REPUBLIC OF TURKEY
FIRAT UNIVERSITY
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE

DESIGN AND IMPLEMENTATION OF THE MOBILE FIRE ALARM SYSTEM USING WIRELESS SENSOR NETWORKS

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(142129108)

Master Thesis
Department: Computer Engineering
Supervisor: Asst. Prof. Dr. Ebubekir ERDEM

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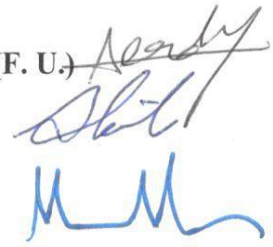

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ABBREVIATIONS

AES: Advanced Encryption Standard
ARM: Acorn Risk Machine
BSD: Berkeley Software Distribution
CAN: Controller Area Network
CSMA: Carrier Sense Multiple Access
DSP: Digital Signal Processing
GSM: Global System for Mobile communications
IDE: Integrated Development Environment
IEEE 1451: Institute of Electrical and Electronics Engineers
ISM: (Instrumentation, Scientific, and Medical) or (Integration Server Management)
IRQ: Interrupt Request
LAN: Local Area Network
LDO: Low Drop Out
LPG: Liquefied Petroleum Gas
MCU: Multipoint Control Unit
MMS: Multimedia Messaging Service
MSP: Modular Simulation Platform
NCAP: Network Capable Application Processor (from IEEE standard 1451.1)
NIST: National Institute of Standards and Technology
PC: Personal Computer
PDA: Personal Digital Assistant
RF: Radio Frequency
RS-232: Radio Sector a standard for serial communication transmission of data.
STIM: Smart Transducer Interface Module (from IEEE standard 1451.1)
SMS: Short Message Service
SPI: Serial Port Interface
TCP/IP: Transmission Control Protocol/Internet Protocol
TEDS: Transducer Electronic Data Sheet
TKIP: Temporal Key Integrity Protocol
TII: Transmitter Identification Information
UDP: User Data Protocol
UWB: Ultra-Wide-Band
UV: Ultra-Violet
WEP: Wired Equivalent Privacy
WI-FI: Wireless Fidelity, wireless internet
WPAN: Wireless Personal Area Network
WPA: Wi-Fi Protected Access
WSN: Wireless Sensor Network

ABSTRACT

Design and Implementation of the Mobile Fire Alarm System Using Wireless Sensor Networks

The surveillance of home or industrial places through sensors and the prevention of problems via prediction are of vital importance for the safety of these areas. This Thesis shows how to increase wireless sensor network (WSN) techniques by composing new design methods and improved a low-cost industrial and home safety systems. So as to guarantee and present accurate solutions to the system, not only temperature and humidity sensors but also flame and gas sensors were used in this study. The design of simple hardware circuit allows every user to utilize this wireless home safety system. A notification was used as a method of informing users related to system. The installed Arduino device which was programmed with Android Studio takes received gas, flame, the temperature, and humidity signals from the sensors. In order to pre-monitor the capability of occurrence of a fire, when it detects that the collected data with control levels exceed a predefined threshold it will enable the communication with WIFI network and send the notification alarm message to the mobile users.

Keywords*:* *Fire Alarm System, WIFI, Notification, WSN, Arduino , Android Studio System , Sensor*.

ÖZET

Kablosuz Sensör Ağları Kullanılarak Mobil Yangın Alarm Sisteminin Tasarımı ve Gerçekleştirilmesi

Ev veya endüstri yerlerinin sensörler vasıtasıyla gözetlenmesi ve tahmin yoluyla sorunların önlenmesi bu alanların güvenliği açısından hayati öneme sahiptir. Bu tez, yeni tasarım yöntemleri oluşturarak kablosuz algılayıcı ağı (KAA) tekniklerini nasıl artıracağını ve düşük maliyetli endüstriyel ve ev güvenlik sistemlerini nasıl geliştirdiğini göstermektedir. Sisteme doğru çözümleri garanti etmek ve sunmak için, bu çalışmada sadece sıcaklık ve nem sensörlerinin yanı sıra alev ve gaz sensörleri kullanılmıştır. Basit donanım devresinin tasarımı, her kullanıcının bu kablosuz ev güvenlik sisteminden faydalanmasını sağlar. Sisteme ilişkin kullanıcıları bilgilendirme yöntemi olarak bir bildirim (uyarı) kullanılmıştır. Kurulan Arduino cihazı, Android Studio ile programlanan algılayıcılardan gelen gaz, alev, sıcaklık ve nem sinyallerini alır. Olası bir yangının oluşmasını önceden izlemek için, toplanan verilerin kontrol seviyeleri ile önceden belirlenmiş bir eşiği aştığını tespit ettiğinde, WIFI ağı ile iletişim sağlanıp uyarı alarm mesajını mobil kullanıcılara gönderilmektedir

Anahtar Kelimeler: *Yangın Alarmı Sistemi, WIFI, Bildirim, KAA, Arduino, Android Studio Sistemi, Sensör.*

1. INTRODUCTION

Improvements in wireless communication and microelectronic articles led to the advancement of low-power sensors and the deployment of large-scale sensor networks. With the capabilities of pervasive inspection, sensor networks have dragged meaningful observation in many applications realms, before-mentioned as position monitoring, target tracking, environment monitoring, army, fire management, as fully as smart settings [1].

The principal goal of sensors network means to assemble the monitoring original data and implement essential information and conclusion support for monitoring station [2].

The technology ensures before remodeling the direction we live, operate, and associate by the natural environment. In the not-too-distant eventuality, miniature, dirt-cheap sensors should be completely diffused onto paths, surfaces, or devices, producing a digital cruel that senses a variation of physical events of investment: monitor foot-traveler or vehicular traffic inside human- conscious scenes also intelligent transportation networks, broadcast wildlife environment requirements for environmental protection, detect forest fires to support fast emergency acknowledgment [3].

