a power jack, an SPI header, a JTAG header, a reset button and an erase button. There are also some cool features like DACs, Audio, DMA, an experimental multi tasking library and more.

ESP8266 Wi-Fi module:



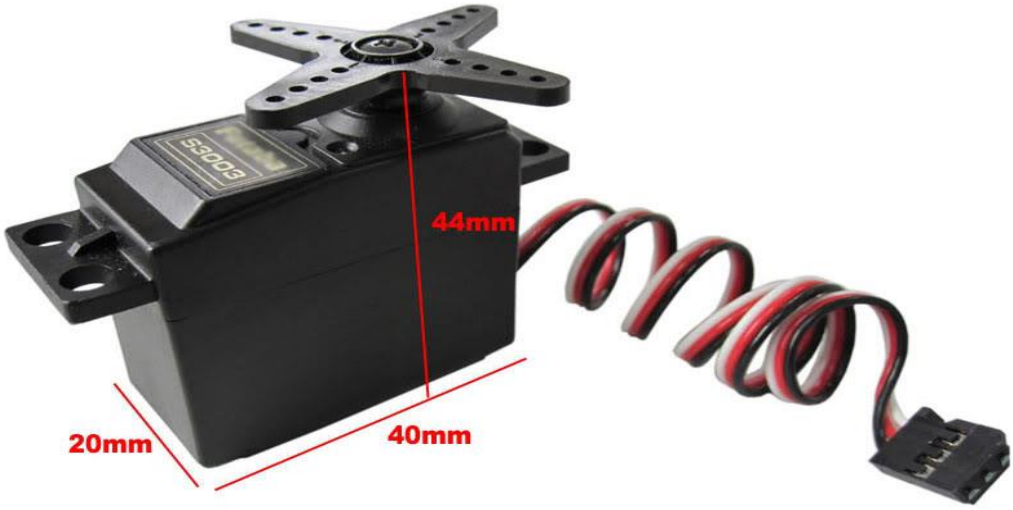
ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.
When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements. ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application-specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch baluns, power management converters, it requires minimal external circuitry, and the entire solution, including the front-end module, is designed to occupy minimal PCB area.

Temperature module:



This is DHT11 is a digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermostat to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed).
Compared to the DHT11, this sensor is more precise, more accurate and works in a bigger range of temperature/humidity.

Servo motor:



This is a 6 kg.cm servo motor. Unlike dc motors, with servo motors, you can position the motor shaft at a specific position (angle) using the control signal. The motor shaft will hold at this position as long as the control signal not changed. This is very useful for controlling robot arms, unmanned airplanes control surface or any object that you want it to move at a certain angle and stay at its new position.

Electronic gas:

Sensitive material of the MQ-5 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exists, The sensors conductivity is higher along with the gas concentration rising. The sensor converts the change of conductivity to correspond output signal of gas concentration.
MQ-5 gas sensor has high senility to Methane, Propane and Butane, natural gas and could be used to detect both Methane and Propane.

Passive infrared sensors:

The PIR sensor itself has two slots each one of them is made of a special material that is sensitive to infrared. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor. This causes a positive differential change between the two half.

Power Supply

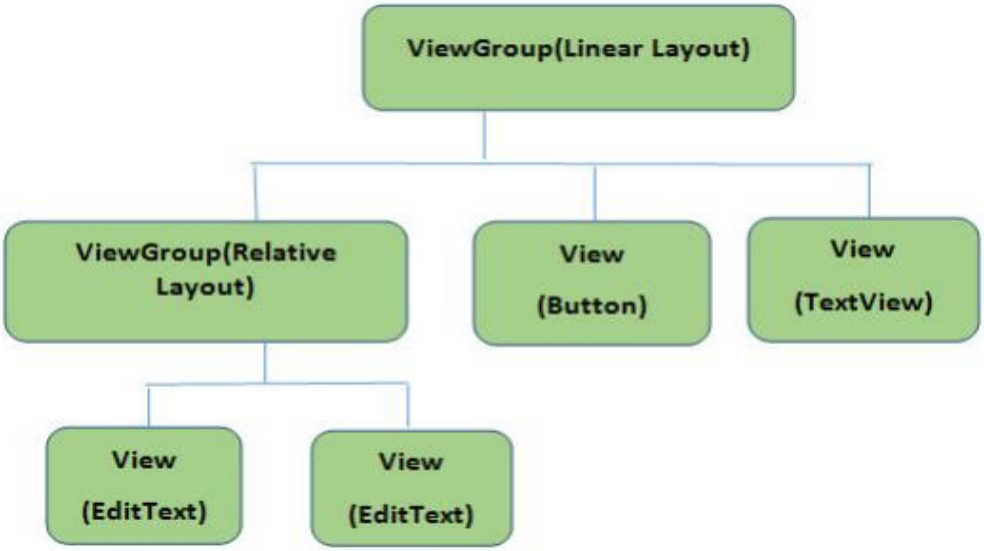
Provides a maximum output power of 230 watts and 12 volts and 9 volts and 6 volts and 5 volts and 3.3-volt High-Flow fan provides efficient cooling for the system and power supply High-quality connectors provide minimal resistance and enhanced electric conductivity Designed and built with high-performance components and power connectors to maximize system performance and durability

