VOICE ACTIVATED SMART HOME SYSTEM FOR HANDICAPPED PEOPLE USING A MOBILE DEVICE

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF APPLIED SCIENCES
OF
NEAR EAST UNIVERSITY

By
ABDULQADER JAMEEL OMAR

In Partial Fulfillment of the Requirements for
the Degree of Master of Science
in
Computer Information Systems

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hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name : Abdulqader Jameel OMAR

Signature :

Date:

To my parents, my wife and my kids...

ACKNOWLEDGEMENT

ABSTRACT

The smart home system has been utilized for about a decade. The primary idea is to make a network linking the electronic and electrical apparatuses in a home. This is a developing technology, which has altered the way people survive. The aim of this Thesis is to develop an Android based voice activated system to help handicapped people to use their everyday appliances at home without muct effort. This work presents a flexible and low cost smart home based on Android operating system to communicate with a computer and the web pages using voice activated mobile system. This function is improved to help handicapped people in order to control the appliances in their homes remotely. The proposed system is composed of Arduino Uno mother board and Ethernet shield as a communicator between the Arduino and the computer as the server. The used system is improved by Eclipse Java and Arduino software. Moreover, the proposed system is completely voice activated system, it includes a voice activated authentication using google voice by the combination of Android system and an SMS based system in order to inform the user and a WiFi dependent system. The proposed system can also be controlled manually by clicking on the lamp on the android application, to either turn ON or OFF the light in the house. The system has an automatic voice responding system with the aid of the Text-Speech system to inform the user whether the lamp is ON or OFF. The proposed system is tested and the obtained results are successfully performed. The novelty of the developed system is that it provides feedback in the form of voice to the user about the state of the equipment controlled.

Keywords: Arduino Uno, Android application, ethernet shield, smart home, eclipse java, voice control

ÖZET

akıllı ev sistemi yaklaşık on yıl boyunca kullanılmıştır. Birincil fikri bir evde elektronik ve elektrik aparatları bağlayan bir ağ yapmaktır. Bu insanların hayatta şekilde değişmiş olan bir gelişmekte olan teknolojidir. Tezin ana amacı, engelliler muct çaba olmadan evde gündelik aletleri kullanmanıza yardımcı olacak bir Android tabanlı Sesle sistemi geliştirmektir. Bu çalışma, bir bilgisayar ve ses aktive mobil sistemini kullanarak web sayfaları ile iletişim kurmak için Android işletim sistemine dayalı esnek ve düşük maliyetli akıllı ev sunuyor. Bu fonksiyon uzaktan evlerinde aletleri kontrol etmek için engelli insanlara yardım etmek için geliştirilmiştir. Önerilen sistem Arduino ve sunucu olarak bilgisayar arasında bir iletişimci olarak Arduino Uno Anakartta ve Ethernet kalkan oluşur. kullanılan sistem Eclipse Java ve Arduino yazılımı ile geliştirilir. Ayrıca, önerilen sistem tamamen bu kullanıcı ve WiFi bağımlı bir sistem bilgilendirmek amacıyla Android sisteminin kombinasyonu ve bir SMS tabanlı sistem tarafından google sesinizi kullanarak bir ses aktif kimlik içerir sistemini harekete sesidir. Önerilen sistem manuel olarak da açmak ya, android uygulama üzerinde lamba tıklayarak ya da evde ışık kapali kontrol edilebilir. Sistem lambası açık veya kapalı olup olmadığını kullanıcıyı bilgilendirmek için Text-Konuşma sistemi yardımı ile sistemin yanıt otomatik bir sesi var. Önerilen sistem test edilmiştir ve elde edilen sonuçlar başarı ile yapılmaktadır. geliştirilen sistemin yenilik kontrollü ekipman durumu hakkında kullanıcıya ses şeklinde geri sağlamasıdır.

Anahtar Kelimeler : Arduino Uno, Android uygulama, ethernet shield, akıllı ev, Eclipse java, sesli kontrol

ABSTRACT

The smart home system has been utilized for about a decade. The primary idea is to make a network linking the electronic and electrical apparatuses in a home. This is a developing technology, which has altered the way people survive. The aim of this Thesis is to develop an Android based voice activated system to help handicapped people to use their everyday appliances at home without muct effort. This work presents a flexible and low cost smart home based on Android operating system to communicate with a computer and the web pages using voice activated mobile system. This function is improved to help handicapped people in order to control the appliances in their homes remotely. The proposed system is composed of Arduino Uno mother board and Ethernet shield as a communicator between the Arduino and the computer as the server. The used system is improved by Eclipse Java and Arduino software. Moreover, the proposed system is completely voice activated system, it includes a voice activated authentication using google voice by the combination of Android system and an SMS based system in order to inform the user and a WiFi dependent system. The proposed system can also be controlled manually by clicking on the lamp on the android application, to either turn ON or OFF the light in the house. The system has an automatic voice responding system with the aid of the Text-Speech system to inform the user whether the lamp is ON or OFF. The proposed system is tested and the obtained results are successfully performed. The novelty of the developed system is that it provides feedback in the form of voice to the user about the state of the equipment controlled.

Keywords: Arduino Uno, Android application, ethernet shield, smart home, eclipse java, voice control

CHAPTER 1
INTRODUCTION

The smart home framework has been around for over 10 years (Brush et al., 2011). The significant believed is to shape a framework joining the electronic and electrical mechanical gatherings in a house. This is a making advancement, which has changed the way individuals live. As indicated by the information scattered by the quantifiable looking over and showcase adapting firm ABI around four million Smart home frameworks were sold all around in 2013 (Jain and Singh, 2014). It is in like way assessed by the same connection that ninty million homes worldwide will utilize Smart home frameworks in the coming two years.

There have been a couple business and investigation varieties of the sharp home framework displayed and delivered (Aqeel-ur-Rehman et al., 2014). By and by, none of the understandings have gotten to be through the standard yet other than security frameworks. Sharp home frameworks have become different diverse movements so far and things have been in the business fragment for over one decade. Google and other different affiliations have got involved in this field. Google has reported a yearning wander named Android@Home for keen home stages. Slighting over 10 years of exceptional improvement in the business, no affiliation has yet succeeded to dispatch smart home as a most likely comprehended headway. The reasons of this slip-up have been comprehensively centered around and recorded in (Edwards et al., 2011). A part of the reasons are as indicated by the going with: (a) cost: The present frameworks are outlandish and are controlled by wealthy family with blessings and liberal house, (b) hard to present: master pros are required to present and diagram the framework, (c) hard to utilize: the control interfaces are hard to use and have low quality, (d) merchant reliance: need to utilize separate frameworks for arranged affiliations' machines, (e) less accommodation: the vast majority of the framework can either screen or control the cutoff points, and (f) not changed: a colossal piece of the frameworks are not balanced with the necessities of the clients. Regardless of the already expressed applications, there are besides some assorted reasons, including multi-client issues and security issues (Cubukcu et al., 2015).

Remote correspondence based smart home framework has snatched a high imperativeness two years ago. Remote correspondence lessens the flexible quality identified with the

establishment and upkeep emerged from its wired assistant. A standard remote smart home framework contains battery worked and low power remote sensors and actuators (Amruth et al., 2015). ZigBee, Wi-Fi and Bluetooth are the standard decision for the foundation of such frameworks. Remote framework based wonderful home frameworks have wound up being especially unquestionably comprehended as they give solace, security, and flourishing. Additionally, they strengthen remote checking work environments. The openness of loathsome remote modules, actuators, and sensors has decreased the crevice between the richness and mass business part divisions of smart home degrees of progress (Gwalior et al., 2015). In any case, remote smart home framework has two or three necessities moreover. The antagonistic radio channel, asset confinement, and versatility power challenges for remote smart home frameworks. Notwithstanding these obstacles a couple connection and affiliations have made a remote smart home framework for isolated applications to be specific light control, remote control, sharp vitality, remote thought, security and wellbeing (Gomez and Paradells, 2010). Particularly, this industry has changed radically since the presentation of trashy PCs and tablets. The client interfaces of the smart home frameworks are significantly less unreasonable and clear now. A standard remote smart home framework ought to need to manage the running with destinations: (a) high focus thickness, (b) multipath radio wave duplication, (c) high impedance, (d) multi hop end-to-end framework, (e) dynamic topology, (f) particular activity traces, (g) web openness, and (h) secured correspondence. The honest to goodness test is to manage these destinations by utilizing focuses that have constrained memory and arranging power, and furthermore have restricted working life (Castellano and Canas, 2014)..

An ordinary remote smart home framework includes two key parts particularly the correspondence conventions, and the client interfaces. The correspondence conventions are utilized for having information to and from the machines in the house. The client interfaces are utilized for checking and managing them. There have been separate methodologies suggested for remote keen home business over the past few years. Some of them circuit (i) IP based courses of action, (ii) Waveins, (iv) Insteon, and (v) Z-wave. The Z-wave is a remote course of action made by Sigma Design. This remote custom has been advanced by the Z-wave affiliation (Obaid et al., 2014). The fundamental reason behind the Z-wave is to guarantee a solid transmission of short messages from a control unit to one or more focus focuses in the frameworks. Insteon is a smart home course of action made by

SmartLabs and advanced by the Insteon Alliance. The tremendous piece of Insteon is that it depicts framework topology made out of radio rehash interface and electrical links join. The inside focuses can be Radio Frequency (RF) just or power line interfaces no one yet or can strengthen both sorts of correspondence. Waveins is a low power remote convention made for controlling and checking mechanical gatherings in a home. It is beginning now overseen and advanced by Wavenis Open Standard Alliance (Baig et al., 2012). This convention depicts physical, partner, and driving force layers. Wavenis associations can be gotten to from the upper layer through an application programming interface. The IP-Based strategies have been started by Low Power Wireless Personal Area Network Group of Internet Engineering Task Force (IETF). This working social event has depicted framework for transmission of IPv6 bundles on top of IEEE 802.15.4 frameworks. These frameworks have been named as LowPAN. The LowPAN takes after the cross portion topology and a coordinating convention is utilized for its operation. The work on LowPAN is still in its beginning stages level and it is normal that it will be a making progression for remote smart home framework later on (Kumar, 2012).

Beginning late, ZigBee based approaches have pulled in incredible examinations the remote smart home industry. This advancement was made by the ZigBee Alliance for low-information rate and short-expand applications. ZigBee was anticipated a suite of bizarre state correspondence conventions used to make solitary achieve frameworks (Thakur and Sharma, 2013). The beginning translation of ZigBee depended on upon IEEE 802.15.4 standard. It works in the 868 MHz, 915 MHz, and 2.4 GHz groups in Europe, North America, and general freely. The ZigBee convention stacks made out of four layers to be a specific application layer, framework layer, physical layer, medium access control. The physical layer and the medium access control layer depend on upon IEEE 802.15.4 standard. The ZigBee Alliance has depicted the application layer and driving force layer (Cubukcu, 2015). The ZigBee depicts three segments for the gadgets to be specific (i) co-ordinator, (ii) switch, and (iii) end contraption. The co-ordinator and switch have more handiness emerged from the end gadgets. The ZigBee end contraptions can transmit information over longer segments by strategy for the switch gadgets. The framework layer sponsorships both are tending to and coordinating for tree and work topologies. In tree topology the facilitator goes about as root. In cross segment topology courses are found and kept up on-interest. The Ad hoc On-Demand Distance Vector (AODV) (Bai and Hung,

2008) has been picked as the controlling convention in ZigBee frameworks. Two organizing frameworks are utilized particularly show point, and different to-one. There are a couple application profiles in ZigBee. A standout amongst the profiles will be advanced mobile home profile in Zigbee, which makes ZigBee an suitableness progress to advanced mobile home frameworks. (Patel et al., 2014). This application profile portrays contraption delineations, demands, and qualities for ZigBee applications in private and business circumstances. A part of the livelihoods of ZigBee wire private and business lighting, HVAC, security, remote light switches, electrical meters, activity association frameworks, and other purchaser and mechanical hardware require a short-run remote exchange of information at an all things considered low rate. Considering all the already expressed focal centers we have picked ZigBee (Zhang et al., 2012).

Voice controlled smart home frameworks have pulled in stunning thought the late years. At to begin with, smart home frameworks were gotten ready for the comprehensive group scanning for overabundance and pushed home. Regardless, there was dependably a need to make a smart home framework for the general open with surprising needs, for example, the old people and the people with disabilities. As per a report circled by the World Health Organization (WHO) around 785 million individuals of 15 years and more arranged live with deficiency (Park and Yoon, 2006). Of these, the WHO Survey reports that about 110 million individuals have basic hindrances in working (Cheng et al., 2007). To help the old individuals and the comprehensive group with frailty smart home advances are getting a handle on voice control or voice assertion frameworks.

1.1 The Significance of the Study

With the constant development of cell phones in its prominence and usefulness the interest for cutting edge universal versatile applications in individuals' everyday lives is continually expanding. Utilizing web administrations is the most open and interoperable method for giving inaccessible administration get to or empowering correspondence amongst applications. A smart business sector for smart local and systems administration is spoken to by occupied people groups and people with physical constraints (Baig et al., 2012; Obaid et al., 2014). Hence the study is to develop an android based voice activated system for smart home using a hardware that depends on Arduino Uno Atmega328p with a

combination of Ethernet shield main board that can help busy families, old people and individuals with physical limitations to remotely control their homes with stress.

1.2 The Aim of the Study

The aim of this study is to develop an android based voice activated system for smart home using a hardware that depends on Arduino Uno Atmega328p with a combination of Ethernet shield main board.

1.3 Limitations of the Study

This field bears the accompanying restrictions:

1- Survey problem areas in Wireless connections through the Android system.
2- This work is confined by the period that leads off from October 2014 till March 2016 depending on the models observed in this field.
3- Required software for the connection and recognition of the proposed system with the computers as server and the Android system.
4- The application must be operated in a noise free environment

1.4 Overview of the Study

This dissertation consists of six chapters and characters:

Chapter One gives a general description of voice activated system for smart home, the problem of the study, the aim of the study, the limitation of the study and the overview of the study

Chapter Two talks about related research works on Voice Activated System for Smart Home.

Chapter Three discussed in the theoretical framework of the Voice Activated System for Smart Home.

Chapter Four talks the system development, architecture, etc.

Chapter Five talks about the system implementation.

Chapter Six talks about the conclusion and recommendations of the thesis and for future studies.

CHPATER 2
RELATED RESEARCH

One of the early exploratory takes a shot at the ZigBee based private robotization framework was appeared in Chen and Wabg (2006). This framework could screen window and entryway, water flooding, gas, smoke, gas spill in a neighborhood from a distant territory. Some essential control frameworks, for case, working a valve and sending signs to security framework have also been affiliated with this application.

In ZigBee based remote smart home framework an entry is a basic part. One of such door designing has been proposed in Kawamoto et al. (2007) to interconnect Digital Living Network Alliance (DLNA) reliable home mechanical gatherings and a ZigBee framework. In a near work by Shunyang et al. (2007), another sort of section outline has been proposed to interface a low-rate home work with the web. A customer can control the neighborhood contraptions by method for web from a far away territory through this door.

A ZigBee based power watching framework has been prescribed in Cheng et al. (2007). Notwithstanding ZigBee remote correspondence the power watching framework moreover uses Web associations and Digital Signal Processing (DSP). DSP is utilized for Web Services and continuous power parameters estimation which are utilized for the correspondence base among the disregarded on frameworks a framework. The proposed framework has been acknowledged and improved for the power organization in a grounds.

Another power organization framework has been proposed in Bai and Hung (2008). This framework saves voltage of the electric outlets and the estimation data of current in an inserted board. It can see any over-weight in the framework and send sign to an electrical switch to kill the power.

A consistent home security framework has been proposed in Hou et al. (2008). The framework can isolate gatecrasher in a home and send messages by method for GSM framework. The framework in like manner can get rule from a far territory to control the house mechanical assemblies.

A remote smart home framework considering ZigBee has been exhibited in Wu and Qin (2008). The framework made out of three central bits (i) home server with GSM module;

(ii) savvy environment affirmation sensor modules, and (iii) insightful home mechanical assemblies. By using these modules, a home can be observed remotely and an alert message can be sent to a remote range. An endless piece of the remote smart home frameworks, are obliged by limited working degree. Such prerequisites can be overcome by using multi-skip correspondence framework.

A ZigBee based installed remote control framework has been executed in Chenguyi et al. (2010). The major good position of this framework is that it gives the remote correspondence capacities on an implanted board instead of on a PC. This kind of Embedded board has made framework more diminutive in size and power fruitful.

The impedance between the home contraption and the home framework has been reviewed in Simek et al. (2011). The makers have shown that the locale of the home gadget in a Personal Area Networks (PAN) circumstance basically impacts the execution of the home framework which furthermore works in the same rehash band.