Including so technological progress gets new requests for data processing within sensor networks. Whatever is required are new computational designs, algorithms also protocol, and plan methodologies and tools to support distributed signal processing, data storage and control, networking, and application evolution. The smart environment relies initial and principal on sensory data of the real life. Sensory information arrives of multiplied sensors from another modality in classified positions [4].

There are four fundamental elements in a sensor network:

(1) An assembly of classified rather localized sensors;

(2) An interconnecting network (usually, though not - forever, wireless-based);

(3) A central aim about information clustering.

(4) A collection of computing support through the central point (or away) to manage data correspondence, case trending, status querying, and data mining [5].

Recently, significant quantities of analysis applications have approved the present implementation and deployment of sensor networks seamstress to the individual requirements of certain sensing including monitoring applications. Into plan to recognize

the actual and implied applications for WSNs, involved and greatly efficient communication rules are expected [6].

With the end intention of delivering their concocted data to a base station. Sensing, processing, including communication, are three key elements whose incorporation in one tiny construction provides increased to a huge symbol of applications [7].

Currently, the era is technology era and all things go to technology, in our life the technology is the major factor for executing our job and the basic of technology is a system or a software for example we have mobile technology but meanwhile it needs a system to perform a job inside itself and if we look at software, the software is used in different domain. For example it's used in services, military, entertainment, market, management and advertisement and many other field. So we can say the technology with itself software or system is an important partner of the human from now, day with day this relationship will be grown up and be a reason for decreasing complexity in our daily life.

A structure fire alarm system consists of sensors, data retrieval, and processing modules. Fire discovery sensors are the intuitive parts of the fire alarm system, comprising sensors for flash, smoke, temperature, gas, and humidity. They are ready to immediately identify the environmental and biochemical information produced by a fire, such as the light (flame), smoke (smoke particles), heat (temperature), gas (combustion gas) and precipitation (air humidity). They can also explicitly communicate the environmental or biochemical information into an energetic signal, later immediately transfer the signal to the fire alert controller. This is the method of data set. There are two kinds of agents of creating fire information: a single-sensor indicator and a multi-sensor indicator.

Hence the load will be decreased on our citizen and therefore the government will be successful in execution of itself job and citizens can take advantage from this project.

The article offers a study and model implementation of new alarm system that applies Wi-Fi technology essentially a network foundation comparing its elements. The designed system consists of pair principal ingredients; the first part is the server (web server) that performs system hub that directs, keys, and observes users' hometown. Rule manager can locally or remotely (internet) control and administration operation code. The secondary part is hardware interface module, whichever affords a suitable interface to sensors and actuator of the alarm system. Contrary most of the possible home automation system in the business, the recommended system is scalable that one server can operate several hardware interface

modules as high as it survives on Wi-Fi network coverage. The system continues a broad scale of office or builds, home [8].

Research plus improvement in technology has produced in making various automated tools which are carrying individuals toward common techniques. External of all materials, the sensor is one before-mentioned device which acts an excellent role in modern day humans' life. Those sensor networks depending on little devices ready about sensing, receiving, processing and license on the data to the root situation where a user can analyze them and invest meaningful choices. Sensor networks allow an extensive amount of datum in the form of a river in a quick real time. Storage and flowing of such a huge datum itself are a challenging responsibility. Also, sensor devices are setback likely to mistakes payable to multiple minds such as weak battery power, environmental influences, hardware malfunctioning. This type of mistakes results in obtaining faulty data. Buying such faulty data for separation or resolution should result in becoming feeble, unreliable results. Therefore, in order to realize the actual result, damage and inexactness in the data requirement do remove before it is being contemplated for experiments. And once the incorrect data are removed, specific, exact data required to be stored in an effective process so that retrieval and processing of data can be built simpler and practical. Common method procedures have been explained in the past by different researchers in order to erase faulty data [9].

A sensor network is viewed essentially a split database that settles environmental determinations respecting the environment signal them, moreover then do doubts from users. Any sensor node typically performs a brook of data matters that are taken from the sensing patterns on the node. Actually, every sensor consists of a short node with sensing, account and contact capacities [10].

We have told that the database view is a modeling and interface issue, but of course the database society has developed a large deal of algorithmic and system architecture to extent this level of indirection in an efficient and dynamic mode. These include query optimization and indexing method and a canonical set of primitive query worker that can be collected to form complex queries. A core defy in relational database systems has been to include that query-based applications stay robust in the face of changing data distributions, physical storage property and query workloads. The infrastructure for datum access in sensor networks will also need to supply a similar form of robustness, in addition to being robust

to node error and noisy sensor readings. Indeed, data descent and routing in the sensor networks look quite analogous to data storage and query working in databases. As such, it looks quite natural to view the sensor network as a database and try to leverage similar benefits in this new case. Of course the properties of the infrastructure and the information in a sensor network are totally different than in a database system [11].

They promote a database style to sensor networks. Declarative inquiries act mostly revised for sensor network cooperation: Users furthermore applications programs events inquiries externally identifying where and in which construction the data is provided in the sensor network and whence individual knowledge is concocted to determine the inquiry response. Exceptional program administration, inquiry optimization, and inquiry processing ways resolution left off the user of the environmental explicit of describing the related sensors, opportunity in-network processing and sending the results following the user [12,13].

A wireless sensor network (WSN) is shown in figure 1.1. A big symbol of multimedia sensor links is stationed at irregular and constantly inside the place which is necessary for monitoring. Each multimedia sensor link has commissioned before-mentioned as wireless transmission, calculation and storehouse etc. Others can unconsciously develop a multi-hop data communication network [14]. When to apprehend the data group instruction sent explanation by assignment administration node, numerous multimedia sensor nodes insistence begin to assemble data and relocate the data set issues to select nodes Sink beside the information forwarding process discovered. Finding node sink posts the end monitoring events to duty administration node with the internet or satellite [15, 16].

The programming of sensor nodes was performed with the Arduino program, and the retrieval of sensor values from the base station and their subsequent recording in the computer processing and simulation operations were performed in the Android Studio software development environment using JAVA language.