Tools used in Android

1_SDK in Android: A software development kit that enables developers to create applications for the Android platform. The Android SDK includes sample projects with source code, development tools, an emulator, and required libraries to build Android applications. Applications are written using the Java programming language and run on David, a custom virtual machine designed for embedded use which runs on top of a Linux kernel

2_XML in Android: Basics And Different XML Files Used In Android: XML stands for Extensible Mark-up Language. XML is a mark-up language much like HTML used to describe data. XML tags are not predefined in XML. We must define our own Tags. XML as itself is well readable both by humans and machines. Also, it is scalable and simple to develop. In Android, we use XML for designing our layouts because XML is lightweight language so it doesn't make our layout heavy.

Basics Of User Interface:



The whole concept of the Android User Interface is defined using the hierarchy of View and ViewGroup objects. A ViewGroup is an invisible container that organizes child views. These child views are other widgets that are used to make different parts of UI. One ViewGroup can have another ViewGroup as a child element as is the case above. Here in the above Diagram ViewGroup (Linear Layout) contains one ViewGroup (i.e. Relative Layout)and two View(Button and Text View). Further, two more View (i.e. 2 Edit Text) are nested inside Relative LayoutViewGroup. It is important

3_Java Language in Android: JAVA is the most popular language in computer science, we have a lot of developers using java more than any other computer language. That is what the Android team just wanted for the initial push of the OS. More developer means more apps, more apps means more publicity, so the best option was JAVA and they preferred it.

4_firebase in Android: Firebase is a mobile platform that helps you quickly develop high-quality apps, grow your user base, and earn more money. Firebase is made up of complementary features that you can mix-and-match to fit your needs, with Google Analytics for Firebase at the core. Firebase allows you to build apps which need authentication, database, file storage, analytics, and server-side functionality without having to own and

Chapter 3

Analysis& Design

System Analysis

User Requirements:

1- control heating and RGB bulbs via touch

2- long and short press support for the alarm button

3- walkout signal on indoor siren can be disabled

4- reboot gateway in advanced settings in the app

5- notification in case of changes in the privacy settings.

System Requirements:

Temperature control. Thermostats adjust heating and air conditioning systems, maintaining the required temperature.

Lighting orchestration. Entryway lighting switches on before people come home, while the dimming control adjusts to outside light intensity.

The locking and unlocking of doors and windows. Welcome guests can enter the house when owners are away, and windows and vent panes close when the weather breaks.

Alerting. The house owner and respective services get alerts in cases of a smoke condition, gas and CO leaks or a break-in.

Naturally, the capabilities of a smart house system are not limited to these examples. The beauty of these systems is that they allow users to create configurations and environments that perfectly fit their specific demands.

Functional Requirement:

The system must allow the user to be able to control all the keys and identify the lamp condition from turning on, off and controlling the gas sensor and controlling the temperature level

Non-Functional Requirement:

Usability Requirement:

The system shall allow the users to access the system from the android platform. The system uses an android platform as an interface. Since all users are familiar with the general usage of android, no special training is required. The system is user-friendly and online help makes using the system easy and also the product will support multiple languages such as Arabic and English.

Availability Requirement:

The system is available 100% for the user and is used 24/7 and 365 days a year. The system shall be operational 24 hours a day and 7 days a week.

Efficiency Requirement:

Mean Time to Repair (MTTR) - Even if the system fails, the system will be recovered back up within an hour or less.

Accuracy:

The system should accurately provide real-time information taking into consideration various concurrency issues.

The system shall provide 100% access reliability.

Framework:

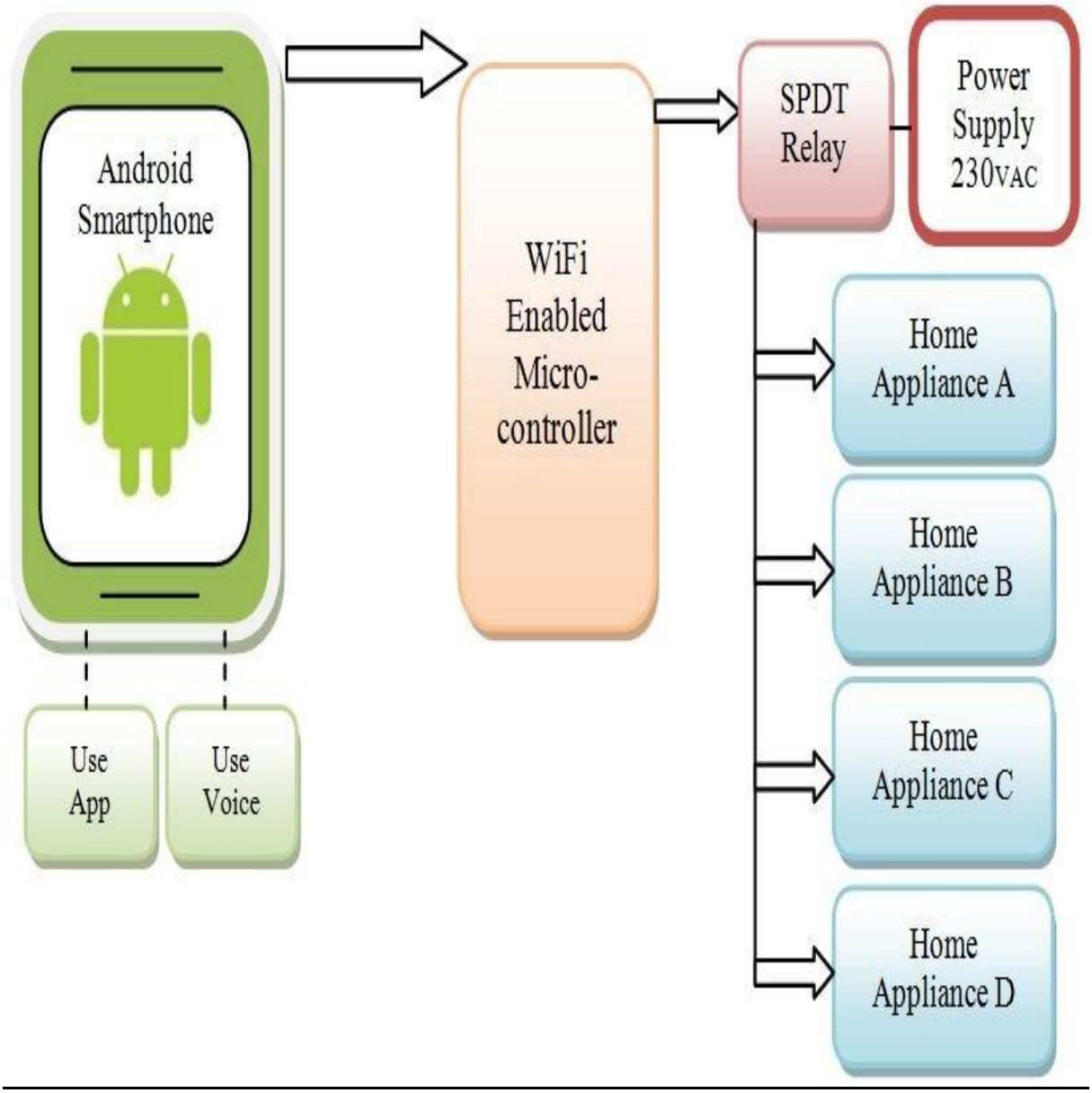


Figure:2 analysis of smart home Diagram

Framework:

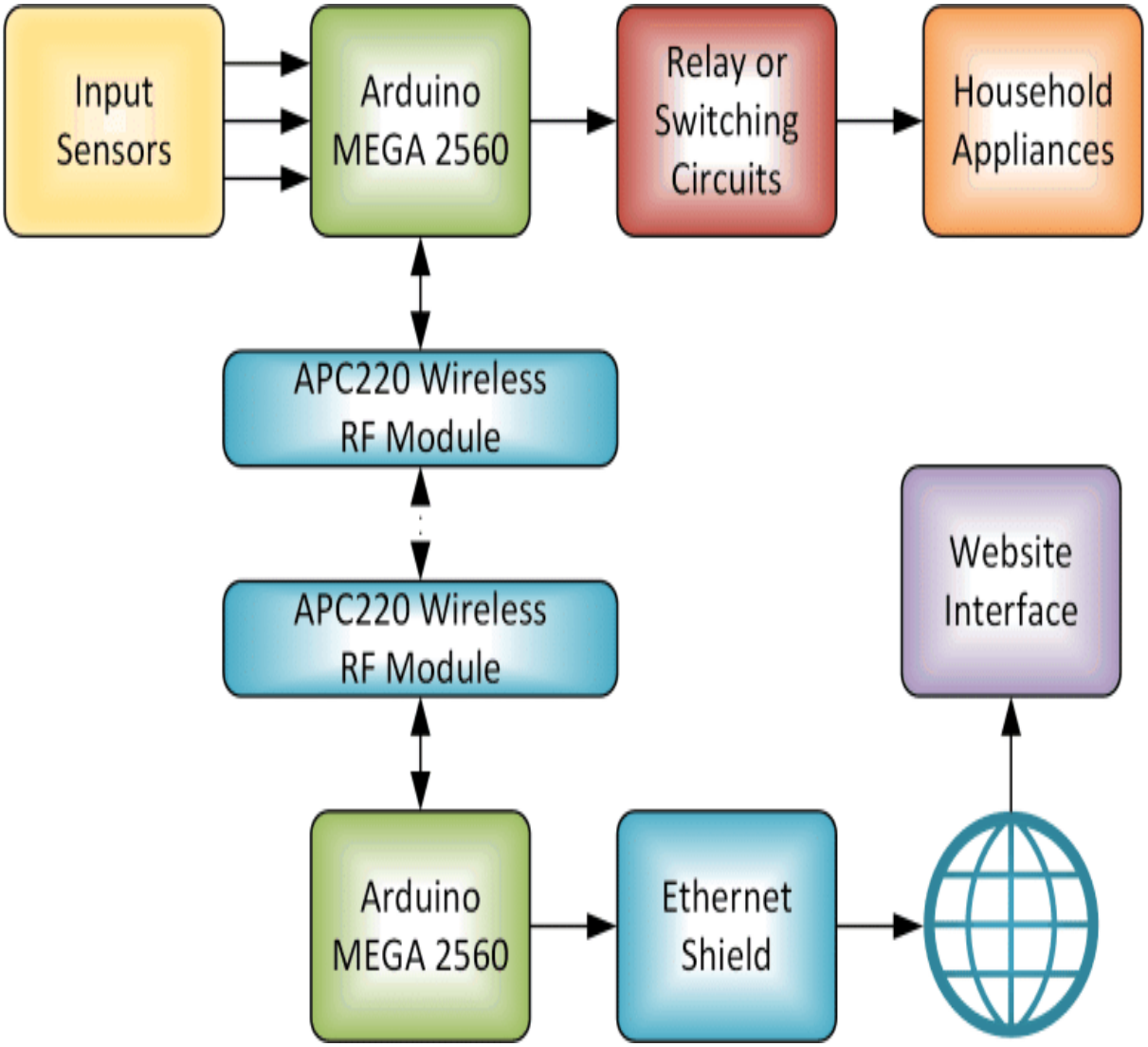


Figure:3analysis of control for web smart home Diagram

use case diagram

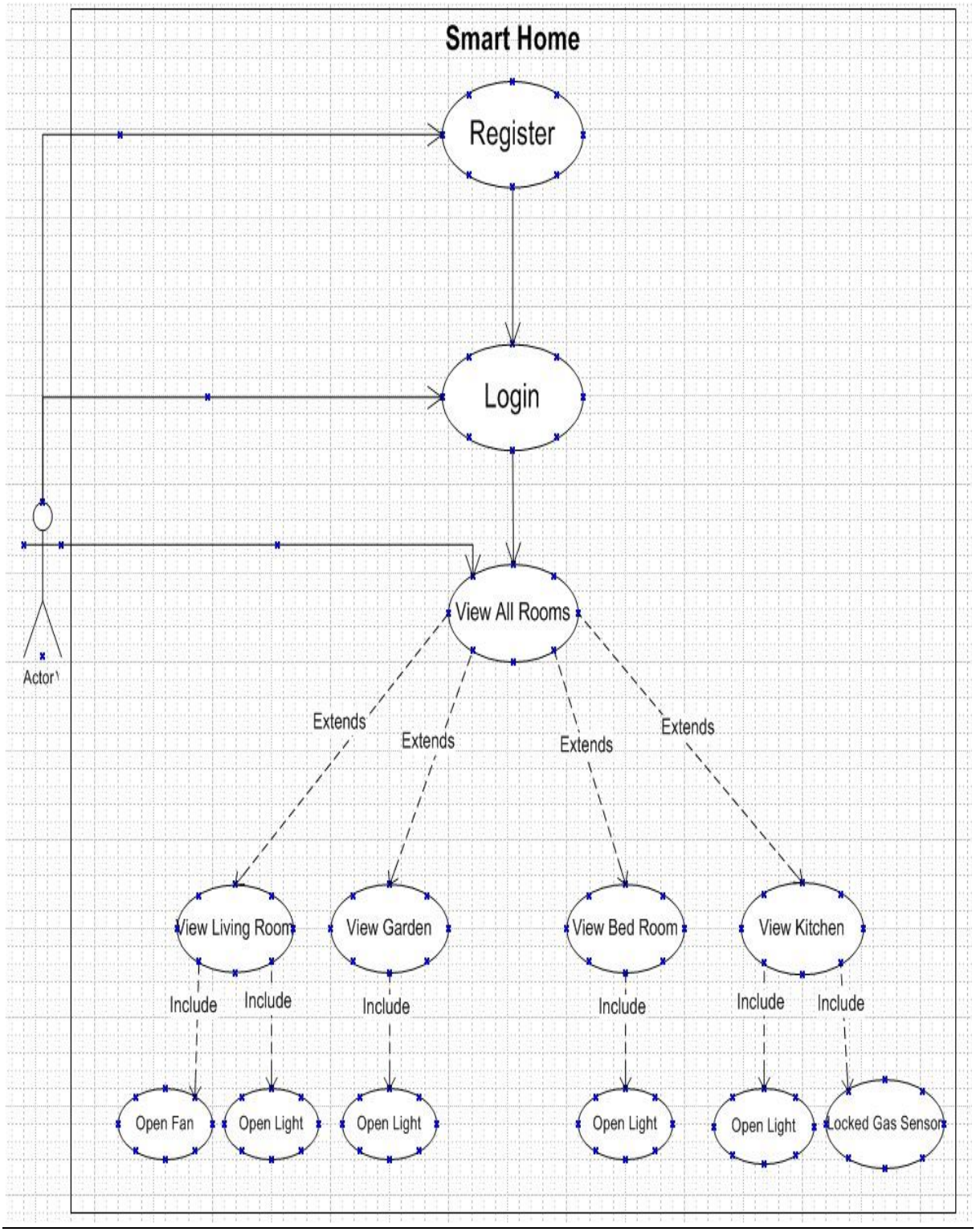


Figure:4 analysis use case diagram

Activity diagram:

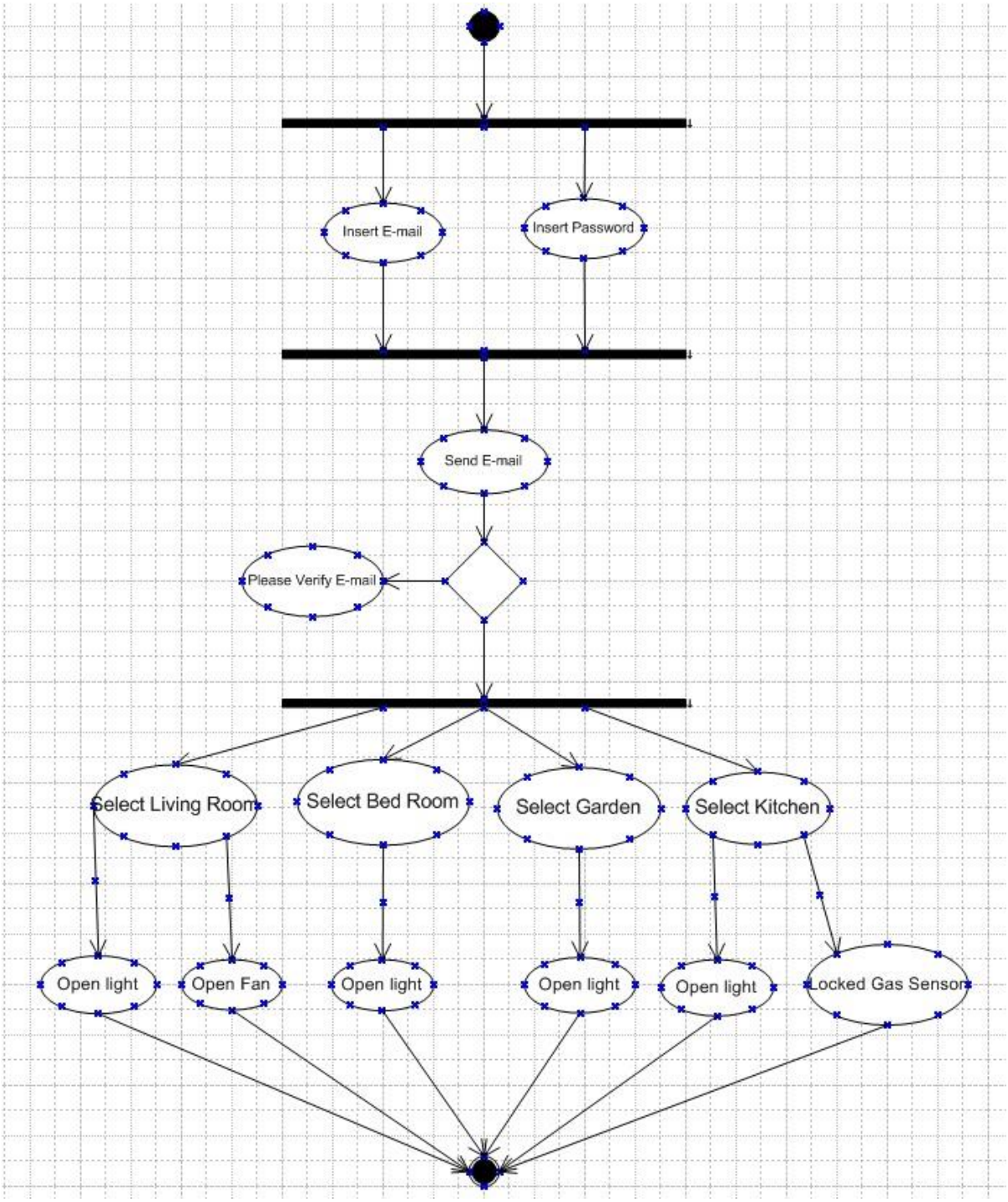


*Figure:4*analysis of the activity diagram

Chapter 4

Project implementation

Code

System light

```
#define PIN_SWITCH_1 30
#define PIN_SWITCH_2 31
#define PIN_SWITCH_3 32
#define PIN_SWITCH_4 33
#define PIN_SWITCH_5 34
#define PIN_SWITCH_6 35

pinMode (PIN_SWITCH_1, OUTPUT);
  pinMode (PIN_SWITCH_2, OUTPUT);
  pinMode (PIN_SWITCH_3, OUTPUT);
  pinMode (PIN_SWITCH_4, OUTPUT);
  pinMode (PIN_SWITCH_5, OUTPUT);
  pinMode (PIN_SWITCH_6, OUTPUT);

digitalWrite(PIN_SWITCH_1, (switch_1==0)?LOW:HIGH);
  digitalWrite(PIN_SWITCH_2, (switch_2==0)?LOW:HIGH);
  digitalWrite(PIN_SWITCH_3, (switch_3==0)?LOW:HIGH);
  digitalWrite(PIN_SWITCH_4, (switch_4==0)?LOW:HIGH);
  digitalWrite(PIN_SWITCH_5, (switch_5==0)?LOW:HIGH);
  digitalWrite(PIN_SWITCH_6, (switch_6==0)?LOW:HIGH)
```