A ZigBee based neighborhood robotization framework and Wi-Fi framework have been asked about on by Wu et al. (2012). The private computerization framework has been acknowledged by using Texas Instrument's MCU gadget LM359B96 in Zhang et al. (2012). Clients can have permission to the framework by a dynamic site page of LwIP TCP/IP convention stack or GSM sms.

The presentations of a ZigBee based smart home framework have been analyzed with those of other advancement based (i.e., WiFi and Bluetooth) frameworks in Rathod et al. (2012). The makers ensured that ZigBee based framework has longer life stood out from WiFi and Bluetooth based smart home framework.

A centrality capable remote sensor framework has been proposed for smart family unit in Byum et al. (2012). This framework utilizes noteworthiness fit sensors. This framework is a condition based self-changing as per decreasing the hugeness use in the neighborhood computerization framework.

A modified Embedded programming period structure has been proposed in Shih and Liang (2012) to make ZigBee programs. The major target is to improve the way of modernized home living circumstances. This structure allows snappy strategy of the supporting

programming for significance control and recognizing contraptions to screen centrality use in a home at whatever point.

The shows of ZigBee advancement have been looked into in Deepak et al. (2013). The presentations of this framework, for occurrence, idleness, got the sign quality marker, and round trek delay have been investigated in this work.

Voice control framework for ZigBee based private robotization has been presented in Zhu et al. (2010). Speaker free modified talk insistence procedure has been utilized. Diverse modes have been utilized for comfort, specifically get trigger mode, voice mystery word trigger mode, and circle confirmation mode. A client can utilize any of the modes depending on the conditions.

A low power voice control structure for the private robotization framework has been proposed in Krishna and Nagendram (2012). In this framework ZigBee framework gets voice request as data to an ARM9 controller, which changes over the data into an obliged association to be utilized as a part of the microcontroller? Eventually, the framework makes some control features to turning ON/OFF the appliances in the house.

A voice control framework considering the customer server for nearby computerization has been appeared in Mardiana et al. (2009). Voice summon is gotten by a customer framework and is sent to a server by method for the Wi-Fi remote framework. The server framework changes over the voice request into a structure that is utilized to control the home machines. Microsoft Speech (SAPI) has been utilized as a part of this work for executing voice insistence framework.

Versatile based voice charge control and watching framework has been executed in Jawarkar et al. (2007), in which artificial intellectual prowess has been utilized for the voice insistence framework. A multi-layer sustenance forward neural framework has been utilized. Another tantamount work has been appeared in Haque et al. (2006). Two controlling frameworks have been proposed, specifically time and talk. For talk assertion Microsoft voice engine contraption has been utilized.

A remote family computerization framework has been proposed for physically tried to control the private devices in Gananasekar et al. (2012). Blemish recognizing verification

framework has similarly been joined into this framework to screen the states of the machines. To give security, RFID based affirmation framework has been utilized. The outcomes appeared in that show that the framework can control up to 20 machines and 40 voice charges can be seen by this framework.

Obaid et al. (2014) proposed a remote sharp neighborhood framework which controlled by voice for elderly and weakened individuals. The proposed framework has two guideline sections to be particular voice attestation framework, and a remote framework. Lab View programming has been utilized to execute the voice certification framework. Obviously, ZigBee remote modules have been utilized to understand the remote framework. In light of the got data at the remote beneficiary associated with the machines pined for trading operations are performed. The proposed framework is an effortlessness and low power framework in light of the way that ZigBee is utilized. Additionally the proposed framework should be arranged of voice request just once.

Another residential computerization system was proposed by Thakur et al. (2013). That demonstrates a system that can be united as a solitary versatile unit and grants one to remotely fans, control lights, aeration and cooling systems, TV sets, security cameras, electronic passages, PC systems, sound/visual apparatus' et cetera and turn on or off any machine that is associated with a divider outlet, get the status of different sensors and take decision in like manner. The general system is controlled from a collector which is joined with HM 2007 talk affirmation chip. This chip sends the voice guidelines in paired progression to microcontroller. The base station unit takes decision and sends the guidelines to the far off station by ZigBee handset.

Khiyal et al. (2009) anticipated a system for controlling home mechanical assembly remotely that is useful for the general populace who are not at home generally. The primary focus of the system is to give security and control the home machines, for instance, AC, lights and cautions. The system is realized by SMS development that is used to exchange information from sender to gatherer over GSM system.

Haque et al. (2006) proposed a system that controls the residential machines utilizing the individual PC. This system is made by using the Visual Basic 6.0 as programming dialect and Microsoft voice motor instruments for a talk affirmation reason. Machines can be either controlled by clock or by voice charge.

Akinyemi et al. (2014) displayed an outline and improvement of an Automated Home Control System (AHCS) utilizing a cell telephone. Where, a cellular telephone went about as a modem for the control of electrical home apparatuses. This is accomplished when the cellular telephone number is dialed and a proper charge catch is squeezed. Also, exhibited how to add to a framework that helped the control of remote gadgets utilizing cell telephones to empower gadgets without infrared, however, joined with force sources to be controlled and thinking about how possible it is of clients to screen the status and utilization of these gadgets. It utilized a programmable interface controller (PIC) to control the exchanging of the yield. At last, this configuration was modified as a focal gadget for four bits of home machines utilizing a transfer to actuate each of the particular electronic devices.

Al-thobaiti et al. (2014) introduced an arrangement and utilization thoughts for a remote persistent smart home structure in light of a central controller (Arduino UNO microcontroller). Where, two operational modes are used in the proposed system. The principal was implied as a manually–automated style from which the customer is able to screen and the devices in the house can be controlled from wherever over the world utilizing the PDA via Wi-Fi correspondence development. The second one was implied a self-robotized mode that enables the controllers to be ready for controlling and verifying particular machines in the accomodation subsequently on account of the signs begins from the relevant sensors. Furthermore, to reinforce the estimation of the hardware utilization, suggested procedure with Matlab-GUI stage for the suggested program was done and the credibility of the structure was displayed.

Babu et al. (2014) aimed at planning a framework which makes working of electrical machines in the home through Android cellular telephone conceivable. The controlling of electrical apparatuses was done remotely through the Android advanced mobile phone utilizing the Bluetooth highlight and voice controlled orders displayed in it. Where, the Android advanced mobile phone was utilized as a remote control for working the electrical machines.

Castellano and Canas (2014) presented the fourth era of a home computerization framework that utilized the open-source JdeRobot system. The framework comprised of a focal hub and a conveyed set of ZigBee remote hub sensor or actuator ones and camcorder

hubs. Additionally a web interface had been sent for the human client access and connection to the framework, so the client can remotely read the present sensor information, see measurements, get cautions and deactivate them, see the video in gushing and send summons to the actuators. The continuous work fabricated a structure to create home automation applications for solace, security, observing and cautions including sensors and actuators at home.

Hossain et al. (2014) presented an approach to manage the control of the electrical and electronic home machines according to the investment of persons using an AVR microcontroller rather than 8051 microcontroller which has altogether inclinations more than 8051 microcontroller. The structure incorporated an infrared sensor circuit which can sense the region of a man, which is more convincing than other sensor circuits. The structure will be started therefore when a man goes into the house and the devices will be controlled by cooperation of persons. Along these lines, the system had been able to be fiscally keen and power saving furthermore an approach to manage minimization of human work.

Jacobsen et al. (2014) characterized a structure development displaying that gave interoperability between remote sensors in home region frameworks joined over the Internet to an organization supplier limit passed on in a cloud base. Where, a key part of this system was the Home Energy Controlling Hub that, from one perspective, gave a stage for checking and gathering of force usage data from devices and machines and, on the other hand, was the association between the sent shrewd automation organizations and the home. Moreover, to ensure openness and straightforwardness, the proposed base relied on upon the representational state trade style development demonstrating. This is grasped by executing the rising ZigBee IP and Smart Energy Profile 2.0 models that to a wide extend fit in with the Internet Protocol suite and forefront web organizations progression.

Jivani et al. (2014) portrayed Global System Messaging (GSM) based secured gadget control structure utilizing App Inventor for Android PDAs. Where, the App Inventor is a most recent visual programming stage for making versatile applications for Android-based moved cells. In addition, the Android Mobile Phone Platform winds up being all the more surely understood among programming engineers, in context of its convincing breaking points and open improvement showing. Where, it is a brain boggling stage for this present

reality interface control, as it offered an agreeable of advantages and beginning now merged a great measure of sensors. Considering all things, no persuading inspiration to shape programming codes to make applications in the App Inventor, rather it gave visual format interface as the way the applications look and utilize squares of interlocking parts to control the application's conduct.

Kumar (2014) displayed an adaptable standalone, irrelevant effort, mind blowing home structure, which depended on upon the Android application relating with the downsized scale web server giving more than the exchanging functionalities. The Arduino Ethernet was utilized to refrain from the utilization of a PC keeping the expense of the general system to a base while the voice incitation was consolidated for exchanging functionalities. Besides, for example, sirens, impedance recognizing evidence sensors, power plugs, light switches, temperature sensors, smoke/gas sensors, current sensors, and dampness sensors had been created in the system to show the achievability and suitability of the recommended home structure.

Madhu et al. (2014) gave a response to keeping the lessening of power in an adequate and fiscally wise method. The structure included a biometric electronic portal jolt and the module of saving power. Exactly the power saving module was traded ON when the customer interesting finger impression matches in passage jolt,. The region of the person in the room was considered when the power saving module switched the machines. It furthermore controlled normal daylight power and the power passed on to air condition and light in accord with the temperature of the room.

Patel et al. (2014) proposed a hardware system using ZigBee and Panda Board as an entryway with the necessity for specific wires and even remotes. While, the remote home area framework doesn't require visible pathway correspondence and the HAS-ZP is a remote home automation system that can be executed in existing home circumstances, without any modification in the base. Home Automation lets the customer control the home mechanical assemblies from his or her propelled cellular telephone or convenient workstation. Where, the delegated exercises can happen dependent upon time or other sensor readings, for instance, light, temperature or sound from any joined contraption in the Home Automation framework, and with the offer of Panda Some help with loading up, starting now going about as a section. Finally, considered end devices like fan, globule,

TV, Music System, portals, windows, et cetera with the single entryway, the structure can control an entire home, paying little heed to the number of rooms or points of confinement where each room will be joined with a lone beneficiary.

Paul et al. (2014) aimed at controlling Home machines by means of Android gadget utilizing WIFI as correspondence, convention and Raspberry Pi as server frameworks. Additionally, they made an easy to use interface for the Android gadget that permitted the client to correspond with the Raspberry Pi server. The server is interfaced with a circuit board that take a control over the apparatuses operating in the dwelling. The correspondence with server permitted the client to choose the suitable gadget. The server spoke with the comparing transfer.

Prasanna et al. (2014) given the idea of discourse acknowledgment being actualized utilizing Hidden Markov Model Toolkit (HTK) in a disconnected from the net way (without web). The human voice was changed over to content utilizing HTK and it is remotely Trans got utilizing GSM modems. As per the got writings machines can be controlled. The module contained a secured discourse recognizer for programmed entryway opening/shutting and a general voice recognizer to control machines like TV, music player, fan, light, and so on. All the above were executed in a minimal effort Raspberry Pi board.

Vacher et al. (2014) proposed an encompassing Assisted Living went for improving the personal satisfaction of more established and handicapped individuals at home on account of Smart Domestics and Home Automation. In any case, numerous studies did exclude tests in genuine settings, on the grounds that information gathering in this space is exceptionally testing and costly, and on account of the couple of accessible information sets. The SWEET-HOME multimodal corpus is a dataset recorded in sensible conditions in DOMUS, a totally equipped Smart Home with collectors and home automation sensors, in which individuals performed Activities of Daily living (ADL). This corpus was made of a multimodal subset, a French home automation talk subset recorded in Distant Speech conditions, and two participation subsets, the first being recorded by 16 persons without inadequacies and the second one by 6 senior and 5 ostensibly debilitated people. This corpus was utilized as a part of studies identified with ADL acknowledgment, setting

14

mindful communication and far off discourse acknowledgment connected to home computerization controlled through voice.

Satria et al. (2015) proposed a versatile application on a Smartphone gadget so that the client can control electronic gadgets; see the measure of stream that has been utilized as a part of the measure of dollars, so the issue is the trouble with sparing power can be determined. Advancement and configuration were finished by gathering information utilizing polls to the respondents. Plan strategy utilizing perceptions, conveying polls and to study writing, and afterward after that does the outline in equipment microcontroller made United Modeling Language (UML), database configuration, code usage and making of client interfaces on IOS and Android. The consequence of this examination is the usage of a remote home automation application in versatile which can help clients so as to control the home and decide the expense of power that has been utilized as a part of each electronic gadget so that the streamlining can be accomplished.

Sen et al. (2015) refered to that automation is a drifting point in the 21st century making it assume a vital part in our day by day lives. The principle fascination of any mechanized framework is diminishing human work, exertion, time and blunders because of human carelessness. With the advancement of current innovation, smart telephones have turned into a need for each individual on this planet. Applications are being created on Android frameworks that are helpful to us in different ways. Another forthcoming innovation is common dialect preparing which empowers us to command and control things with our voice. Joining these, their study shows a miniaturized scale controller based voice controlled home automation framework utilizing smartphones. Such a framework will empower clients to have control over each machine in his/her home with their voice. All that the client needs is an Android smartphone, which is available in just about everyone's hand these days, and a control circuit. The control circuit comprises of an Arduino Uno microcontroller, which forms the client commands and controls the exchanging of gadgets. The association between the microcontroller and the smartphone is built up through Bluetooth, a boundless remote innovation utilized for sharing information.

As indicated by Gupta (2015), the key goal of our framework configuration is to give simple intends to typical, handicapped and maturity persons to control and work home machines. Since home automation is picking up prominence step by step in today's reality,

we require a framework which is reasonable and easy to actualize. Both these qualities are available in our venture which has the ability to supplant existing advances. Commonsense voice acknowledgment unit is used keeping in mind the end goal to store and perceive the client's voice. In addition, this undertaking likewise helps in productive utilization of the power which is an imperative requirement in everyday life.

Amrutha et al. (2015) demonstrated that Voice Recognition is the procedure in which certain expressions of a specific speaker will consequently perceived that depend on the data incorporated into individual discourse waves. Their paper illuminates upon the innovation and mechanical headway in the field of voice acknowledgment and likewise centers upon various steps included for speaker recognizable proof utilizing MATLAB Programming. Voice controlled remote smart home framework has been displayed for elderly and debilitated individuals. The proposed framework has two fundamental segments in particular (a) voice acknowledgment framework, and (b) remote framework. Every home burden will be having two commands ON and OFF commands. Automation of 2 loads, for example, fan and light has been tried by giving 4 voice commands through PC. At the point when client makes his own particular profile and mechanizes the heap discourse acknowledgment precision of more than 90% is accomplished. Other individuals why should permitted robotize the heap by the client can utilize client profile and accomplish a discourse.

Kumar and Shimi (2015) displayed the configuration of the minimal effort voice acknowledgment based home automation framework for the physically tested individuals experiencing quadriplegia or paraplegia (who can't move their appendages however can talk and tune in) to control the different home apparatuses and can impel the bed rise just by the voice commands as indicated by their need and solace. Their proposed framework comprises of a voice acknowledgment module, Arduino uno microcontroller, transfer circuit to and a customizable bed. The voice acknowledgment module should be prepared first before it can be utilized to perceive commands. Upon effective acknowledgment of voice command the Arduino drives the comparing load with the assistance of the hand-off circuit. The flexible bed rise can be set to the three unique modes according to the client solace and need. The exactness of voice acknowledgment module is additionally measured in various conditions. The trial results approve the elements of the proposed framework.

The outcomes demonstrate the framework can give extraordinary right hand to the physically tested individuals with no third individual's aids.

Manikandan et al. (2015) demonstrated in their undertaking the control of gadgets utilizing the voice acknowledgment technique. Here HM2007 programming perceives the voice and it changes over into twofold arrangement and transmits to the principle control gadget by utilizing zigbee handset. Laplace programming is utilized to handle the primary control gadget. The equipment usage can be accomplished by sensors, fan engine controller gadget, Voice acknowledgment gadget and light power control gadgets. With the assistance of this procedure is utilized to control the fan speed and light power by utilizing the voice commands.

CHAPTER 3
THEORITICAL FRAMEWORK

3.1 Smart Homes

A couple of widespread middleware stages focused on home circumstances, changing living game plans into smart homes. The greater part of them analyzed the joining of innovation and organizations through home systems administration for mechanization and an unrivaled personal satisfaction (Kamilaris, 2012).