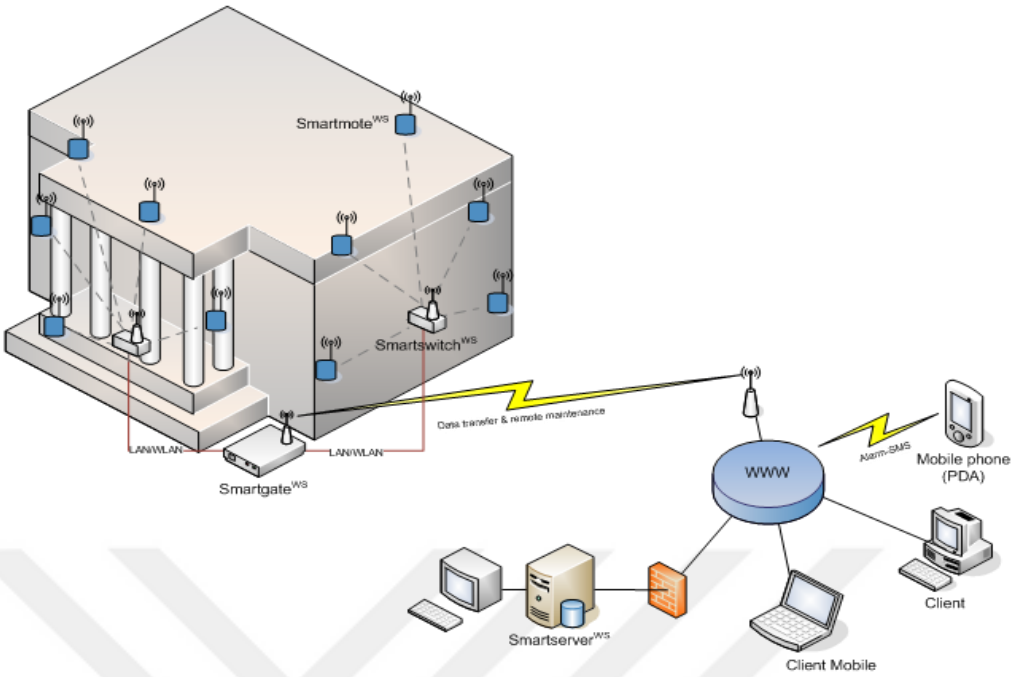


Figure 1.1 Diagram of WSN

1.1. Objectives

The objective or purpose of this program is to know the risk before it happens, which is great damage or other meaning is to reduce damage from fire incidents of physical, moral and health terms.

As the world moved towards the use of a mobile phone in their daily lives, so we designed a special application of the system alarm fire is composed of two parts (Software and Hardware) when there is a glitch somewhere will emit a signal or alarm on the Mobile to warn you of the danger exists in that place, which gave the signal or alarm.

The main aim of the project is to develop a new Android application that is dedicated to the user to serve as an information gateway for anyone who wants get information about the alarm . To achieve this aim, the following objectives have been adopted:

1. To understand the core issues of the Android Apps development.
2. To learn the basic concept of design and development of Android Apps
3. To design and implement a useful app for the user to serve as a guide for providing information about the alarm.

1.2. Related Work

In the year of 2008 [17], this paper concentrates at the faraway watching framework, in mild of the reality that the far off checking framework has more and more utility, a faraway looking at framework taking into account SMS through GSM (Global System for Mobile communications). The equipment and programming engineering of the framework consists in mild of the overall engineering of the framework. On this framework, the far-flung sign is transmitted through GSM machine. The framework incorporates two sections which might be the checking awareness and the remote watching station. The checking awareness comprises of a PC and a TC35 correspondence module for GSM. The computer and the TC35 are related by RS232. The faraway looking at station comprises of a TC35 correspondence module for GSM, an MSP430F149 MCU (Multipoint Control Unit), a presentation unit, sensors and a statistics assembling and managing unit. The product for the observing cognizance and the far off checking station had been composed using Visual Basic.

WSNs fulfill those requirements. Proper capabilities for sensor nodes encompass: ease of set up, self-identification, self-prognosis, reliability, time recognition for coordination with different nodes, a few software program capabilities and DSP (Digital Signal Processing), and trendy manipulate protocols and community interfaces [18].

There are numerous sensor manufacturers and plenty of networks on the market nowadays. It's far too luxurious for producers to make special transducers for every community available on the market. Distinctive components made through distinctive producers should be well matched. Consequently, in 1993 the IEEE and the countrywide Institute of requirements and era (NIST, National Institute of Standards and Technology) commenced work on a widespread for smart sensor networks. IEEE 1451, the usual for smart sensor networks turned into the result. The objective of this fashionable is to make it easier for specific producers to expand clever sensors and to interface the one's gadgets to networks. Fundamental additives consist of STIM (Smart Transducer Interface Module from IEEE standard 1451.1), TEDS (Transducer Electronic Data Sheet), TII (Transmitter Identification Information), and NCAP (Network Capable Application Processor from IEEE standard 1451.1) as special in the discern. A main final results of IEEE 1451 studies is the formalized idea of a clever Sensor. A clever sensor is a sensor that offers extra functions beyond those

vital for generating an accurate illustration of the sensed quantity [19]. Covered might be signal conditioning, sign processing, and choice-making/alarm functions. A widespread model of a clever sensor is shown inside the discerning. targets for clever sensors consist of shifting the intelligence towards the factor of measurement; making it fee effective to integrate and maintain disbursed sensor systems; developing a confluence of transducers, manage, computation, and communications in the direction of a commonplace purpose; and seamlessly interfacing several sensors of various kinds. The idea of a digital Sensor is likewise depicted. A digital sensor is a bodily sensor/transducer, plus the associated sign conditioning and virtual sign processing (DSP) required to achieve reliable estimates of the specified sensor records. The digital sensor is a part of the smart sensor.