Code

Control of gas sensor and servo motor

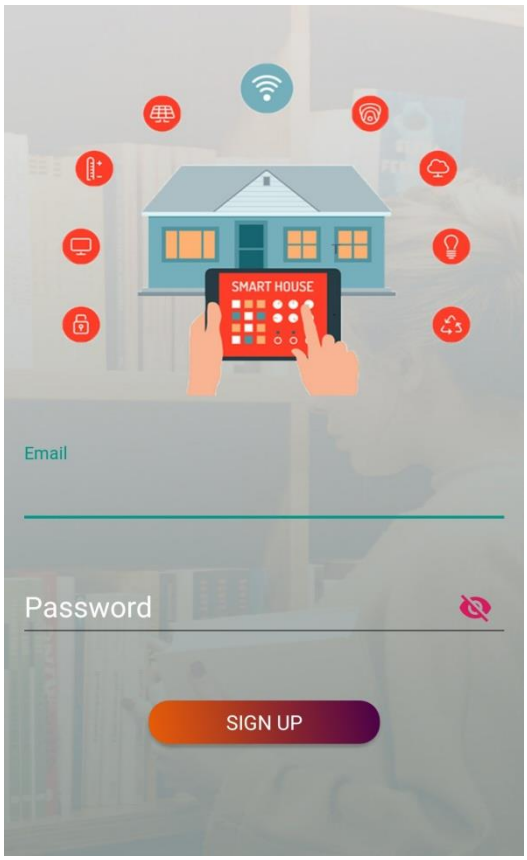
```
int val=analogRead(A0);
  if(val>250)
  {
   digitalWrite(29,HIGH);
    delay(1000);
     digitalWrite(28,HIGH);
    delay(10000)
   }
   else
   {
    digitalWrite(29,LOW);
     digitalWrite(28,LOW);
     }
     Serial.println(val);
      delay(300)
 myservo.write(150);
 delay(3000);
 myservo.write(20);
```

Application Design

Launch Screen:

This screen appears when the program starts, then the user chooses to log-in in case of already having an account or to sign-up in case of not having one.

-This screen appears to each user



Registration Screen:

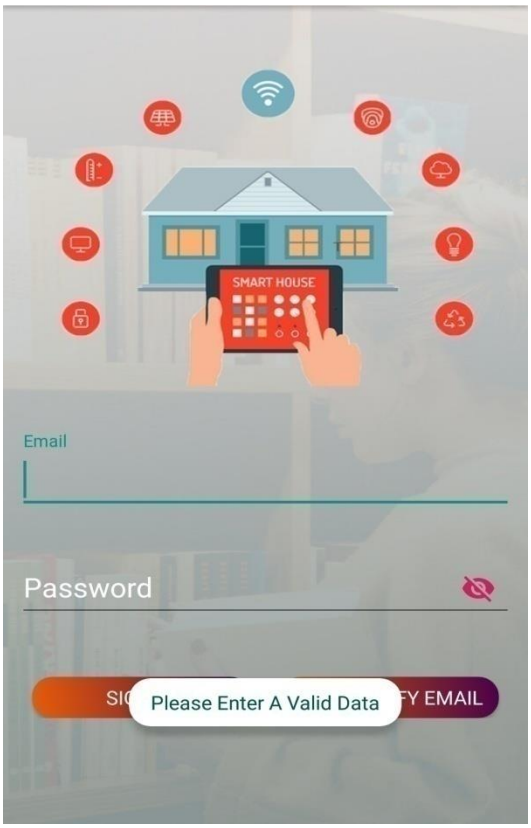
Each user fills his/her information here to sign up for an account.

-For users: they have to use their emails and password accounts to register.

Login Screen:

- Each user enters his/her E-mail and previously selected password.

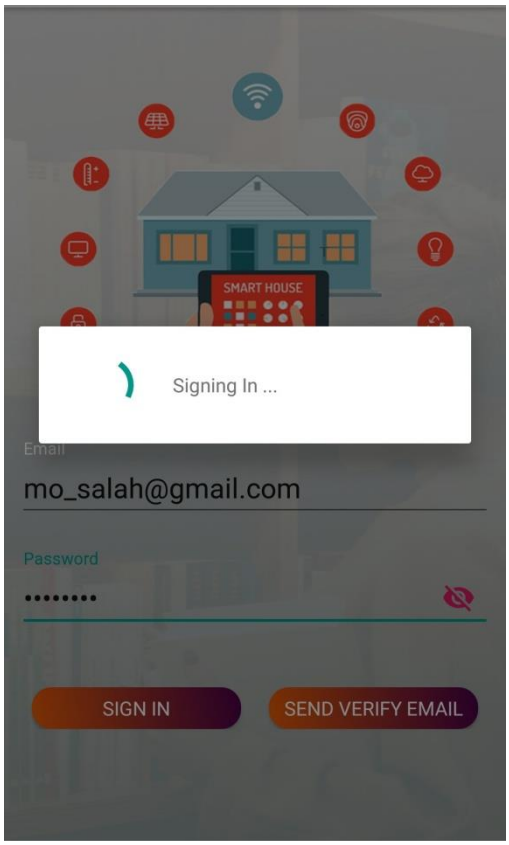
-If user click on Sign in button with empty information , will appear a custom toast include this message "please Enter a valid data" .