Association mindfulness in families incorporates home ecological conditions, for instance, temperature, clamminess and brightening, and in addition data about the tenants, for instance, their area, flexibility following and occupant conduct. The Intelligent Home is a recreated wise home environment, populated with machine operators. These operators associate and facilitate to perform home assignments successfully by sharing resources. The House (Amrutha et al., 2015) is a living research facility for the home, with incorporated ubiquitous sensor engineering. The vision of this endeavor was to add to an instructing home, to study innovation that propels conduct change in setting. The Aware Home is another case of a living lab for pervasive figuring research. The innovation used incorporates human position following through ultra-sonic sensors, RF innovation and video, affirmation through floor sensors and vision systems. Microsoft's EasyLiving is a middleware for building clever home circumstances in light of XML informing, incorporating the geometric learning of people, gadgets and spots. The versatile house permits the home to program itself by watching the lifestyle of the occupants and afterward figuring out how to foresee their necessities, by method for neural systems. The Gator Tech smart house makes and passes on extensible smart house progressions, utilizing an organization, arranged Open Service Gateway activity (OSGi) structure that encourages organization association. This work fuses RFID labels, which are appended to electrical gadgets, to consequently see while connecting the gadgets to outlets furthermore a smart floor, which serves as a position-just area system. Figure 3.1 is a depiction of this smart house, where numerous segments of the house present smart conduct (Sen et al., 2015). Dealing with an Adaptive Versatile Home (MavHome) wander uses a progressive disguised Markov model for perceiving the exercises and conduct of the tenants and controlling adaptively the earth, including lights, fans, and small blinds. Taking after a

substitute methodology, iDorm likewise focuses on computerizing a living circumstance, regardless, rather than a Markov model; it shows tenant conduct by learning feathery gauges that guide sensor state to actuator readings speaking to occupant activities. The setting is a grounds living arrangement environment, which is mechanized utilizing cushioned fundamentals learned through perception of tenant conduct. At long last, the work performed in showing that inescapable, clear sensor gadgets can be used to see exercises of everyday living from genuine homes. It is an early endeavor to see exercises of enthusiasm, for instance, toileting and washing, by method for guileless Bayes classifiers, with revelation correctnesses extending from 25% to 89%, contingent upon the assessment criteria used (Werner-Allen et al., 2010).
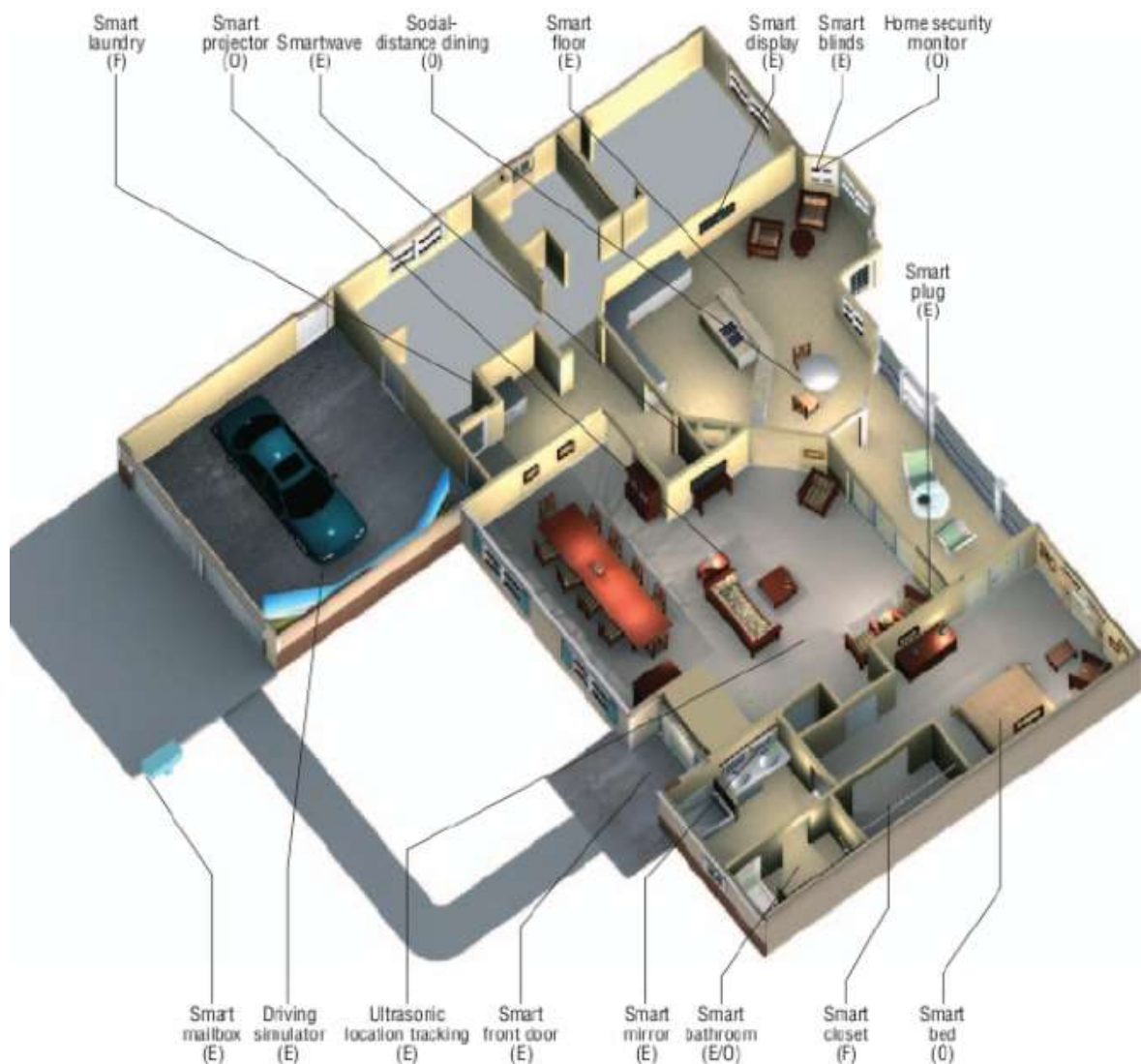

Figure 3.1: The Gator Tech smart house (Kamilaris, 2012)

3.2 Smart Homes and the Web

The expanding acknowledgment of the Web of Things (WoT) and the potential made from the act of Web-empowering physical gadgets and ordinary articles, enlivened scientists to apply the Web standards in the smart home space. At the start, smart home endeavors fused WS - for communications with family unit gadgets. Aiello (2010) proposed an infrastructure for residential networks based on WS-*, to address gadget heterogeneity. The author considers the part of Web administration for interoperability of home appliances, after listing diverse scenarios for smart home, for example, the X10 convention and shut gateways from remote administration suppliers. The idea of this approach is displayed in Figure 3.2.
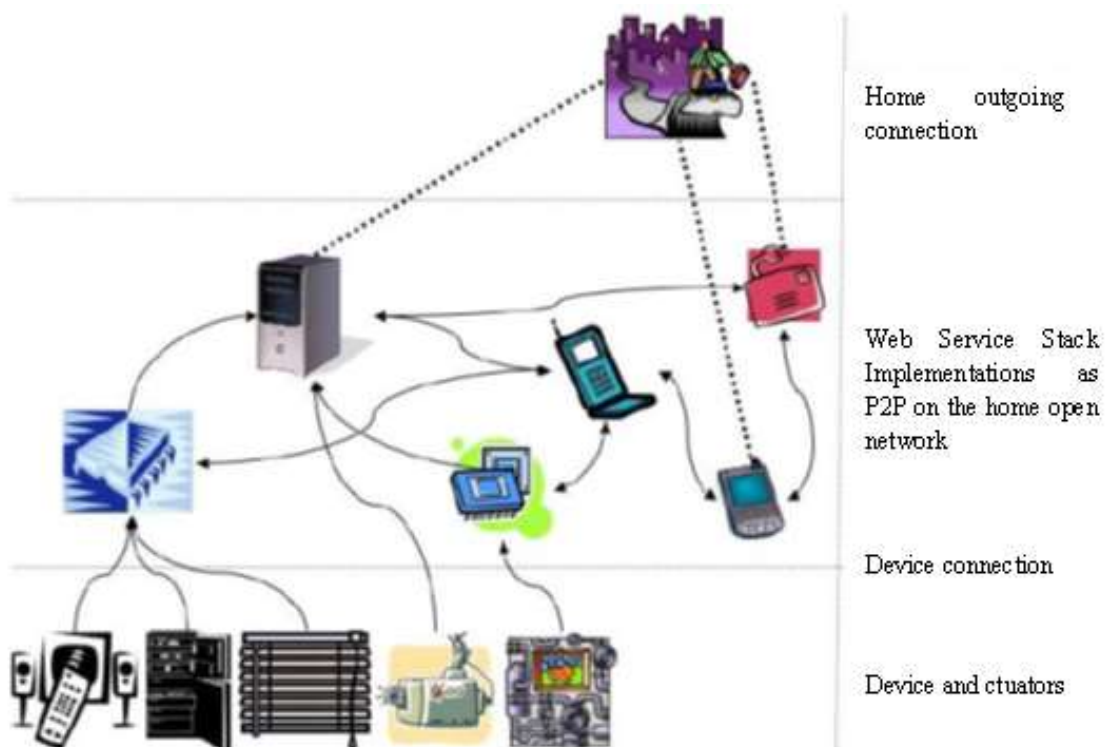

Figure 3.2: WS-* based home architecture in (Aiello, 2010)

Gomez and Paradells (2010) present the current emerging architectures and advancements, suitable for wireless home area networks. ZigBee, Z-Wave, INSTEON, Wavenis, and IP-based arrangements (6LoWPAN) are completely investigated and compared, as far as physical characteristics, communication modes, networking, and security and so on. As stated in the overview the increasing functionalities of a few arrangements and meeting

toward IP propose that future smart home applications will profit by enhanced quality, security, and interoperability. In another related overview (Kovatsch et al., 2010) IPv6 and 6LoWPAN are favored over various existing advances for smart homes (X10, KNX, ZigBee and digitalSTROM). This comparison is appeared in Table 3.1. As the authors note, IPv6-based WSN is experienced and future-confirmation, easily, simple establishment utilizing remote embedded gadgets, auto-configurable, offers wide-scale system, common customer association and security. The creators guarantee that Internet innovation, using IPv6, can transform into the future standard in smart home.

Table 3.1: Smart home arrangements in comparison to IPv6 (Kovatsch et al., 2010)

	X10	KNX	ZigBee	dS	IPv6(6LowWPAN)
Network Size	2^8	2^{16}	2^{16}	2^{16}	2^{64} persub net
Data rate	20b/s	9.6kb/s	20...250 kb/s	200b/s	250kb/s...1Gb/s
Security	None	High (EIBsec)	Medium (AES)	Low	Medium 6LowWPAN AES only
Installation overhead	Low	High	Low	Medium	Low
Maturity	1975	2002(1990)	2004	2010	1998 (1969)
Interface	Custom stations	App. Gateway	App. Gateway	Web services	RESTful Web, TCP, UDP
Costs	Low	High	Medium	Medium	Low
Connectivity	Low	Medium	Medium	Medium	Low

3.3 The Internet of Things (IoTs)

New progressions like short-range remote correspondences, RFID and ongoing restriction are in a matter of seconds turning out to be to a great extent ordinary, permitting the Internet to infiltrate into the genuine universe of physical articles. The presentation of

IPv6, the tries for porting the IP stack on the introduced gadgets and the meaning of 6LoWPAN empower the vision of the Internet of Things, which insinuates a system of articles, where everything is especially and generally addressable, recognized and oversaw by PCs. It is an amassing of developments that make it possible to unite things like sensors and actuators to the Internet. The IoTs is a consolidated part of the Future Internet and could be depicted as an element worldwide system foundation with self con-figuring abilities relying upon the standard and interoperable correspondence understandings where PHY and virtual things have characters, physical qualities, and virtual characters and utilize smart interfaces, and are consistently joined into the data system (Zanella et al., 2014; Wortmann et al., 2015).

The IoT aims at extending current Internet, which includes billions on hubs, into the everyday world, employing trillions of Internet-enabled hubs. These hubs include sensors, actuators, smart meters, smart power outlets, information appliances, RFID tags and so on. These inserted devices will be harnessed in a broad range of applications, for example, building and industrial automation, smart metering, logistics and so on. The IoT vision is delineated in Figure 3.3.

The particular characteristics of the IoT are still under research. Inclinations, for example, its architecture, size, unpredictability, time and space issues, as well as the ambient intelligence and autonomous control of this novel idea are still in a premature level. Current applications of the IoT are found in logistics (RFID tags), smart homes (ZigBee/6LoWPAN), large-scale platforms for sensor data (Cosm, Paraimpu), in business cards (QR codes) and so forth (Gupta et al., 2015).
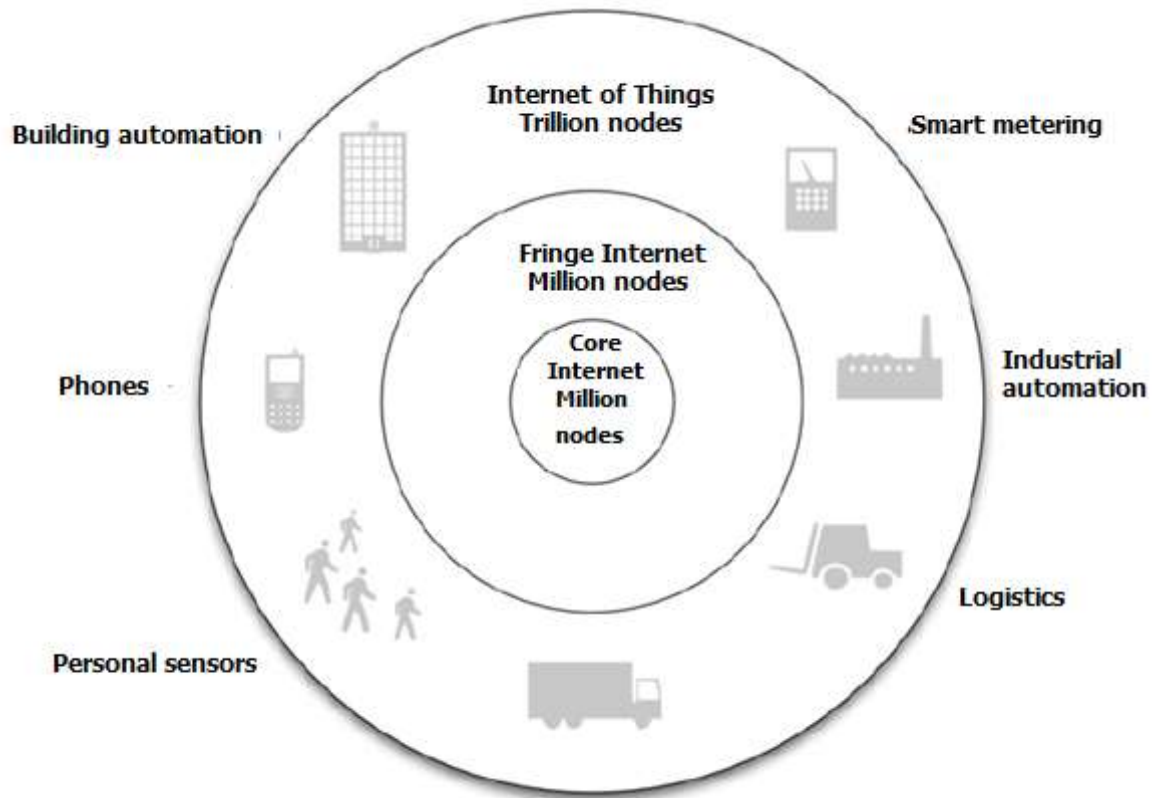
Figure 3.3: The Internet of Things vision

3.4 Smart Home Automation

Embedded physical devices, for example, household appliances are getting to be smarter and smarter. They are outfitted with installed chip and remote handsets, offering limited correspondence capacities and giving smart conduct. Regular articles are fitted with little, shabby portable processors, sensors and actuators. Sensors and remote sensor systems are being passed on in smart home courses of action, measuring with exactness the ecological conditions inside the home environment. Their dynamic detecting functionalities and their developing exactness empower the change of wise home applications that offer propelled mechanization (Kamilaris, 2012). Homes are changed into astute homes, fusing introduced sensors and actuators, and pervasive innovation. This converging of processing with physical things presents the thought of data apparatuses (Castelli et al., 2011), characterized as gadgets or machines, proposed to perform some specific usefulness however are usable, in the meantime, for the reasons of registering. Run of the mill cases

of registering gadgets incorporate smart phones, embedded sensors and actuators, radio-repeat distinguishing proof (RFID) chips and smart cards.