In the year of 2008 [20], the paper concentrates on, smart private thief alert, crisis warning, home caution, toxic gasoline spillage far off programmed sound warning and remote manipulate framework, which relies upon on 89c51 single chip PC. The framework can play out a programmed alert, which calls the police hotline range, therefore. It may likewise be a voice alert and indicates warning came about a deal with. This eager security framework may be applied control the electric strength remotely thru telephone.

In the year of 2011 [21], his paper well-known shows a remote display screen and manage caution framework in view of GSM and ARM (Acorn RISC Machine). This framework makes use of ARM-based microcontroller LPC2368 because of the MCU, a smoke sensor MQ-2 to apprehend the hurtful gas, the temperature sensor DS18B20 to display the temperature, the moistness sensor HS1101 to check the stickiness in the room. Moreover, we make use of entryway appealing transfer, we alter them at the entryway and windows to screen the intrusion. In the occasion that the householder returns, he can input the name of the game word via the console. The microcontroller then impairs the alert from the door attractive switch. Once the anomalous happens, the MCU receives the alert flag directly, and the framework controls the camera to take snapshots and send mixed media messages (MMS, Multimedia Messaging Service) to light up the warning information. In the year of 2011 [22], safety plays a major function in today’s global and it's miles important that top protection structures are to be implemented in places of education and paintings. This work modifies the existing protection version installed in industries and this system additionally can be utilized in homes and workplaces. The primary goal of the work is designing microcontroller primarily based poisonous gasoline detecting and alerting device. The risk

gasses like LPG (Liquefied Petroleum Gas) and propane were sensed and displayed each and every 2d inside the LCD show. If those gas exceeds the ordinary stage then an alarm is generated right now and also an alert message (SMS) is sent to the authorized individual via the GSM. The benefit of this automated detection and alerting machine over the manual technique is that it offers quick response time and correct detection of an emergency and in the flip main faster diffusion of the important situation.

An embedded gadget for unsafe fuel detection has been carried out; right here best two gases (LPG and Propane) have been detected for demo cause. The fuel sensors and the important degree of the respective gasoline must be recognized, and then this device can be applied for detecting various gases both in home place together with locations of tutorial establishments, residential and industrial regions which avoids endangering of human lives. This system affords quick reaction price and the diffusion of the crucial scenario can be made faster than the manual strategies.

In the year of 2015 [23], security and automation is a prime situation in our day-to-day existence. The approach to home and business automation and protection device design is almost standardized nowadays. In this paper, we've attempted to boom these requirements via combining new design techniques and advanced a low price domestic and commercial automatic safety systems. All and sundry desires to be as a whole lot as relaxed as viable. The layout of simple hardware circuit allows every person to apply this Wi-Fi home security device with PIR sensor, gasoline sensor, Smoke sensor and major fuse Failure Detector at home & Industries.

It is able to be implemented to any levels of the security device. The structure of the gadget particularly consists of three components the GSM MODEM and the interface circuit that include the extraordinary sensors used. The function of the GSM MODEM is the remote communication between the user and the controller via the RS232 serial verbal exchange general. The function of the controller is to continuously test the inputs coming from the unique sensor and send a message via the GSM network in case of emergency. The microcontroller is attached to special gadgets like a smoke detector, motion detector through relays. The GSM related to the person, police station, and hearth brigade through the cellular cell network. An interface circuit has been designed which includes sensors as input devices. Then the programmed microcontroller has been linked to the interface circuit and the GSM MODEM via the serial port of the GSM MODEM [24].

1.3. Organization of the Thesis

The rest of this thesis is organized as follow:

Section 2: (Wireless sensor network) In general, owner speaks in this section for the definition of Wireless, its applications in all areas and the ways in which the user in the network, the types WSN frequency.

Section 3: (Fire Alarm System) Here we surmise explain in our system design and Mobile system (Android) And Mobile applications with the ways and methods of knowledge and used in restructuring the Implementation Rules Mobile Phone**.**

Section 4: (Hardware Architecture) Here we surmise explain parts hardware belong to our work, such as Microprocessor (Arduino) and sensors (gas and flame and the temperature and humidity) and Wireless system how to work, and also network level (Router).

Section 5: (Construction of Frame-Application Mobile System) In this section, we offer Mobile Phone steps applicable a system for fire alarm with surrounding procedures and how to configure the database and save it as well as display the results and discuss it and ordered control using (Simulation Matlab).

Section 6: (Conclusion) This section summarizes and discusses the contributions of this research work. It also discusses the limitations of the features introduced in this research work, and future directions of our research.

2. WIRELESS SENSOR NETWORKS

WSN is a collection of large sensor nodes each can sense, process, and talk to its peers so as to work together in a cooperative manner. A sensor system will be comprising from claiming many batteries worked sensors that gather information Furthermore exchange it should a number of gateways sensors similarly as demonstrated in fig. 2.1. Remote sensor networks need aid start on a chance to be deployed toward an accelerated pace [25]. This is achieved by embedding numerous distributed sensor nodes into the physical world and networks these devices so that they can coordinate to perform higher-level identification and tasks. They get the data to a sink. The sink is wired to a gateway which provides out-of-network connectivity (e.g., Internet).

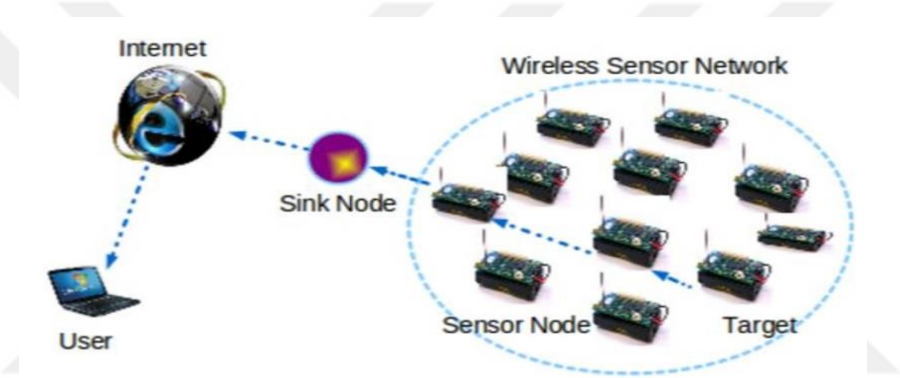


Figure 2.1 Wireless sensor network

WSN is a collection of sensors (sensor nodes) that are used in the transmission or go after physical or chemical phenomenon given (such as temperature, humidity, vibration, light etc. ...) and then move the information on the phenomenon wirelessly to the data processing station to take usefulness of them without human exist in the position of the physical phenomenon [26].