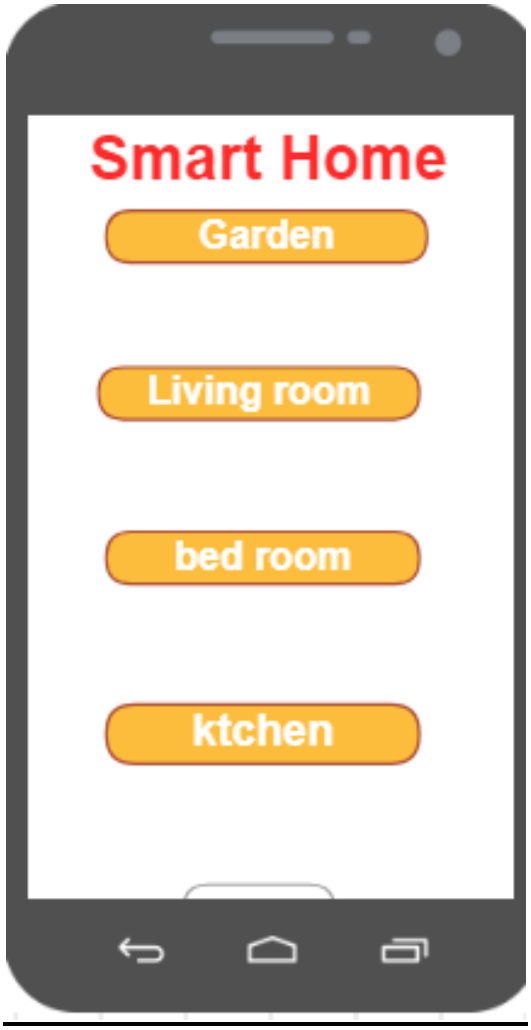


Login Screen:

-If we login with different E-mailwill appear a custom toast include this message "please Sign Up Firstly".

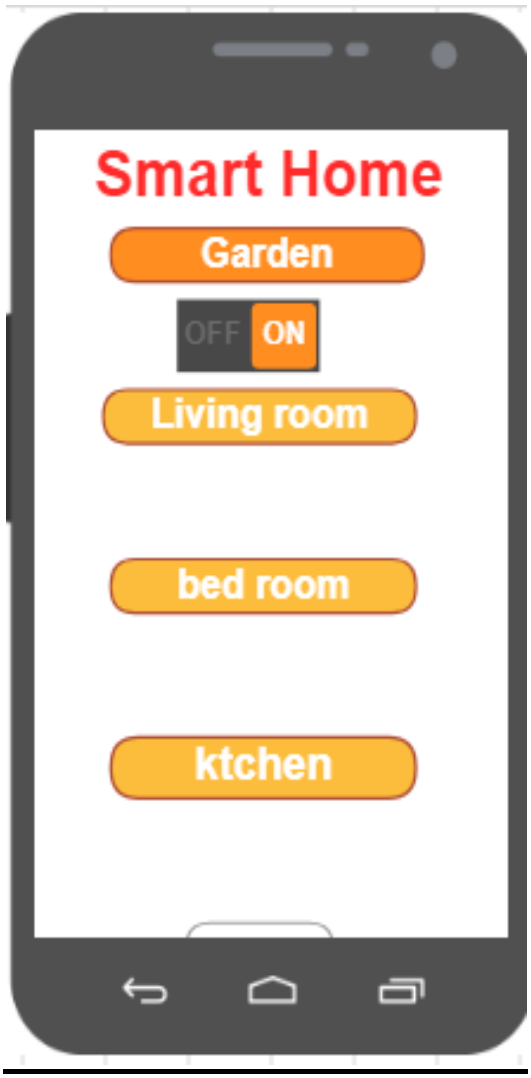
-Finally, after we sign up with the correct e-mail and password directly will appear the Interface Screen.





Interface Screen:

When the user signs in, this screen will appear with four buttons each linked with a pre-defined screen for instance: Button 1: Directs to the garden screen. Button 2: Directs to living room screen.Button 3: Directs to bedroom screen. Button 4: Directs to kitchen screen.



Garden Page:

-Each user will be shown in his/her garden.

-When clicking on the switch button the page will show button to turn on/off the light in the garden.