This example seems to legitimize Mark Weiser's vision of the Disappearing Computer (Kumar and Shimi, 2015), as per which the most noteworthy progressions are those that vanish. They mesh themselves into the fabric of regular routine life until they are unclear from it. These increased machines, when interconnected; they can shape remote systems, broadening neighborhoods into smart pervasive circumstances. Sooner rather than later, homes will offer new mechanization potential results to their tenants, expanding their comfort level. Changes will happen to the way people live and connect with their home surroundings, when innovation withdraws away from plain sight of their lives, when data handling is totally coordinated into regular articles and exercises. For instance, coffee machines gave the idea that can get ready coffee consequently, as indicated by the customer's slants. Refrigerators that offer committed programming interfaces for their control are being conveyed. At this point, residential smart meters have been introduced in our lives as sensor devices that measure in small time intervals the vitality utilization of a house. Besides, smart power outlets are devices that measure the utilization of individual electrical appliances and control their operation in real-time. It is normal that soon, smart appliances would handle automatically their intended operation and work optimally keeping in mind the end goal to save vitality and perform their task viably. They may even take advantage of the functionality of the inevitable smart lattice of power to synchronize their operation with its present state. For example, they may react to pricing signals and choose when it is most economical to operate. In general, the practice of equipping smart homes with smart meters, smart appliances and smart power outlets, enables the augmentation of smart homes into vitality aware situations. Towards this end, this theory will analyze the earth portrayed above and investigate and offer compelling arrangements (Byun et al., 2012).

3.5 Embedded Sensor Technology

This area gives a diagram of the technological advancements in inserted sensor technology. The segment begins with a depiction of inserted sensor devices, residential smart meters and smart power outlets, and continues with defining wireless networks of sensor and actuator devices. Finally, various wireless conventions for asset constrained situations are

examined, involving IEEE 802.15.4, ZigBee and 6LoWPAN (Bhatti et al., 2010; Kamilaris, 2012).

3.5.1 Sensor Devices

Late advances in miniaturized scale electro-mechanical systems innovation, remote correspondences, and computerized equipment have empowered the change of straightforwardness, low-control, multi-useful sensor center points that are little in size and convey untethered in short separations (Baig, 2012). Sensors can gauge with high exactness ecological conditions, for instance, temperature and stickiness or physical events, for instance, weight and development. The peruser can graphically see such a sensor contraption (Tmote Sky sensor bit) in the left of Figure 3.4. In the benefit of the same figure, the inside layout of this sensor stage is shown. Tmote Sky bits have the same design and layout as Telosb bits (Lopelli et al., 2011). Such stages are perfect for low power, moderately high information rate sensor system applications made with various objective out of adaptation to non-critical failure and enhanced simplicity. They brag an expansive on-chip RAM size, IEEE 802.15.4 radio and an incorporated on-board receiving wire, giving a reach on a fundamental level up to 125 meters. Then again, practically speaking, when snags exist, for instance, dividers or trees, their span achieves only 20-30 meters.
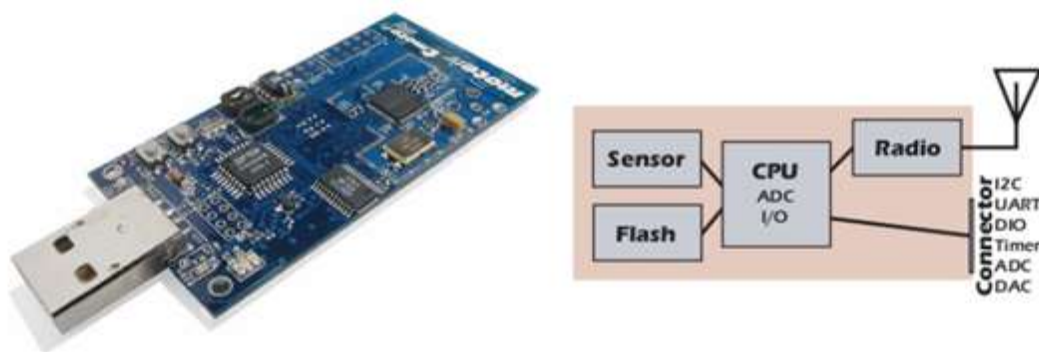

Figure 3.4: A Tmote Sky physical sensor device and its internal design (Lopelli et al., 2011)

3.5.2 Residential Smart Meters and Smart Power

Outlets In the latest years, residential smart meters have gained popularity. Electrical smart meters measure the utilization of electrical vitality in houses and buildings, in incessant

intervals and communicate that data in any event every day back to the utility for observing and charging purposes. Smart meters are a fundamental component without bounds smart framework of power. In any case, smart metering does not just influence the future improvement of the shrewd network, additionally motivates the rational management of the electrical utilization in houses and buildings. It is planned that each home in Britain will be furnished with smart meters by 2020 (Amrutha et al., 2015). Smart power outlets are wireless devices that measure the utilization of individual electrical appliances and control their operation in real-time. They may frame multi-bounce wireless networks inside the home environment, to propagate the power related measurements to a central smart home application. Another category of smart devices, which are associated with electrical utilization are smart appliances. These devices are an important component in realizing the advantages of smart network advancements. They have the potential to significantly enhance the stability and operational proficiency of the electrical lattice with restricted impact on the lives of the occupants. Their main operation involves responding to pricing signals from the lattice, and chooses when it is most economical to execute their task. According to various logical studies (Nilsson, 2014), convenient electrical utilization feedback through smart metering, is accepted to decrease electrical utilization by a fraction of 5-15%. Enabling inhabitants to analyze and screen their power footprint in real-time using intuitive visualization apparatuses, allows intelligent and effective vitality management. Now and again, analytical feedback (per room/electrical appliance) can diminish the vitality utilization up to 20% (Madhu, 2014).

The American Council for an Energy-Efficient Economy (ACEEE) assessed more than 36 diverse residential smart metering and feedback programs internationally. This is a standout amongst the broadest investigations of its kind. Their decision was that to realize possible feedback-induced savings, smart meters must be utilized as a part of conjunction with in-domestic displays and all around outlined programs that effectively inform, engage, empower and motivate individuals (Manikandan et al., 2015). There are close general calls from both the essentialness business and customer groups for a national social showcasing effort to bring issues to light of smart metering and give customers the data and reinforce they need to wind up more imperativeness capable, and what transforms they ought to make to understand the capability of proposed smart meters. Residential smart meters are placed where the home interfaces with the power lattice, measuring the total

vitality utilization of the house. Figure 3.5a displays a typical residential smart meter, installed on the main supply of the house. Figure 3.5b demonstrates a commercial smart power outlet. These outlets should be connected on electrical appliances to request to measure their electrical utilization and manage their operation. The entire home-residential smart metering items available in the market include Wattson, Onzo and Current Cost. A comparison between electric smart meters and smart power outlets, considering their overall accuracy is exhibited in (Liikkanen and Nieminen, 2009).

(a) A typical residential smart meter

(b) A smart power outlet

Figure 3.5: A typical residential smart meter and a smart power outlet (Liikkanen and Nieminen, 2009)

3.5.3 Wireless Sensor Networks (WSN)

A Wireless Sensor Networks comprises of spatially passed on self-ruling sensors, which agreeably screen physical or natural conditions, for instance, temperature, moisture, sound, vibration, weight, development, toxins et cetera (Lopelli et al., 2011). Every sensor runs a multi-skip directing calculation, where mediator center points limit as forwarders, transferring information parcels to a base station (sink). Base stations have significantly more computational, essentialness and correspondence resources and go about as passages between sensor center points and the end customers. The topology of WSN can shift from a direct star system to a progressed multi-jump remote cross section system. The engendering strategy between the ricochets of the system can be directing or flooding.

The fundamental attributes of WSN include: power usage limitations for centers utilizing batteries or essentialness collecting; capacity to adjust to center and correspondence disappointments; center compactness; heterogeneity of center points; versatility to substantial game plans; capacity to withstand brutal ecological conditions; and simplicity of use.WSN plays a key part in enabling high-accuracy sensor and actuation systems in houses, buildings and surrounding spaces by providing a reliable, practical and extensible arrangement. Their gear can be placed in existing as well as new structures, without significant changes in the present infrastructure. Basic applications of WSN involve woodland fire recognition, air contamination monitoring, health monitoring, industrial control, agriculture and nursery monitoring. WSN can also be sent in inaccessible rural areas where the human transition is troublesome e.g. backwoods, wildernesses and volcano. In Figure 3.6, we can watch an arrangement of a WSN on an active volcano (Werner-Allen et al., 2010). In this particular organization, wireless sensor hubs identify seismic occasions and course them, through the wireless network to a base station.
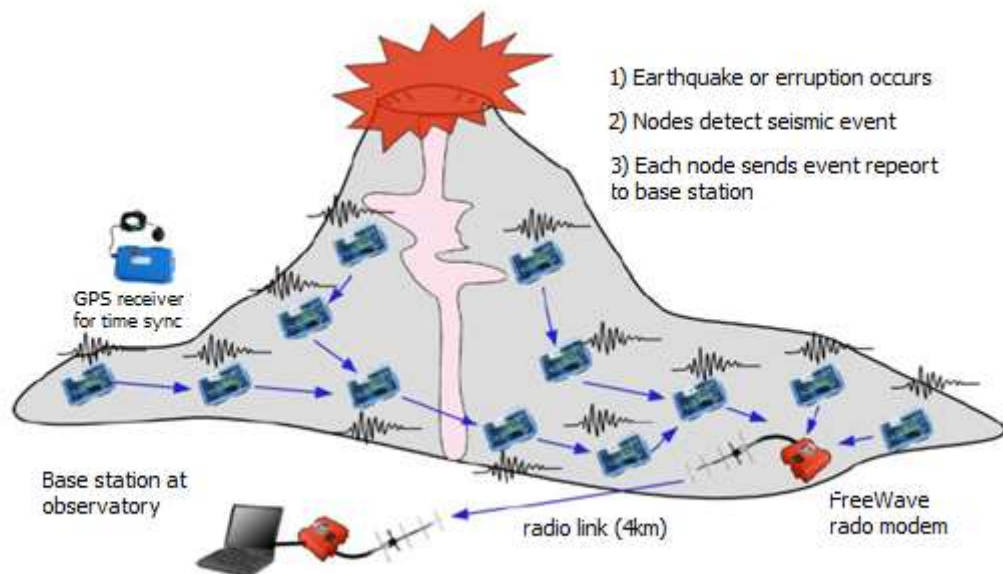

Figure 3.6: A deployment of a WSN for volcano monitoring (Werner-Allen et al., 2010)

3.5.4 Operating Systems for Sensor Devices

Various operating systems for installed devices and especially sensor bits have been created during the last 10-15 years. The most surely understood are TinyOS and Contiki.

TinyOS is a free and open-source; part based working system and stage, focusing on WSN. It is an introduced working system, written in the nesC programming dialect as a game plan of coordinating assignments and structures. It fundamentally began as a joint effort between the University of California, Berkeley and Intel Research, and has subsequent created to be a worldwide consortium, the TinyOS Alliance (Levis et al., 2010).

TinyOS applications are made in nesC, which is really a tongue of the C programming dialect, enhanced for the memory confinements of sensor systems. TinyOS projects are amassed of programming parts, which are joined with one another utilizing interfaces. Interfaces contain meanings of summons and events. Parts must execute the events they use and the charges they give. TinyOS gives interfaces and parts to fundamental equipment reflections, for instance, incitation, detecting bundle correspondence, directing and capacity. A general thought of the programming model can be found in Figure 3.7. TinyOS is absolutely non-blocking: it has one stack. In this way, all I/O operations that last more than two or three hundred microseconds are offbeat and have a callback. A TinyOS section can post an assignment, which the OS will timetable to run later. Assignments are non-preemptive and continue running in first in, first out (FIFO) ask. This clear synchronous model is regularly satisfactory for I/O-driven applications; in any case, its issue with CPU-overwhelming applications incited the enhancing of TOSThreads, a string library for the OS (Sen et al., 2015).
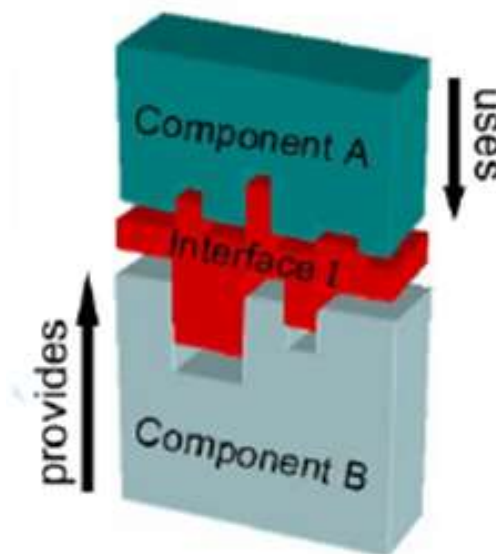

Figure 3.7: General programming model of TinyOS (Levis et al., 2010)

Contiki (Coulson et al., 2012) is likewise an open-source, significantly versatile, multitasking working system for memory effective organized introduced systems and remote sensor systems. It is mostly expected for exceptionally shabby microcontrollers. A common Contiki setup is 2 kilobytes of RAM and 40 kilobytes of ROM. For correspondence inside of a remote sensor system, Contiki uses the RIME low-control radio systems administration stack. The RIME stack executes sensor system traditions extending from dependable information aggregation and best-effort system flooding to multi-bounce mass information exchange and information spread. Contiki is formed in the C programming dialect and includes an event driven segment, on top of which application projects can be powerfully stacked and emptied at run time. Contiki shapes utilize the lightweight proto-strings that give a direct, threadlike programming style on top of the event driven bit. Notwithstanding proto-strings, Contiki likewise supports per-process discretionary multithreading and between technique correspondence utilizing message passing (Dunkels et al., 2010).

To give a long sensor system lifetime, it is urgent to control and decrease the force usage of every sensor center point. Contiki gives a product based force profiling component that screens the essentialness utilization of every sensor center. The structure permits power profiling at the system scale with no extra equipment for being programming based. Contiki's energy profiling system is used both as an exploration gadget for trial assessment of sensor system traditions and as an approach to appraise the lifetime of a system of sensors. A complete establishment of Contiki involves the accompanying elements: a multitasking bit; protothreads; elective per-application pre-emptive multithreading; TCP/IP organizing; GUI; arranged inaccessible showcase using Virtual Network Computing; a little Web program; an individual web server; and a clear talnet client. Other, less well known working systems for the embedded gadgets incorporate MANTIS, Nano-RK and LiteOS (Bhatti et al., 2010).

3.5.5 IEEE 802.15.4

IEEE 802.15.4 is the proposed standard for Low-Rate Wireless Personal Area Networks (LR-WPAN). It characterizes the physical and media access control layer of these systems (in light of the OSI model). It works in three repeat groups as showed up in Table 3.2. IEEE 802.15.4 is expected for remote sensor applications that need short-go interchanges, to boost the battery lifetime of sensor gadgets. The primary attributes of the standard

incorporate actuation and deactivation of the radio handset, essentialness area inside of the present channel, join quality sign for bundles, channel decision, transmitting and accepting parcels through the physical (PHY) medium and additionally clear channel evaluation (CCA). Other critical attributes incorporate continuous suitability by assigning of ensured time spaces, sway shirking through CSMA/CA and coordinated sponsorship for secure correspondences (Lopelli et al., 2011).

Table 3.2: 802.15.4 physical layer (Lopelli et al., 2011)

Frequency (MHz)	Modulation	Channels No.	Bit rate (Kbps)
868-868.6	BPSK	1	20
902-928	BPSK	10	40
2400-2483.5	16-ary-QPSK	16	250

3.5.6 6LoWPAN

Integrating IP with implanted devices and WSN has various important advantages. Those advantages incorporate the simple interconnection with other IP arranges, the reuse of the current Internet framework, the use of definitely comprehended IP-based advancements in inescapable circumstances and the use of existing force observing and symptomatic contraptions. The test in supporting IP traditions in WSN is to beat the confinements experienced by sensor systems like lower force usage, low commitment cycles, limited data transmission and diminished unwavering quality. To address these confinements, IETF made the 6LoWPAN working get-together, which intends to add to the support of IPv6 over the standard IEEE 802.15.4, with a particular final objective to import comprehended the abilities of IPv6, for instance, Neighbor Discovery (ND) and Mobile IP (MIPv6) into low-control gadgets. A Low-control Wireless Personal Area Network (LoWPAN) is an essential, simplicity of correspondence system that permits remote accessibility in applications with obliged power and loose throughput requirements. A LoWPAN commonly incorporates gadgets that coordinate to unite the physical environment for certifiable applications. IPv6 over Low power Wireless Personal Area Networks (6LoWPAN) (Korte et al., 2010), as expressed some time as of late, is an

adaption layer that permits viable IPv6 correspondence over IEEE 802.15.4. It characterizes a LoWPAN outline position for IPv6 information bundles and a clear header weight arrangement which uses shared association data. Likewise, work based parcel movement is immediately tended to. The most without a doubt comprehended working systems for sensors offer officially 6LoWPAN usage, for changing sensor bits into IPv6-empowered gadgets. These executions are blip for TinyOS and uIPv6 for Contiki. Blip 2.0 (Kamilaris, 2012), the Berkeley low-control IP stack, is a usage in TinyOS of different IP-based traditions. Utilizing blip/TinyOS, multi-ricochet IP systems might surrounded, comprising of unmistakable bits conveying over shared traditions. uIPv6 is an open-source TCP/IP stack, equipped for being used with minor 8-and 16-bit microcontrollers. It was at first made by Adam Dunkels of the Networked Embedded Systems group at the Swedish Institute of Computer Science, at first called uIP. In October 2008, Cisco, Atmel and SICS declared a totally agreeable IPv6 extension to uIP, called uIPv6 An examination of IPv6/6LoWPAN and ZigBee is given in Table 3.3. Plainly, 6LoWPAN offers a greater number of capacities than ZigBee, supporting a bigger number of sensor gadgets, better information rates, insignificant exertion and higher system (Zanella et al., 2014).