Remote programmed meter perusing (AMR) is a standout amongst the speediest developing businesses to short-go radio gadgets. Remote accumulation about utility meter information (electricity, water, gas) will be a cost-efficient method for gathering utilization information to those charging framework chip once produces low-cost, low-power radio chips and transceivers for remote AMR requisitions [27].

Sensor node is an instrument that has a microprocessor and a monitoring ability and wireless connectivity and maybe also has a small screen to show readings, generally the sensor of small hardship size of the memory of constant and changeful, both, also experience

from the finite energy stock components of the sensor and the idea of job sensor components as shown in Figure consists of the following modules:

1. Sensor Module (Sensor unit).
2. The unit of data storage (Memory) and processed (Micro-controller).
3. Unit transmission and reception (Recover & Transmitter unit).
4. Power unit.

A WSN may be an accumulation about sensor hubs which would deploy for a sensor fields which gather information furthermore course information again of the base station. A sensor hub a chance to be separated from four fundamental parts, viz. The sensing unit, a preparing unit, a transceiver unit, and a force unit [28, 29]. The restriction will be those heart of the directing standard to WSN. The position discovering framework serves that sensor hub should uncover its position in the earth. The control unit provides for those steady control supply of the sensor hubs which may be those prime target territory of the intruders.

2.1. Applications of WSNs

In this section, we summarize remote sensor system clinched alongside applications, the provisions from claiming sensor networks incorporate war zone surveillance, fight harm assessment, mechanical methodology screening also control, well-being monitoring, home automation, movement observing and so forth. Likewise, it may be indicated in the fig. 2.2.

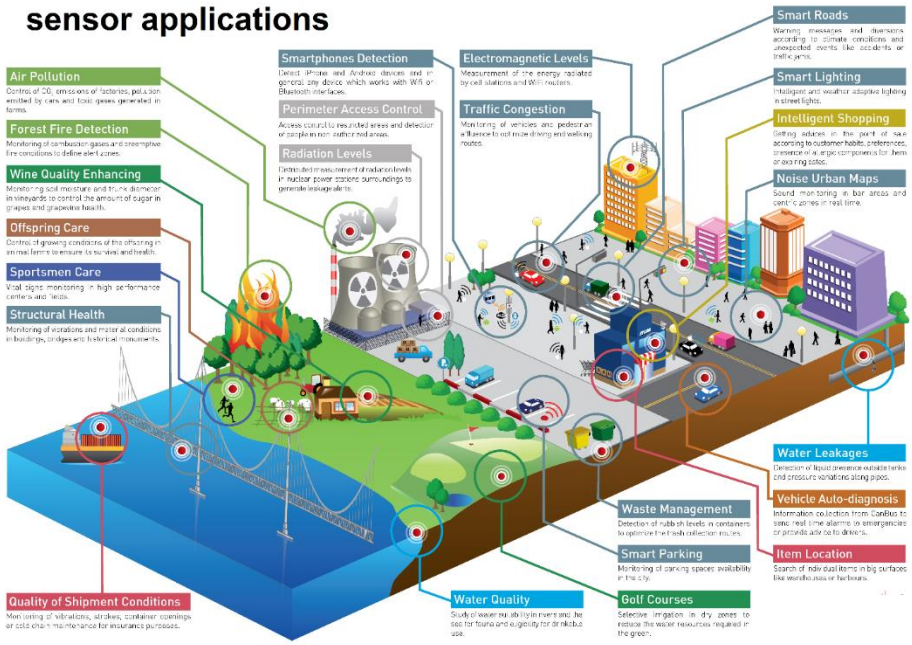


Figure 2.2 Applications of sensor networks

2.1.1. Calamity Response

WSNs are additionally found advantageous to the identification of different disasters, for example, avalanche [30], Volcanoes [31,32] also backwoods fire [33]. At sensor, hubs identify an event about whatever such occasions they impart that data will their neighboring hubs to in-network information amassed. A bunch head or sink hub makes the choice on the catastrophe event recognizing the data gained starting with different sensor hubs. Such collective choice-making enhances those unwavering quality of the choice produced eventually Tom's perusing that whole system [34-37].

2.1.2. Inventive Industries

WSNs need to be settled on a huge effect in the mechanization Furthermore control of the streamlined techniques. The profits of WSN over streamlined provisions are with increment processing efficiencies, to decrease ecological impact, to structure an end circle toward both sensing and controlling different gear during disjoint areas. The sensor hubs can be set at remote furthermore manually distant areas due to their little measure Also ability with imparting remotely. The WSNs would subsequently discover advantageous for steel, chemical, oil furthermore gas, and also mash, furthermore petroleum commercial enterprises. Further, the sensor hubs proficiency to sense and control those climatic parameters makes them handy for pharmaceutical, creation also development commercial enterprises [38].

2.1.3. Security and Observation

Security and more identification needs aid those vital requisitions for WSNs. Sensor hubs with movement sensing competencies might a chance to be deployed during the outskirts with identity those interloper [39] crossing those line of control. Henceforth observation of regions, assets, perimeters, outskirts and cleared territories can be made proficiently carried toward deploying WSNs.

2.1.4. Regulation Agriculture

Various beginning deployments of WSNs hold shown commitment to position many points covered by the agricultural district. With the advice of WSNs, a multiple of the operating actions can be accurately executed resulting in allowing optimization and minimization of the cost acquired in agriculture. The sensor nodes can be used in the field to include various atmospheric and soil parameters. These can support in creating a decision on spraying, compost and pesticide applying. The WSNs may too assist for the applications such as trouble discovery, past discovery, plant temperature prediction, flame detection, automating flooding etc. Some of the continuing and past agriculture plans in India are [39, 40] etc. Other major problems that can be determined using WSNs include truffle agriculture and cattle tracking.