Living Room Page:

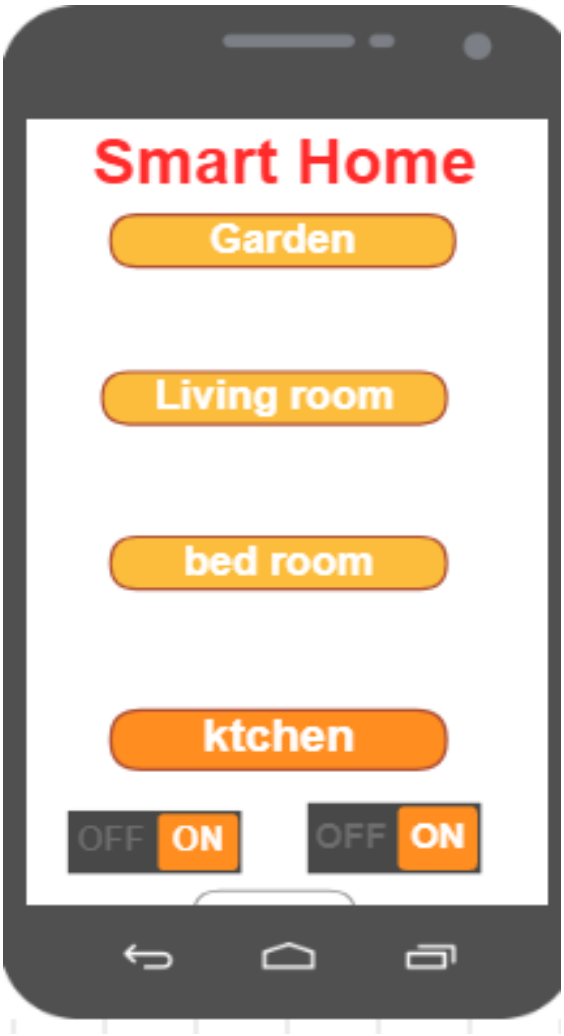
-Each user will be shown in his/her living room.

-When clicking on the right switch button the page will show button to turn on/off the light and the left switch button the page will show button to turn on/off the fan in the living room.

Bed Room Page:

-Each user will be shown in his/her bedroom.

-When clicking on the switch button the page will show button to turn on/off the light in the bedroom.



Kitchen Page:

-Each user will be shown in his/her living room.

-When clicking on the right switch button the page will show button to turn on/off the light and the left switch button the page will show button to turn off the gas sensor in the kitchen room.

Chapter 5
Conclusion

Conclusion

smart home or smart house. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems.[2] When connected with the Internet, home devices are an important constituent of the Internet of Things. A home automation system typically connects controlled devices to a central hub or "gateway".[3] The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet.

Smart home technology uses devices such as linking sensors, features and other appliances connected to the Internet of things (IoT) that can be remotely monitored, controlled or accessed and provide services that respond to the needs of the users.[1] It stands for *Self-Monitoring Analysis and Reporting Technology*. The technology was originally developed by IBM and was referred to as Predictive failure analysis.[2] The first contemporary Smart home technology products became available to consumers between 1998 and the early 2000s.[3] Smart home technology allows users to control and monitor their connected home devices from Smart home apps, smartphones, or other networked devices.[4] Users can remotely control connected home systems whether they are home or away. This allows for more efficient energy and electric use as well as ensuring your home is secure. Smart home technology contributes to the health and well-being enhancement by accommodating people with special needs, especially older people [5][6][7]. Smart home technology is now being used to create *smart cities*.[8]Smart city functions are similar to a Smart home, where systems are monitored to more efficiently run the cities and save money.

Reference

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https://www.arduino.cc/en/Main/Software

[2] arduino board simulation

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[3] Arduino Products

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[4] Arduino create

https://create.arduino.cc/

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[6]Over 500 colors by color name, (N.D), retrieved from http://cloford.com/resources/colours/500col.htm

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[8]Custom ListView with Image View and Text View in Android, (N.D), retrieved from https://www.caveofprogramming.com/guest-posts/custom-listview-with-imageview-and-textview-in-android.html

[1]Learn Java, (2018), retrieved from https://www.codecademy.com/learn/learn-java

Tools used developing the application

arduino IDE https://www.arduino.cc/en/Main/Software

arduino create https://create.arduino.cc/

Android Studiohttps://developer.android.com/studio/

XAMPPhttps://www.apachefriends.org/index.html

Visio https://products.office.com/en-us/visio/flowchart-software

ملخص المشروع باللغة العربية

البيت الذكي

يهدف المشروع الى سهوله التحكم فى المنزل من الداخل والخارج بشكل مريح وسهل عن طريق التحكم فى التطبيق الذي يحتوي على (نظام الإضاءه , وحساس الغاز , وحساس درجه الحرارة , وحساس الحركه)

ويتيح التطبيق من خلال الواجهات الموجودة في الموبيل سهوله التحكم عن طريق الواي فاي في كل شيء في المنزل منها التحكم في نظام الأنارة للمصابيح وتشغيل المروحه وعند تسرب الغاز فى اجواء المنزل يتم غلق صمام الغاز اوتوماتيكياً وأيضاً يعمل حساس درجه الحرارة على قياس درجه الحرارة للغرفه ما اذا كانت مرتفعه او منخفضه فيعمل اوتوماتيكياً ويعمل حساس الحركه على استشعار حركه الانسان ويضيء المصابيح ألياً وما الي ذلك..