Table 3.3: Comparison of IPv6/6LoWPAN and ZigBee (Zanella et al., 2014)

	ZigBee	**IPv6/LoWPAN**
Network size	2^{16}	2^{64} per subnet
Data rate	20…250 kb/s	250 kb/s...1 Gb/s
Interface	App. Gateway	RESTful Web, UDP, TCP
Maturity	2004	1998
Costs	Medium	Low
Installation overhead	Low	Low
Connectivity	Medium	High
Security	Medium (AES)	Medium (AES)

3.5.7 Arduino Uno Atmega328P

The Uno is a microcontroller board taking into account the ATmega328P. It has 14 computerized data/yield pins (of which 6 can be used as PWM yields), 6 easy inputs, a 16 MHz quartz gem, a force jack, a USB association, a reset catch and an ICSP header. It contains everything expected to bolster the microcontroller; essentially interface it to a PC with a USB link or power it with an AC-to-DC connector or battery to begin.. You can tinker with your UNO without stressing a lot over accomplishing something incorrectly, most dire outcome imaginable you can trade the chip for a couple of dollars and begin once again once more (Flores, 2015).

"Uno" implies one in Italian and was denoted the arrival of Arduino Software (IDE) 1.0. The Uno board and form 1.0 of Arduino Software (IDE) were the reference adaptations of Arduino, now developed to more up to date discharges. The Uno board is the first in a progression of USB Arduino sheets, and the reference model for the Arduino stage; for a broad rundown of present, past or obsolete sheets see the Arduino record of sheets (D'Ausillio, 2012).

3.5.8 Voice Activated Systems for Smart Homes

Home automation is not another idea in today"s world, it is utilized to give accommodation to client to remotely control and screen the machines and it gives a superior utilization of power. The effective utilization of power makes the HOME automation to assume an essential part in day by day life. As by the development of PC (PCs), web, cellular telephone and remote innovation makes it simple for a client to remotely get to and controls the apparatuses. A ton of examination has been done and numerous arrangements have been proposed to remotely get to the HOME apparatuses. Some of them utilized web, remote innovation to impart and control home apparatuses, others utilized Bluetooth and GSM innovation for controlling the home machines (Baig et al., 2012; Sen et al., 2015).

CHAPTER 4
SYSTEM DEVELOPMENT

4.1 System Environment

The system architecture is mainly divided into five sections:

- Controller (handicapped person)

- Mobile phone with an application for voice recognition

- Personal computer (Wampserver 2.5 installed with the LED service webpage)

- Arduino Uno main board combined with Ethernet shield

- Router

The system is a part of the online system; therefore the system requires to be connected to control the domestic appliance via android application which connects to the Arduino Uno with the Ethernet shield through the access point Wi-Fi and the PC server for turning on and off the LEDs. The application is connected to the internet via the Wi-Fi service. The software is installed on a mobile device and can run properly on the Android system for mobile devices.

4.1.1 Overview of IP Based Security System

The Figure 4.1 shows all the functions of the system, and depicts the modules started from the portable gadget module to the modules of LEDs. The portable module sends a request to the Web service as a communication between them via Wi-Fi network. The developed application on Android gives the opportunety to the user to set the App settings of the application according to the connection requirements, such as the IP address from which the application can communicate with Webservice module or changing the telephone number which is used by the system to send SMSs to this number automatically while the LEDs are turn ON or OFF.

The Webservice module configures a communication to the local computer server at the smart house. This computer needs low-performance, because few connections are received from the mobile module periodically. However, the internet connection is required so that

a Webserver can receive a request from the user's Android portable device and a wireless access point so that Arduino Uno hardware sends the feedback to the Webserver.

A portable device (Laptop) as a hardware components and Apache server as a software component are used for creating the web service. The LED module turn ON and OFF the LEDs. Arduino Uno with the Ethernet shield as a hardware components are used for creating LED module and Arduino Uno IDE is used as a software component for editing Arduino code using C++ language programming..
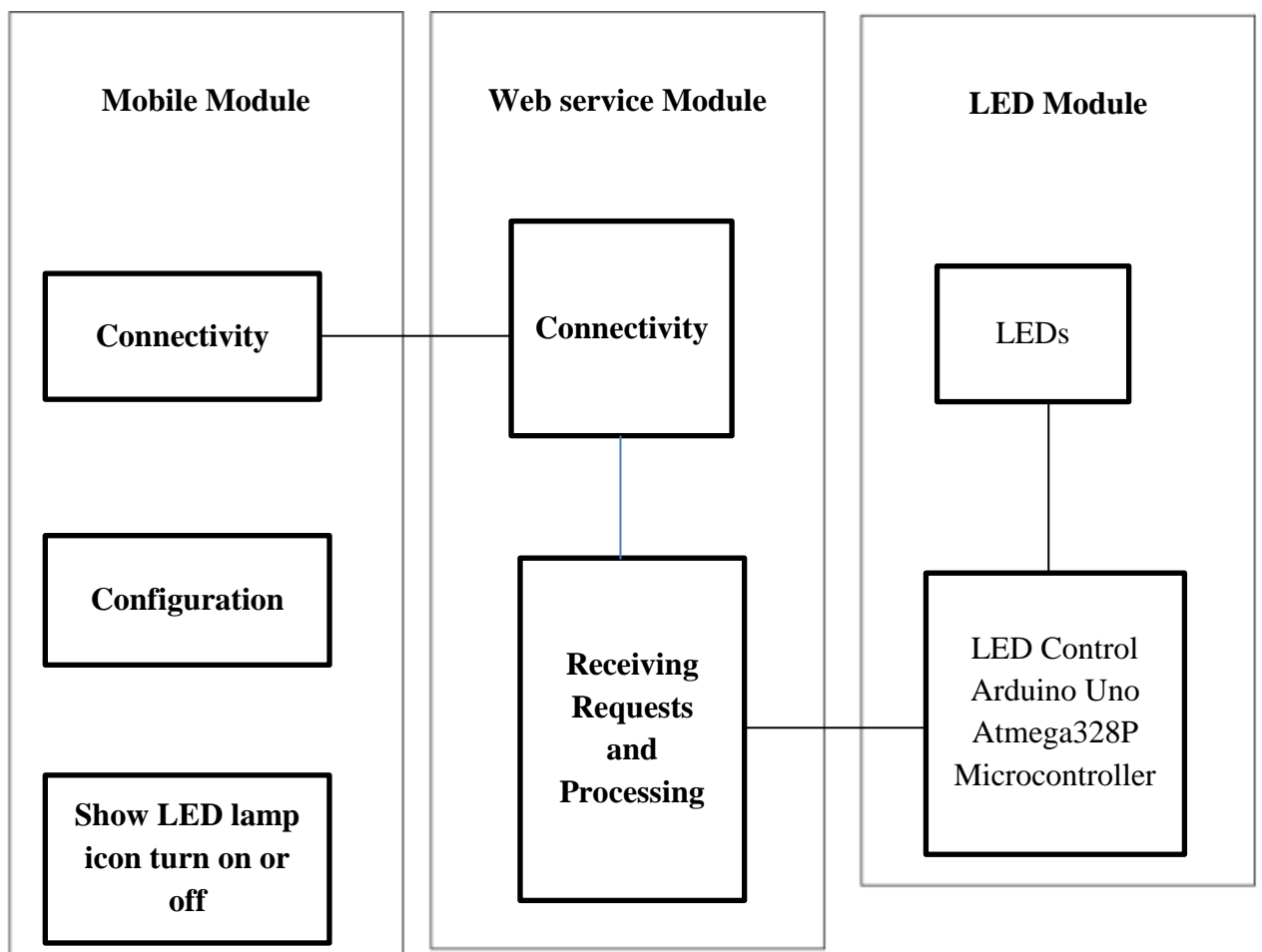

Figure 4.1: Block Diagram of the Sysytem

4.2 System Technology

In this study a set of technologies is used which offers the many of the flexibilities and improvements to build the Voice control application.

Mobile Technology: The system mainly based on mobile devices. Because the mobile device characteristics like available to the user, access to the internet, easy to use, etc.

Computer Technology: The Wampserver 2.5 was installed with the LED service webpage in the computer.

Voice Library: It is a set of static methods that give users smart access to the main speech interaction components. These approaches are the only ones exposed to other programming languages via the Java Native Interface (JNI) (Sen et al., 2015).

Google Voice: It is a set of static methods that give users access to the main speech interaction components via the Google platform.

Arduino Uno Integrated Development Environment (IDE) platform: Arduino is an open-source PC equipment and programming endeavor, task and client group that undertakings and produces microcontroller-based packs for assembling computerized gadgets and shared items that can sense and control things in the physical world (Flores et al., 2015).

The undertaking depends on microcontroller board outlines, made by a couple of shippers, using distinctive microcontrollers. These systems give sets of cutting edge and straightforward I/O sticks that can be interfaced to various extension sheets ("shields") and different circuits as it is shown in Figure 4.2. The sheets highlight serial interchanges interfaces, including USB on a couple models, for stacking programs from individual PCs. For programming the microcontrollers, the Arduino venture gives a coordinated improvement environment (IDE) in light of the Processing venture, which consolidates support for the C and C++ programming tongues as it is shown in Figure 4.3.

The essential Arduino was exhibited in 2005, proposing to give a sparing and basic course for youngsters and experts to make contraptions that team up with their surroundings using sensors and actuators. Basic representations of such contraptions got ready for learner pros join direct robots, indoor regulators, and movement discoverers.

Arduino sheets are available monetarily in preassembled structure, or as do-it-without anybody's help packs. The equipment diagram particulars are transparently available, allowing the Arduino sheets to be created by anybody. Adafruit Industries assessed in mid-

2011 that more than 300,000 power Arduinos had been fiscally made and in 2013 that 700,000 power sheets were in customers' grasp (Mathew et al., 2015).

Figure 4.2: Arduino Uno Board (Mathew et al., 2015)

Figure 4.3: Arduino Uno IDE platform Board

WampServer: Alludes to a product stack for the Microsoft Windows working system, made by Romain Bourdon and comprising of the Apache web server, OpenSSL for SSL bolster, MySQL database and PHP programming dialect shown in Figure 4.3.
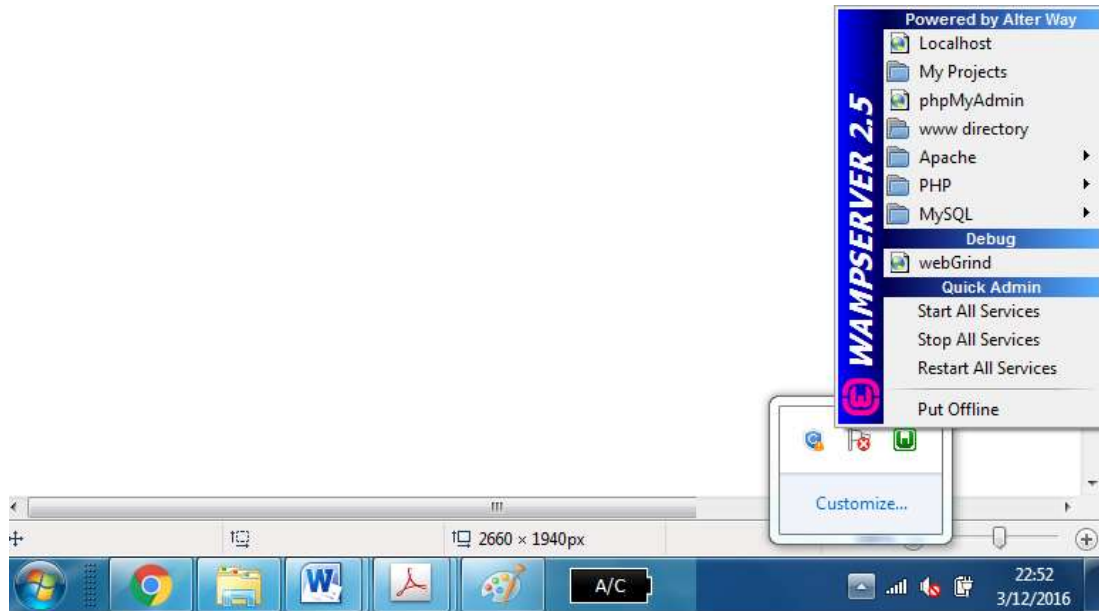

Figure 4.4: Screenshot of WampServer

Router: A router is a contraption that advances information packs along systems. A router is associated with no under two systems, regularly two LANs or WANs or a LAN and its ISP's system. Routers are arranged at doors, the spots where two or more systems associate.

Routers use headers and sending tables to choose the most ideal approach to forward the bundles, and they use traditions, for instance, ICMP to correspond with each other and arrange the best course between any two hosts.

Figure 4.5: Router

IEEE 802.11(Wireless 802.11): It is a game plan of physical layer (PHY) and media access control (MAC) particulars for completing remote neighborhood PC correspondence in the 2.4, 3.6, 5, and 60 GHz repeat groups. They are made and kept up by the IEEE LAN/MAN Standards Committee (IEEE 802). The origin adaptation of the standard was released in 1997, and has had coming about changes (Gong et al., 2015). The standard and modifications give the reason to remote system things using the Wi-Fi brand. While each change is definitively denied when it is combined in the latest variant of the standard, the incorporated world inclines to market to the modifications in light of the way that they succinctly mean capacities of their things. In like manner, in the business focus, each correction tends to end up its own standard. The server IP have to be set manually and use the same IP in the mobile application and also upload it to the Arduino Uno as it is show in Figure 4.6.
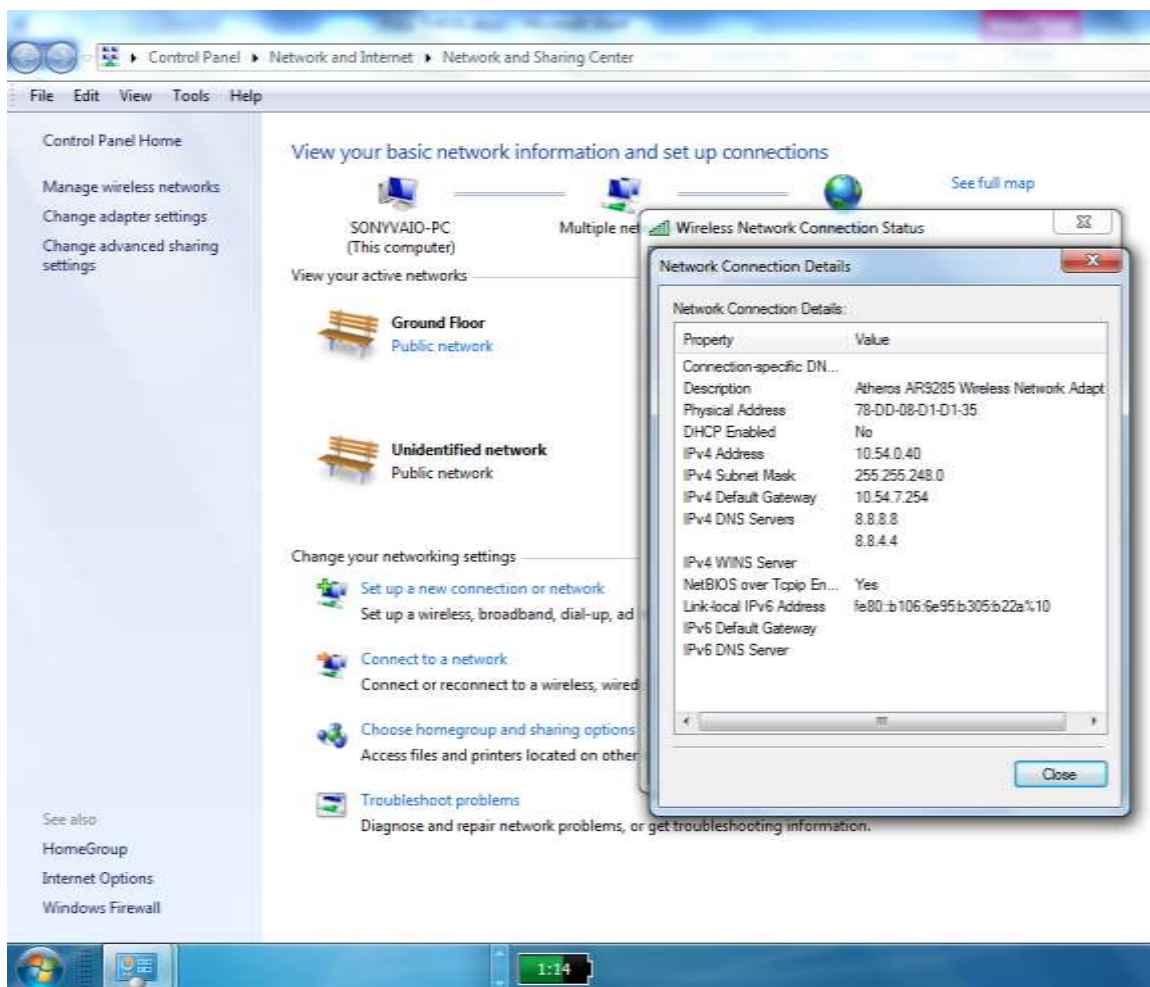

Figure 4.6: Screenshot of Wireless 802.11 connection

4.3 Mobile Operating System

A versatile working system (or portable operating system) is a working system for smartphones, tablets, PDAs, or other cell phones. While PCs, for instance, the normal tablets are versatile, the working systems commonly used on them are not viewed as portable ones as they were initially planned for more noteworthy stationary desktop PCs that generally did not have or require specific portable components. This refinement is getting clouded in some more a la mode working systems that are half and parts made for both jobs.