2.1.5. Ecological Monitoring

Regarding are remarkable of the designs and analysis projects explored in the ecological monitoring the application of WSNs.

• **Watershed:** watersheds is necessary to warrant water supply to the rising human population in the society. Accumulate data for learning the water operations of streams and seas counting the result of environmental determinants and social action [41].

• **Scientific investigation:** Sensor networks are doing applied for many experimental types of research including environmental and ecological ones.

• **Infection monitoring:** Developing municipal and industrial countries require active infection monitoring technology.

• **Weather:** Individual analyses of weather happening at fine granularity improve direct weather-dependent applications such as cultivation and more help explain another effect such as the extent of pandemics.

• **Threat-Identification:** Sensors can be applied to classify possible threats such as petrochemical infection of water allocation operation at several locations, pathogens in the settings, and other mental differences in an analytical foundation.

• Coal works monitoring for dangerous gasses [41].

2.1.6. Health (Body Area Networks)

Body distance networks are formed by unless decreasing sensor nodes or embedding them within the human shape to measure many parameters. Those are intelligent of interfacing wirelessly with several extra also by a base position located at the clinic and hospital in real-time. The sensor nodes are able of adopting analytical parameters of a case to identify the events of infection attacks so as heart attack, diabetes, and asthma and communicate the same to the mobile device provided by a family segment and a doctor. Physiological sensors used by sufferers in their own houses can support doctors release wellness concern for areas, wherever social healthcare team is in shortage or hospital foundations, are limited. Such rules are also very beneficial for elder-care [42].

2.2. Wireless Sensor Network Standards

Should encourage those around the world improvement and provision from claiming WSNs, there will be a have to fabricate an expansive low- expense advertise for sensor results in the field. For this purpose, it will be essential to define important guidelines thus that sensor items starting with distinctive producers might interoperate. A considerable measure from claiming endeavors have been committed and are under possibility to get to a number institutionalization associations in place with bind together the market, prompting low - cosset and interoperable devices, also avoiding the burgeoning from claiming proprietary contrary organize conventions. Should a certain extent, those achievement about WSNs as an engineering will generally depend on the prosperity for these institutionalization exertions [43].

2.2.1. The IEEE 802.15.4 Standard

The IEEE 802. 15. 4 [44] may be a standard created Toward IEEE 802. 15 errand assembly 4, which specifies those physical and Macintosh layers for low consumed WPANs (Wireless Personal Area Networks). Concerning illustration defined in its task commission request, the objective for undertaking one assembly 4 will be will provide a standard to ultimo low complexity, ultimo low cost, ultra-low force consumption, low- information rate remote connectivity around modest devices. The first arrival of the IEEE 802. 15. 4 standards might have been conveyed in 2003 and may be uninhibitedly dispersed done [45]. This

discharge might have been reconsidered on 2006, yet the new discharge will be not yet uninhibitedly conveyed. Its protocol stack is basic flexible and doesn't require any foundation. The standard need the accompanying features [45]:

- Information rates from claiming 250 kbps, 40 kbps, and 20 kbps.
- Two tending to modes: 16- b it short also 64- b it IEEE tending to.
- Backing for discriminating inactivity devices.
- Those CSMA (Carrier Sense Multiple Access) - ca channel entry.
- Programmed organize stronghold eventually Tom's perusing the facilitator.
- Completely handshaking protocol to exchange unwavering quality.
- Control oversaw economy to guarantee low- control utilization.

• Exactly 16 channels in the 2. 4- GHz ISM (Instrumentation, Scientific, and Medical) or (Integration Server Management) band, 10 channels in the 915- MHz band, 1 channel in the 868- MHz band. The physical layer of the IEEE 802. 15. 4 standard need being specified on existing together with different IEEE norms for remote networks, to the example, IEEE 802. 11 (WLAN), IEEE 802. 15. 1 (Bluetooth). It offers actuation and deactivation of the radio transceiver, transmission from claiming packets on the physical medium. It works previously, a standout amongst those emulating three license- free bands:

- 868 – 868. 6 MHz (e.g., Europe) for an information rate from claiming 20 kbps.
- 902 – 928 MHz (e.g., North America) with an information rate of 40 kbps.
- 2400 – 2483. 5 MHz (worldwide) with an information rate for 250 kbps. That Macintosh layer gives information and oversaw economy benefits of the upper layers. The information administration empowers transmission and gathering of Macintosh packets through that physical layer. The over-saw economy benefits incorporate synchronization, timeslot management, companionship and disassociation from claiming gadgets of the organize. Moreover, the Macintosh layer executes fundamental security components [46].

2.2.2. The ZigBee Standard

The IEEE 802. 15. 4 standard best define those physical Macintosh layers without specifying the higher protocol layers, including those, organize and requisition layers. Those ZigBee standards [46] may be created ahead highest priority on the IEEE 802. 15. 4 standards and defines those organize and provision layers. The organize layer gives systems administration functionalities to diverse organize topologies, and the requisition layer gives a structure to disseminated requisition advancement and correspondence. Those two

protocol stacks can be make joined together will help short-go low information rate remote correspondence with battery - powered remote gadgets. Those possibility provisions for these measures incorporate sensors, intelligent toys, advanced mobile badges, remote controls and home mechanization.

Those ZigBee protocol stack might have been recommended In those limit about 2004 by those ZigBee collusion [47], a companionship for organizations attempting together with empowering reliable, cost-effective, low-power, remotely networked, monitoring, control items in view of an open worldwide standard. The first arrival of ZigBee might have been reconsidered during those wind about 2006, which introduces extensions on the institutionalization about provision profiles and exactly minor upgrades of the system and provision layers. Both discharges might make uninhibited downloaded at a ref. [64]. For a thorough presentation of the IEEE 802. 15. 4.