Versatile working systems solidify components of an individual PC working system with different parts accommodating for versatile or handheld use; more frequently than barring, and an expansive segment of the going with considered critical in the present day portable systems; touch screen, cell, Bluetooth, Wi-Fi, GPS portable route, camera, camcorder, talk acknowledgment, voice recorder, music player, close field correspondence and infrared blaster.

Cell phones with portable interchanges capacities (e.g. smartphones) contain two portable working systems – the essential customer facing programming stage is supplemented by a second low-level selective consistent working system which works the radio and other equipment. Research has exhibited that these low-level systems may contain an extent of security vulnerabilities permitting malicious base stations to build raised measures of control over the versatile device (Lin et al., 2015).

4.3.1 Android Operating System

Android is a portable working system (OS) at this moment made by Google, in light of the Linux part and formed fundamentally for touchscreen cell phones, for instance, smartphones and tablets. Android's customer interface is mainly in light of direct control, using touch flags that unreservedly compare to genuine activities, for instance, swiping, tapping and pressing, to control on-screen objects, alongside a virtual console for substance information. Notwithstanding touchscreen gadgets, Google has further made Android TV for TVs, Android Wear for wrist watches, Android Auto for automobiles and each with a specific customer interface. Varieties of Android are moreover used on diaries, preoccupation reassures, propelled cameras, and different hardware. Beginning 2015, Android has the greatest presented base of each working system (Cinar, 2015).

At initially made by Android, Inc., which Google acquired in 2005, Android was disclosed in 2007, alongside the setting up of the Open Handset Alliance – a consortium of programming, equipment, and telecom associations provided for pushing open gauges for cell phones (Nimodia & Deshmukh, 2012). Beginning July 2013, the Google Play store has had more than one million Android (applications) disseminated and more than 50 billion applications downloaded (Hall & Anderson, 2009). An April–May 2013 survey of portable application engineers found that 71% of creators make applications for Android and a recent report found that 40% of full-time proficient architects consider Android to be their need target stage, which is commensurate to Apple's iOS on 37% with both stages far above others. At Google I/O 2014, the association revealed that there were more than one billion element month to month Android customers, up from 538 million in June 2013 (Pile, 2016).

Android's source code is released by Google under open source licenses, but most Android gadgets finally dispatch with a blend of open source and selective programming, including prohibitive programming required for getting to Google organizations. Android is understood with advancement associations that require a moment, ease and versatile working system for front line gadgets. Its open nature has enabled an unfathomable gathering of architects and enthusiasts to use the open-source code as an establishment for gathering driven ventures, which incorporate new parts for bleeding edge clients or pass on Android to gadgets initially conveyed with other working systems. Meanwhile, as Android has no brought together update system most Android gadgets disregard to get security overhauls: Research in 2015 inferred that privilege around 90% of Android telephones being utilized had known however unpatched security vulnerabilities due to nonattendance of redesigns and backing (Mohamed & Patel, 2015). The achievement of Android has made it a goal for patent prosecution as a noteworthy part of the implied "smartphone wars" between advancement association.

Figure 4.7 Screenshot of Android Operating System

4.4 Java Programming Language

Java is a general-use PC programming dialect that is synchronized, in view of class, article arranged, and especially expected to have as few execution conditions as could be expected under the circumstances. It is intended to permit application engineers "compose once, run anyplace" (WORA), implying that collected Java code can execute on all stages that reinforce Java without the requirement for recompilation. Java programs with the client interface are typically gathered to byte code that can execute on any Java Virtual Machine (JVM) paying little mind to PC design. Starting 2015, Java is thought to be a standout amongst the most widely recognized programming dialects being used, particularly for customer server web applications, with a reported 9 million engineers (Cinar, 2015). Java was some time ago created by James Gosling at Sun Microsystems (which has subsequent to been produced by Oracle Corporation) and distributed in 1995 as a center a portion of Sun Microsystems' Java stage. The dialect acquires a lot of its language structure from C++ and C; however it has less low-level offices than both of them. Consequently, this study utilized Java programming for making the voice control application.

4.5 Android Development Tool (ADT)

Android Development Tools (ADT) is a Google-gave plugin to the Eclipse IDE that is intended to give an integrated environment in which to construct Android applications. ADT extends the abilities of Eclipse to let engineers set up new Android projects, make an application UI, include bundles based the Android Framework API, troubleshoot their applications utilizing the Android SDK instruments, and export marked (or unsigned) .apk records in order to appropriate their applications. It is free to download. It was the authority IDE for Android yet was supplanted by Android Studio (based on IntelliJ IDEA Community Edition).

4.6 Use-Case Diagrams

The use-case system illustrated the system design, which it is a way of better understanding the system actions of the users and it explains how the user uses the system (Singh et al., 2016). It also shows the relationship between the users and other subsystems Figure 4.8.
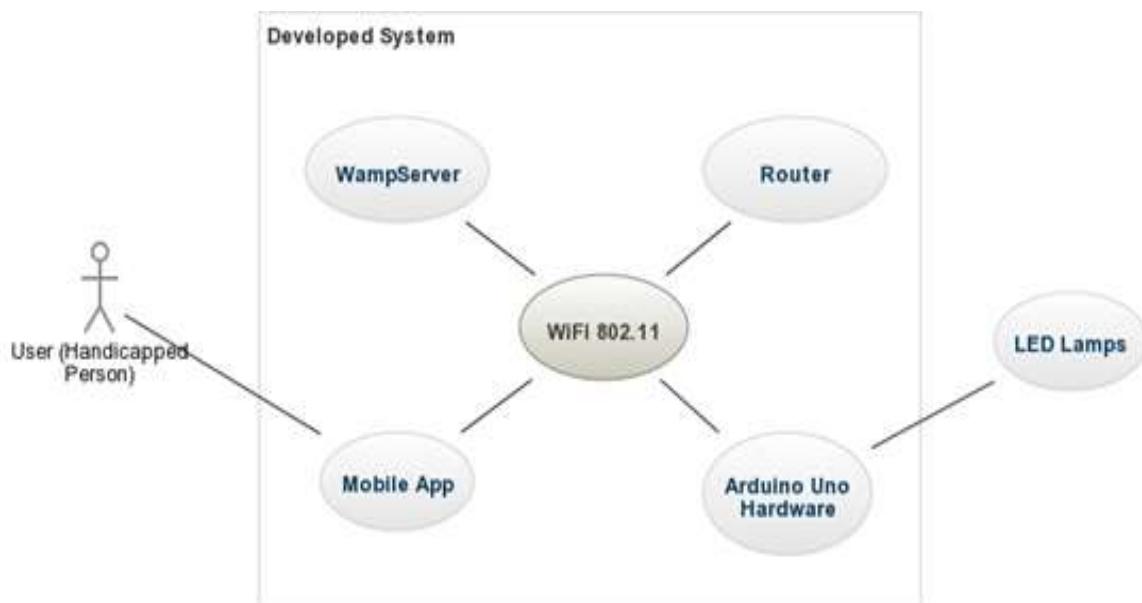

Figure 4.8: System controller (Handicap person) and the operational side of the developed system

4.7 System User

This system is developed to serve handicapped users who can control the appliances in the house. The system is programmed to start once the Arduino Uno is "On" and the voice application in the phone is authenticated.

4.8 The User (Handicapped Person)

The handicapped person with the need of assistance run the application on Android OS on mobile devices and then the voice-based authentication dialog message will appear to say the password, then with the correct password which is '1234' the program will open and then the user The user has to say A, B, C, D, E, F, G and H without touching the mobile system for the authentication process in order to operate the Arduino and the Ethernet shield which connected to the access point. As shown in the flowchart below Figure 4.9.
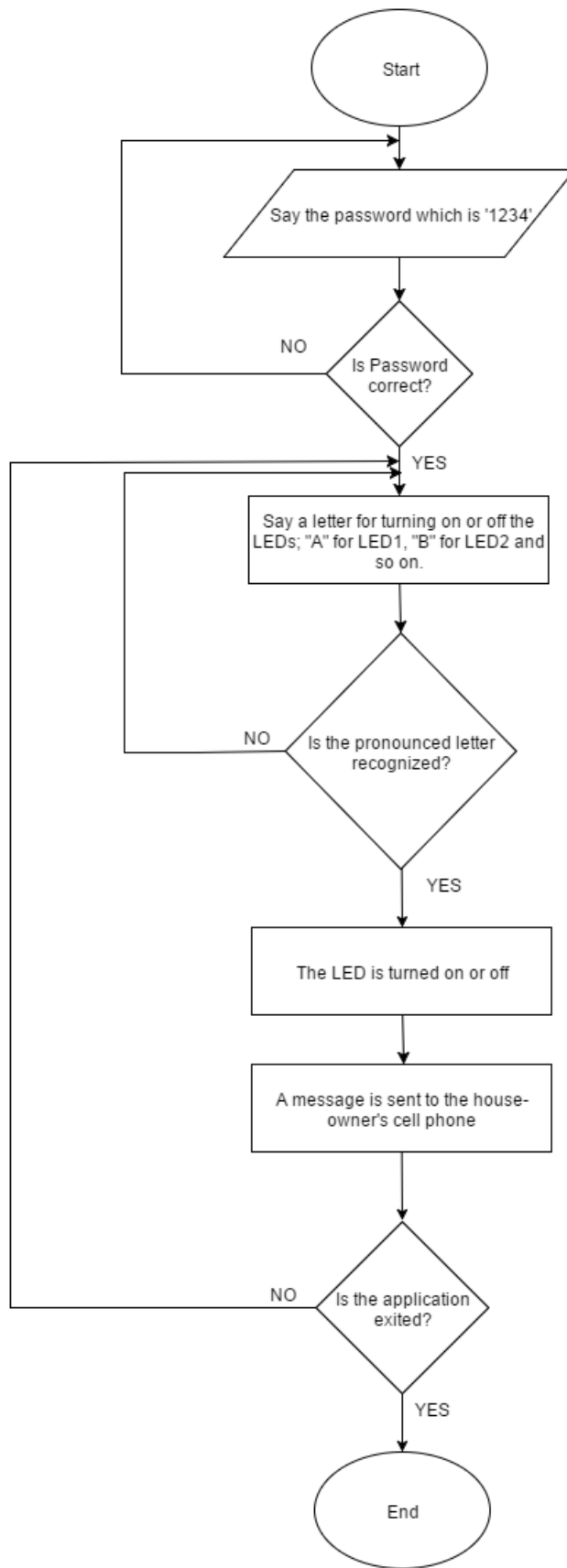
Figure 4.9: System Flowchart

45

4.9 The Sequence Diagram

The Sequence Diagram models the joint exertion of things in perspective of a period game plan. It shows how the articles associate with others in a particular circumstance of a use case. It can be created from the flood of events which have been described in the usage case depiction figure 4.10. It components are portrayed as takes after;

- *Actor (User):* An on-screen character model a sort of imagined by a component that coordinates with the subject (e.g., by exchanging signs and data), yet which is outside to the subject (i.e. as in an event of a performing artist is not a bit of the illustration of its contrasting subject). On-screen characters may identify with parts played by human clients, outer equipment users, outside equipment or different subjects.

- *Call Message (run ()):* A message characterizes a specific correspondence between Lifelines of an Interaction. Call message is a sort of message that speaks to summon of operation of target help.

- *Return Message:* A message characterizes a specific correspondence between Lifelines of an Interaction. Return message is a sort of message that speaks to the go of data back to the guest of a related previous message.

- *Create Message:* It is a sort of message that speaks to the instantiation of (target) life saver.

- *Destroy Message:* It is a sort of message that speaks to the solicitation of obliterating the lifecycle of target help.

- *Lifeline:* It indicates to an individual (something) participating in a connection.

- *Recursive Message:* It is a sort of message that speaks to summon of message of the same help. Its objective focuses to an actuation on top of the initiation where the message was invoked from.
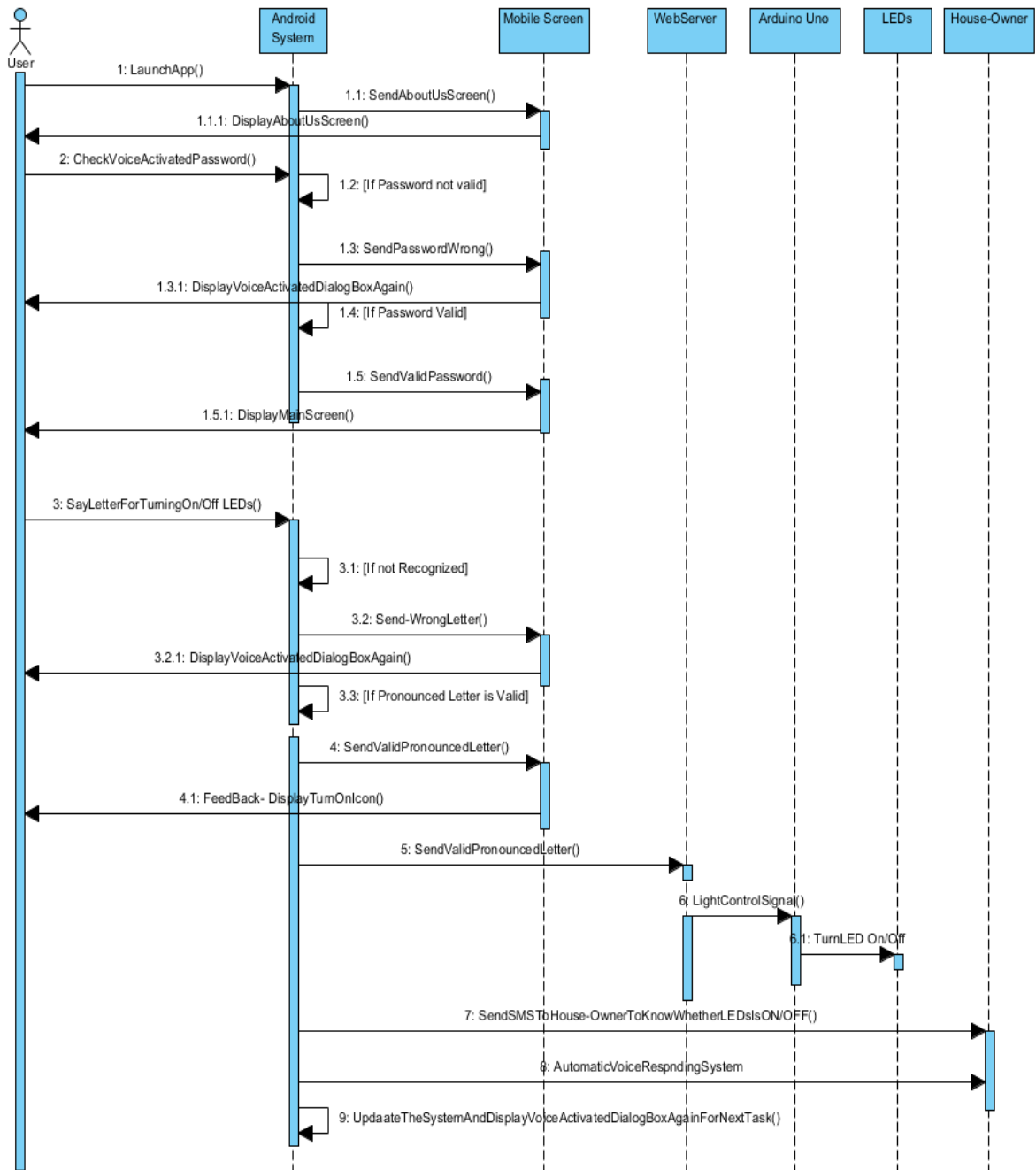
Figure 4.10: Sequence diagram of the developed system

4.10 System Requirements

The system needs some of hardware and software tools, such as computer tools and computer device.

4.10.1 Computer tools

The tools are used for developing the Voice activated application as follows:

- SONY laptop based on Windows 7 (32 bit) operating system was used.

- Arduino Uno IDE is used for editing Arduino Uno code

- WampServer 2.5 is also used to connect the application to Arduino Uno through the access point (WiFi) and the Microsoft Visual C++ 2012 Redistributable (x86) have to be installed so that WampServer run.

- Android Eclipse platform is used for editing the Android code.

- Java Development Kits (JDK) – version 7u17 with Eclipse to compile and deploy the application using Java programming language code.

- Google voice speech recognition library was used

- Voice library was also used

4.10.2 Mobile Device

The application is suitable for Mobile devices which have these features:

- Android Operating System

- Size: any inches

- Resolution: any resolution

- Any Internet Explorer for running the LED service page

CHAPTER 5
SYSTEM IMPLEMENTATION

5.1 The Developed System

A voice automated home is designed using a mobile application to help disable people (i.e. People not using their hands) to control the electrical appliances in their home. So therefore software that can enable them to do that effectively without stress and struggle will be duly appreciated by them. This application is a voice control application that enables the handicapped people to control the appliances in their home effectively without any forms of aid from anybody. This application can light up the LED lamps through speaking to it. This chapter described implementation of all functions of the users.

With the proposed system, the user can control the house illumination inside the house by a voice activated system; the proposed system is designed to be suitable for the handicapped people. The proposed system is designed using the main board Arduino Uno and the Ethernet shield as the second main board. The idea of using these two main boards is the consistence of the pulse width modulation port as an integrated part with the Arduino, which gives the minimum cost and minimum number of hardware parts. The proposed system can support maximum six parts including all electronics as oven, camera, music set, lights and TVs. These options are as examples for the application of the proposed system, the available in the proposed system as LEDs to show the operation of the system. Also, their flexibility gives the user, especially the handicapped users to control their houses by voice with the minimum number of hardware parts. The system is coded as a character for each part, for example "A" means the light of the salon, while "B" indicates the light of the bathroom, C indicates the light of the garden and so on.

The user has to say "A, B, C, D, E and F" without touching the mobile system for the authentication process in order to operate the Arduino and the Ethernet shield which connected to the access point. The system block diagram is shown in Figure 5.1.
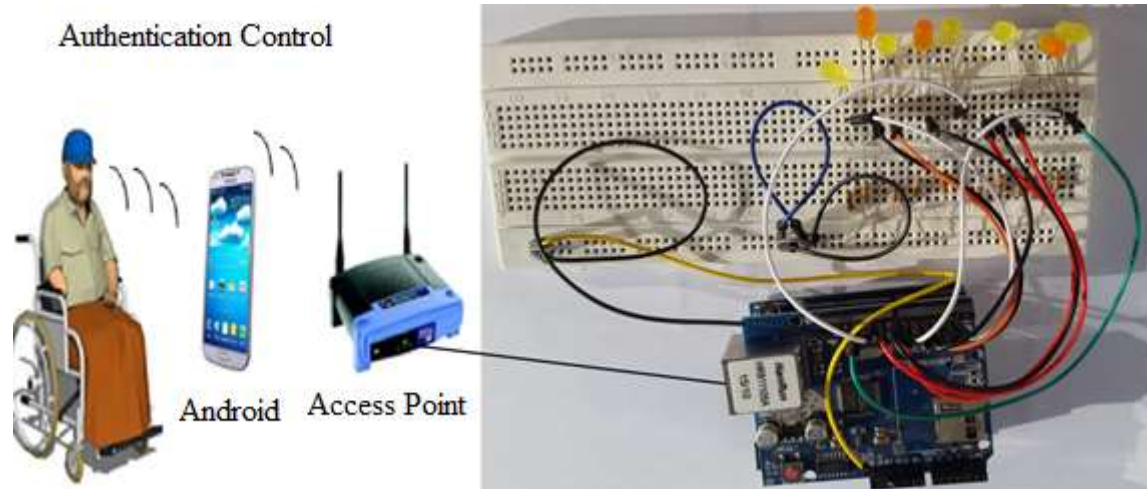
Figure 5.1: Proposed System and the interface process

5.2 Users Handicapped

The users are aided with switching on the router, Arduino Uno Hardware, personal computer and connecting the computer and mobile phone to the internet, afterwards he/she is also aided with the opening of the WampServer and the opening of the voice command application. Welcome screen is shown in Figure 5.2.
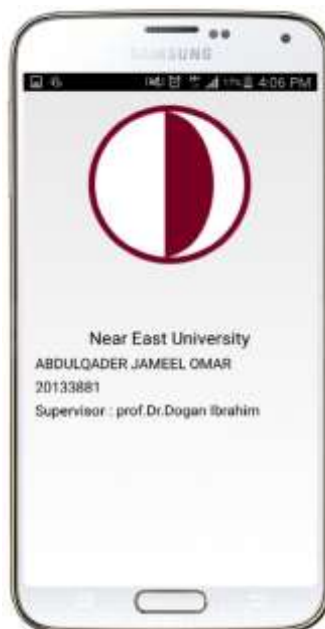
Figure 5.2: Screenshot of developed application

50

5.2.1 Voice Contol Application Openning

The user startup the application by saying YES if the used wants to use the previous saved IP address and the cell phone number which the system sends SMS to it while turning on or off the LEDs or say NO if the user wants to use different IP address and cell phone number. It is shown in Figure 5.3.
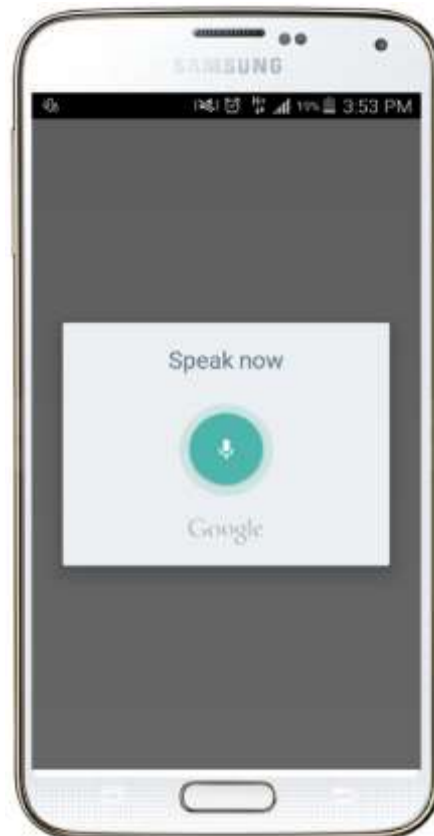
Figure 5.3: Voice Control Application Openning

5.2.2 Voice-Based Authentication Screen

The user startup the application by saying "1234" afterwards the application will open start navigating via using the voice command application. It is shown in Figure 5.4.
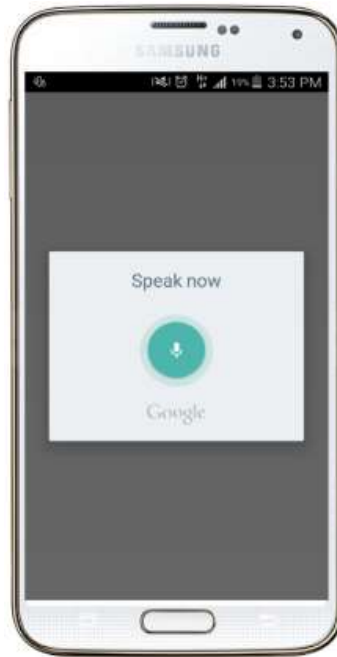
Figure 5.4: Voice-Based Authentication Screen

5.2.3 Changing the Application Settings

The user has the opportunety to use a new IP addess for the connection and a new cell phone number for sending SMSs to it from the system automatically while turning on or off the LEDs. It is illustrated in Figure 5.5.

Figure 5.5: Changing the Application Settings
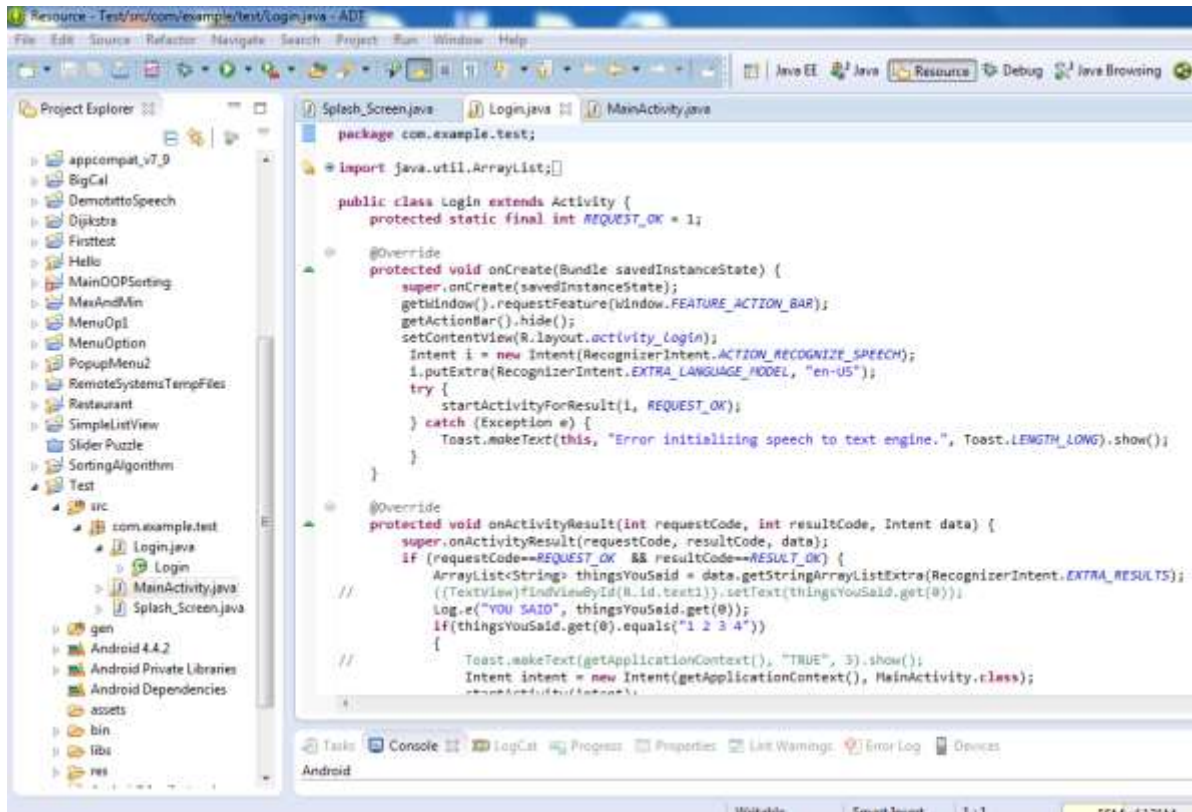
Figure 5.6: Screenshot of Login/authentication coding environmental

5.2.4 Home Page Opening

After the user has successfully opened the application in is a mobile phone by authenticating it with the "1234" password. The home page automatically opens and the user can navigate by saying either "A, B, C, D, E, and F" to switch ON any of the LED lamps used for the study.
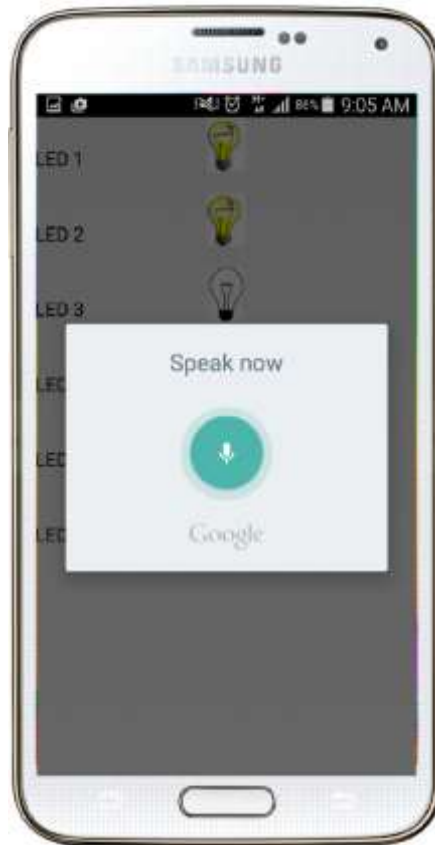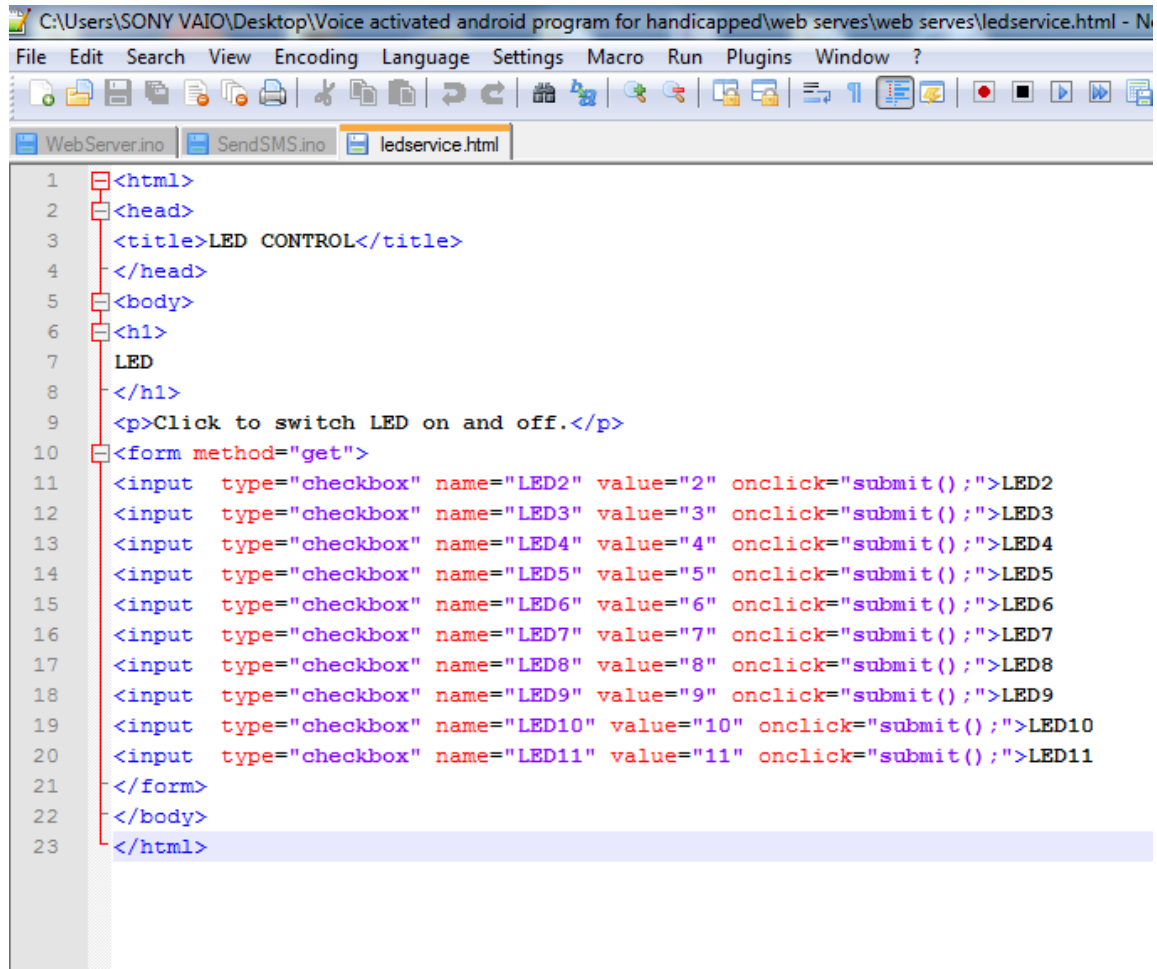
Figure 5.7: Screenshot shows HOME page prompted by the user's voice

5.2.5 LED Lamps Operation

In home page the user just has to say "A" to open Lamp "A" or "B" or "F" to open any of the lamps that is used for the study. If you say for example 'A' again, then the LED1 will be turned off. If what you say is recognized, a voice recognition dialog window will be displayed automatically asking to repeat saying the intended word. The voice activated dialog window is displayed over and over again automatically every 10000 milliseconds. If the LED turned on or off, a text message will be sent to the house-owner's cell phone so that to be aware about what is happening in the house for example If a user says 'A' the LED1 will be turned on and 'LED1 is on' message will be sent to a cell phone number which is used in the system.