2.2.3. The IEEE 1451 Standard

Those IEEE 1451 guidelines would a gang from claiming keen transducer interface principles that defines a situated from claiming open, common, network- autonomous correspondence interfaces for interfacing transducers (e.g. , sensors alternately actuators) on microprocessors, defiant systems and control/field networks. Transducers have a total assortment for provisions done industry, manufacturing, mechanical control, automotive, aerospace, building and biomedicine. Since the transducer showcase is exact diverse, transducer producers need aid looking for approaches on raise low-cost, networked and remote advanced mobile transducers. Yet all the one issue for transducer producers is the vast number from claiming wired and remote networks in the business today. Currently, it may be excessively unreasonable for transducer producers to prepare interesting keen transducers to those vast number for networks on advertise. Therefore, a set of open measures that would universally accept the suited about IEEE 1451 keen transducer interface standards [48].

Those way characteristic for these norms will be that definition about transducer electronic data sheets (TEDS), which will be a memory gadget appended will a transducer for storing transducer identification, calibration, revision data, estimation range, manufacture - related information, et cetera. The objective for 1451 is to make it less demanding for transducer producers on create keen gadgets and with the interface the

individual's units with networks, systems and instruments toward incorporating existing, rising sensor and systems administration advances. To in turn word, it is on a permit that entry from claiming transducer information through a basic set for interfaces if the transducers would associate with frameworks alternately networks through a wired alternately remote medium. The crew of IEEE 1451 guidelines may be supported eventually Tom's perusing those sensor innovation organization specialized foul council of the IEEE defiant and estimation culture. The definitions of the IEEE 1451 principles [48] would briefly depicted below:

• IEEE 1451. 0 defines a set about regular commands, as a relatable point operation and TEDS for those crew from claiming IEEE 1451 keen transducer principles. Through this summon set, you quit offering on that one might entry whatever sensors or actuators in the 1451- built wired and remote networks.

• IEEE 1451. 1 defines a normal article model describing the conducting technique about advanced mobile transducers, an estimation model that streamlines estimation courses and the correspondence models utilized to the standard, which incorporates that customer - server publish - subscribe models.

• IEEE 1451. 2 defines transducers - with - NCAP interface and TEDS for a purpose - will - perspective configuration.

• IEEE 1451. 3 defines a transducer - to - NCAP interface and TEDS for multi-drop transducers utilizing a conveyed correspondence building design. It’s permitted numerous transducers will a chance to be displayed similarly as nodes, ahead a multi-drop transducer network, imparting and as a relatable point one sets for wires.

• IEEE 1451. 4 defines a blended - mode interface for simple transducers for simple and advanced working modes.

• IEEE 1451. 5 defines a transducer-to-NCAP interface and TEDS to remote transducers. Protocol principles for remote networks, to the example, 802. 11 (Wi-Fi), 802. 15. 1 (Bluetooth), also 802. 15. 4 (ZigBee), need aid constantly recognized concerning illustration exactly of the physical interfaces to IEEE 1451. 5.

• IEEE 1451. 6 defines a transducer - to - NCAP interface and TEDS utilizing the high, the lion's share of corps parts don't stay in their starting work areas once their completed CAN (Controller Area Network)-open organize interface. Both inalienably protected and no inalienable safe provisions are constantly upheld [49].

2.3. Radio-Frequency Technologies for WSNs

A number remote checking and control provisions are accessible to the streamlined and home businesses. Some fittings platforms would specific for upgrading special case characteristic (e.g.., secondary information rate, in length exchange range, alternately low-power mode). However, the most of the prohibitive parameters to WSNs would both control utilization and separation. This briefly portrays separate radio recurrence technologies, despite huge numbers of them, are not suitable alternately need aid not yet fully produced for WSNs [50].

2.3.1. Wi-Fi Technology (IEEE 802.11.a/b/h/g)

The Wi-Fi innovation permits separate gadgets similar to laptops, individual machines (PCs, Personnel Computers), mobile phones and personage advanced assistants (PDAs, Personal Digital Assistant) on conveying the middle of each other or with uniting with the web without expecting a link association. The organization for electrical hardware particular architects (IEEE) characterized those Wi-Fi system conventions IEEE 802. 11a, 802. 11b and 802. 11g working in the unlicensed radio groups about 2. 4 and 5GHz. Therefore, at whatever sort of standard Wi-Fi–certified gadget has the ability to work everywhere the planet with information rates from claiming 11Mbps for IEEE 802. 11b alternately 54Mbps to IEEE 802. 11a. for course, those more amazing that separation of the get point, those more level the execution. Wi-Fi engineering organization fails to offer a low-power mode and is additionally not really exceptionally coordinated. Thus, a low-fueled and profoundly incorporated WSN can't utilize this technology, which is the reason we provide for barely a review about this existing engineering [51].

2.3.2. ZigBee Technology

Those ZigBee engineering will be a interchanges standard to frameworks for necessities for example, such that in length battery life, low information rates, secure communications and less unpredictability compared to past remote norms. It is in light of those IEEE 802. 15. 4 standards [52] to remote particular region networks (WPANs).

2.3.3 Bluetooth Technology (IEEE 802.15.1)

Those bluetooth remote interchanges engineering gives a particular range organize to trading information the middle of bluetooth-capable units inside a specific vicinity. Bluetooth innovation needs a low-power mode and helter skater coordinated circuit units and work in the unlicensed 2. 4-GHz band, yet all it may be restricted to short-distance interchanges. Therefore, this innovation organization will be not the majority proper to create a WSN. To this reason, bluetooth will be barely said also portrayed concerning illustration an existing innovation organization [47].