The system has an automatic voice responding system with the aid of the Text-Speech system. For instance, when the user says "A" when the lamp A is ON the system will say automatically that lamp 1 is ON and so on.

54

Also the house appliances can be controlled manually by clicking the lamp icon on the android application on the phone and the light can either turn on or off Figure 5.10.


```html
<html>
<head>
 <title>LED CONTROL</title>
 </head>
<body>
<h1>
 LED
 </h1>
 <p>Click to switch LED on and off.</p>
<form method="get">
 <input  type="checkbox" name="LED2" value="2" onclick="submit();">LED2
 <input  type="checkbox" name="LED3" value="3" onclick="submit();">LED3
 <input  type="checkbox" name="LED4" value="4" onclick="submit();">LED4
 <input  type="checkbox" name="LED5" value="5" onclick="submit();">LED5
 <input  type="checkbox" name="LED6" value="6" onclick="submit();">LED6
 <input  type="checkbox" name="LED7" value="7" onclick="submit();">LED7
 <input  type="checkbox" name="LED8" value="8" onclick="submit();">LED8
 <input  type="checkbox" name="LED9" value="9" onclick="submit();">LED9
 <input  type="checkbox" name="LED10" value="10" onclick="submit();">LED10
 <input  type="checkbox" name="LED11" value="11" onclick="submit();">LED11
 </form>
 </body>
 </html>
```

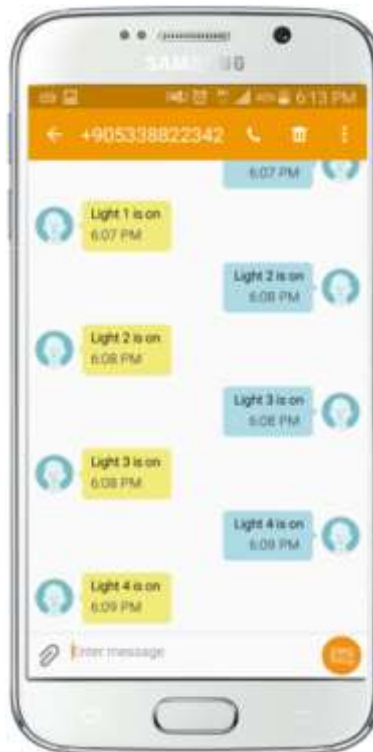**Figure 5.8:** Screenshot of LED service page coding environmental

Figure 5.9: Screenshot of messages received from the system

Figure 5.10: Screenshot of lamp manually turned on/off

CHAPTER 6
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This thesis has described the design and development of a voice activated Android based smart home system aimed to help people with disabilities to control their everyday appliances at home without much effort. The developed system is based on the Arduiono UNO microcontroller development board, an Android mobile phone, and a server. The reason for choosing the Arduino UNO development board has been because of its popularity, low cost and the availability of large number of applications software. Additionally, it is very easy to maintain and upgrade the Arduino software as it is based on the standard C language.

The developed system has been tested and worked without any problems. Smart homes are becoming commonly used, especially with the development of the Internet of Things (IoT) technology. More and more companies are investing in the design and development of smart homes.

The novelty of the developed system is that it gives feedback to the user in the form of voice. Thus, the handicapped user knows whether an applicance has been turned on or not. This is highly important as far as the safety at home is concerned.

6.2 Recommendations

The developd system can be enhanced and made more useful by adding the following modifications:

1. Improve the composed program so that it is more user friendly in the smart home
2. Use another higher performance Arduino board so that additional features can be added to the system.
3. Developing the same application for other operating systems such as IOS and windows.
4. Make the software to recognize single user voice rather being voice sensitive in nature.

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APPINDICES

APPENDIX A

ANDROID ECLIPSE JAVA SOURCE CODES

The source codes of the developed application are written by Java language programming. This section shows the important source codes of the activities.

Main activity class

```java
        private class Connection extends AsyncTask<Void, Void, Void> {

                protected void onPostExecute(Void paramVoid) {
                        //when connection end ,start google voice again
                        pd.dismiss();
                         Intent i = new
Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
                i.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL, "en-US");
                try {
                  startActivityForResult(i, REQUEST_OK);
                } catch (Exception e) {
                }

                        super.onPostExecute(paramVoid);
                 }

                protected void onPreExecute() {
                        super.onPreExecute();
                        pd.show();
                }
        }
```

```java
        @Override
    protected void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);
        //google voice method
        if (requestCode==REQUEST_OK  && resultCode==RESULT_OK) {
            ArrayList<String> thingsYouSaid =
data.getStringArrayListExtra(RecognizerIntent.EXTRA_RESULTS);
//          ((TextView)findViewById(R.id.text1)).setText(thingsYouSaid.get(0));
            Log.e("YOU SAID", thingsYouSaid.get(0));
            if (thingsYouSaid.get(0).equals("A"))
            {
                    ll1();


            }
            else if (thingsYouSaid.get(0).equals("B"))
            {
                    ll2();
            }
            else if (thingsYouSaid.get(0).equals("b"))
            {
                    ll2();
            }
            else if (thingsYouSaid.get(0).equals("a"))
            {
                    ll1();
            }
            else if (thingsYouSaid.get(0).equals("C"))
            {
                    ll3();
            }
            else if (thingsYouSaid.get(0).equals("c"))
```

69

```java
{
        ll3();
}
else if (thingsYouSaid.get(0).equals("D"))
{
        ll4();
}
else if (thingsYouSaid.get(0).equals("d"))
{
        ll4();
}
else if (thingsYouSaid.get(0).equals("E"))
{
        ll5();
}
else if (thingsYouSaid.get(0).equals("e"))
{
        ll5();
}
else if (thingsYouSaid.get(0).equals("F"))
{
        ll6();
}
else if (thingsYouSaid.get(0).equals("f"))
{
        ll6();
}
else
{
        //if google voice didn't catch the word < reopen again
```

```java
            Intent i = new
Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
            i.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL, "en-US");
            try {
                startActivityForResult(i, REQUEST_OK);
            } catch (Exception e) {
                Toast.makeText(this, "Error initializing speech to text engine.",
Toast.LENGTH_LONG).show();
            }
        }
    }
}
```

Voice based authentication activity class

```java
public class Login extends Activity {
    @Override
    protected void onActivityResult(int requestCode, int resultCode, Intent data) {
        super.onActivityResult(requestCode, resultCode, data);
        if (requestCode==REQUEST_OK  && resultCode==RESULT_OK) {
        ArrayList<String> thingsYouSaid =
data.getStringArrayListExtra(RecognizerIntent.EXTRA_RESULTS);
//        ((TextView)findViewById(R.id.text1)).setText(thingsYouSaid.get(0));
        Log.e("YOU SAID", thingsYouSaid.get(0));
        if(thingsYouSaid.get(0).equals("1 2 3 4"))
        {
//                Toast.makeText(getApplicationContext(), "TRUE", 3).show();
                Intent intent = new Intent(getApplicationContext(), MainActivity.class);
                startActivity(intent);
        }
        else
```

```java
        {
                Toast.makeText(getApplicationContext(), "Wrong Password, Try Again",
3).show();

                        Intent i = new
Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
                i.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL, "en-US");
                try {
                    startActivityForResult(i, REQUEST_OK);
                } catch (Exception e) {
                    Toast.makeText(this, "Error initializing speech to text engine.",
Toast.LENGTH_LONG).show();
                }
            }
        }
        }
```

The source codes of Arduino Uno are written by C++. This section shows the important source codes of the activities.

```cpp
void loop()
{
   EthernetClient client = server.available();  // try to get client

   if (client) {  // got client?
      boolean currentLineIsBlank = true;
      while (client.connected()) {
         if (client.available()) {   // client data available to read
            char c = client.read(); // read 1 byte (character) from client
            HTTP_req += c;  // save the HTTP request 1 char at a time
            // last line of client request is blank and ends with \n
            // respond to client only after last line received
            if (c == '\n' && currentLineIsBlank) {
               // send a standard http response header
               client.println("HTTP/1.1 200 OK");
               client.println("Content-Type: text/html");
               client.println("Connection: close");
               client.println();
               // send web page
               client.println("<!DOCTYPE html>");
               client.println("<html>");
               client.println("<head>");
               client.println("<title>Arduino LED Control</title>");
               client.println("</head>");
```

```
                client.println("<body>");
                client.println("<h1>LED</h1>");
                client.println("<p>Click to switch LED on and off.</p>");
                client.println("<form method=\"get\">");
                ProcessCheckbox(client);
                client.println("</form>");
                client.println("</body>");
                client.println("</html>");
                Serial.print(HTTP_req);
                HTTP_req = "";   // finished with request, empty string
                break;
            }
            // every line of text received from the client ends with \r\n
            if (c == '\n') {
                // last character on line of received text
                // starting new line with next character read
                currentLineIsBlank = true;
            }
            else if (c != '\r') {
                // a text character was received from client
                currentLineIsBlank = false;
            }
        } // end if (client.available())
    } // end while (client.connected())
    delay(1);      // give the web browser time to receive the data
    client.stop(); // close the connection
  } // end if (client)
}

// switch LED and send back HTML for LED checkbox
void ProcessCheckbox(EthernetClient cl)
```

```
{
  if (HTTP_req.indexOf("LED2=2") > -1) {
    LEDNO=2;
      // see if checkbox was clicked
      // the checkbox was clicked, toggle the LED

    if (LED_status) {
      LED_status = 0;
          checked="<input type=\"checkbox\" name=\"LED2\" value=\"2\" \
      onclick=\"submit();\" checked>LED2";
    }
    else {
      LED_status = 1;
      unchecked="<input type=\"checkbox\" name=\"LED2\" value=\"2\" \
      onclick=\"submit();\">LED2";
    }
  }
}
```

APPENDIX B

ARDUINO UNO C++ SOURCE COES

The source codes of Arduino Uno are written by C++. This section shows the important source codes of the activities.

```cpp
void loop()
{
  EthernetClient client = server.available();  // try to get client

  if (client) {  // got client?
    boolean currentLineIsBlank = true;
    while (client.connected()) {
      if (client.available()) {   // client data available to read
        char c = client.read(); // read 1 byte (character) from client
        HTTP_req += c;  // save the HTTP request 1 char at a time
        // last line of client request is blank and ends with \n
        // respond to client only after last line received
        if (c == '\n' && currentLineIsBlank) {
          // send a standard http response header
          client.println("HTTP/1.1 200 OK");
          client.println("Content-Type: text/html");
          client.println("Connection: close");
          client.println();
          // send web page
          client.println("<!DOCTYPE html>");
          client.println("<html>");
          client.println("<head>");
          client.println("<title>Arduino LED Control</title>");
          client.println("</head>");
```

```
            client.println("<body>");
            client.println("<h1>LED</h1>");
            client.println("<p>Click to switch LED on and off.</p>");
            client.println("<form method=\"get\">");
            ProcessCheckbox(client);
            client.println("</form>");
            client.println("</body>");
            client.println("</html>");
            Serial.print(HTTP_req);
            HTTP_req = "";    // finished with request, empty string
            break;
          }
          // every line of text received from the client ends with \r\n
          if (c == '\n') {
            // last character on line of received text
            // starting new line with next character read
            currentLineIsBlank = true;
          }
          else if (c != '\r') {
            // a text character was received from client
            currentLineIsBlank = false;
          }
        } // end if (client.available())
      } // end while (client.connected())
      delay(1);      // give the web browser time to receive the data
      client.stop(); // close the connection
   } // end if (client)
}

// switch LED and send back HTML for LED checkbox
void ProcessCheckbox(EthernetClient cl)
```
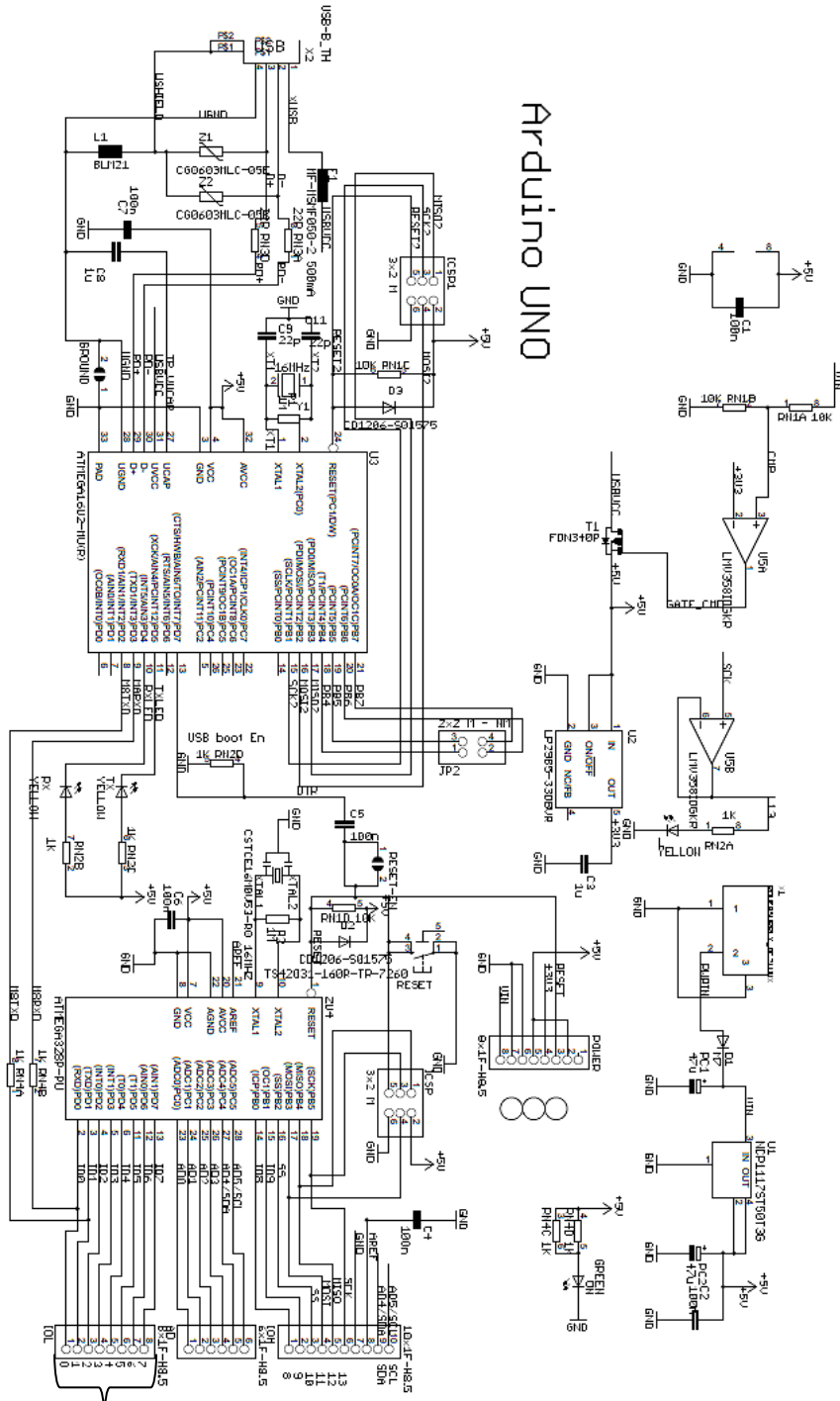
```
{
  if (HTTP_req.indexOf("LED2=2") > -1) {
   LEDNO=2;
     // see if checkbox was clicked
     // the checkbox was clicked, toggle the LED

     if (LED_status) {
        LED_status = 0;
           checked="<input type=\"checkbox\" name=\"LED2\" value=\"2\" \
        onclick=\"submit();\" checked>LED2";
     }
     else {
        LED_status = 1;
        unchecked="<input type=\"checkbox\" name=\"LED2\" value=\"2\" \
        onclick=\"submit();\">LED2";
     }
  }
}
```

Pins from zero to 7 are connected to resistor for each LED

The mentioned pins in the Arduino ATMEGA328P from pin 2 to pin 7 and pin 8 are connected to the LEDs as entrance, then to the resistor with 22 ohm value and then to the ground. Where pin zero as a receiver of the transmitted orders by the ATMEGA328P-PU chip, pin 1 as a transmitter in the ATMEGA328P-PU chip. Moreover, the power socket is connected as: Pin 1 is free, pin 2 and 5 to +5volts, pin 3 to reset, pin 4 to +3volts, pins 6 and 7 to ground, and pin 8 to input voltage.