2.3.4 UWB Technology (IEEE 802.15.3)

The Ultra-Wideband (UWB, Ultra-Wide-Band) innovation permits a majority of the data to be transmitted during an expansive transfer speed in exact pulses that are regularly 1 should 2 Nano-seconds long and possess in any event 25% of the focused frequency, a significant part more than different frameworks. The utilization of this engineering organization may be restricted to the go about frequencies from 3. 1 to 10. 6 GHz. An alternate amazing trademark from claiming UWB is its finer conduct technique in regards to interferences over different advances because of the utilization of spread-spectrum regulation strategies [53].

Regardless of hosting a more amazing proportion about transmission speed over control utilization over other comparative innovations such as Wi-Fi, UWB may be restricted to short-go requisitions. It is, therefore, proper for versatile devices, with getting in length battery life without WSNs requiring bigger distances. This may be the primary purpose behind not setting off under further subtle elements on UWB engineering organization [49].

2.3.5. Advantages Ranges WI-FI

The process of preparing a quick and easy their networks, they do not need to be extensions of the wires and the drilling of walls.

It can be moved these devices in all directions, carried and wandered out so that it can be remained permanently connected to the internet.

The connection speed of up via Wi-Fi to 54 Mbps, in its speed does not compare with the modem phone, but is several times faster than the connection by cable or DSL, also confirms

Graham Melville, director of product marketing in the wireless business department at simple company Technologies Symbol Technologies. Preparation of Wi-Fi networks are cheaper than wired networks, especially at the level of the big companies, it also serves Melville, also less expensive and management, and their prices will continue to decline due to increasing demand and the continuation of its support devices. It could be installed in places difficult to extend the cables, archaeological sites, the best example of that where it is difficult conducting excavations which if not impossible to do so [54].

2.3.6. Wi-Fi Shield CC3000 Device

This CC3000 Arduino shield integrated an onboard LDO (Low Drop Out), a chip Antenna and a level logic shifter. It works fine with Arduino or Arduino compatible main board. It uses Serial Port Interface (SPI, Serial Port Interface) for communication so you can push data as fast as you want or as slow as you want. It has a proper interrupt system with IRQ (Interrupt Request Query) pin so you can have asynchronous connections. It supports 802.11b/g, open/WEP/WPA/WPA2 security, TKIP & AES (Advanced Encryption Standard). A built in TCP/IP stack with a "BSD (Berkeley Software Distribution) socket" interface supports TCP and UDP (User Data Protocol) in both client and server mode, with up to 4 concurrent socket connections as it is shown in the fig. 2.3 below [54].

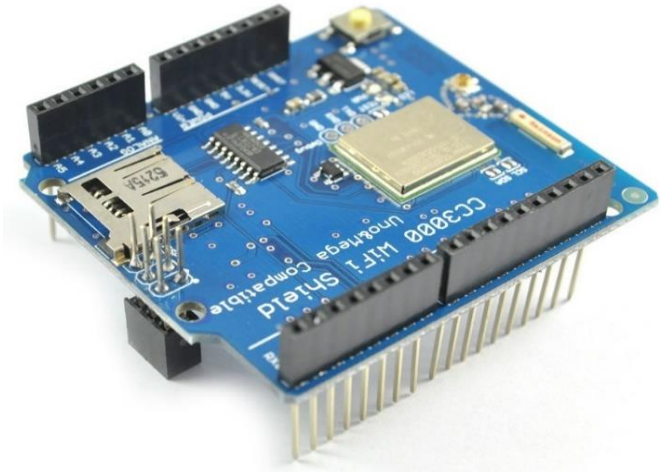


Figure 2.3 Wi-Fi Shield CC3000 device board

The proposed network structure consists of several sensor nodes organized in an HDG204 Wireless LAN 802.11b/g. For this preliminary study considered for gas monitoring in homes or other buildings, the sensor nodes were programmed as a star topology configuration. One of the nodes is the HDG204 coordinator and the others were end devices. The coordinator is always active and it is mains powered, therefore, its energy depletion is not so significant in the network. On the other hand, end devices were battery-powered and reducing their energy depletion is an important matter for the longevity of the network. So as to decrease the power consumption of the hardware as much as possible, it has been decided to design novel wireless sensor node, with the possibility of balancing activation of its components [48].

3. FIRE ALARM SYSTEM

3.1. Fire Alarm System Architecture

The concept can be a fire alarm is essential to our lives, using a mobile technology helps us more to minimize the damage. We have to study how to design the structure and composition of the system after reading close to our idea of the projects. We have created our system can be divided into two parts software and electronic devices (Hardware) and use of the wireless network to receive data and studied and analyzed according to the terms of the alarm and read data.

This thesis presents an implementation of the mobile fire notification system for measuring some physical data with gas, flame and temperature and humidity sensors in the home or buildings where people live. Fig. 3.1 shows the design of the mobile fire alarm system. Gratitude to the self-organization manner sensor nodes from the network and the nodes collect information such as temperature, humidity, gas, flame or other fire monitoring arguments and sent the data to the cluster head which are responsible for the data aggregation and the data packets transmission. Finally, data is wirelessly transmitted to the gateways.

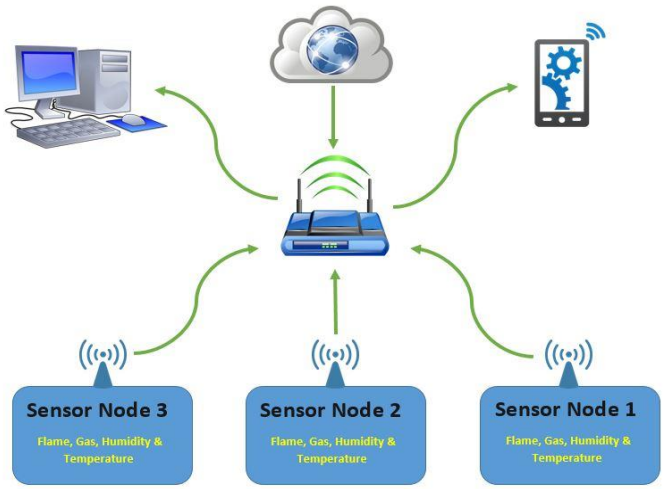


Figure 3.1 Design of the mobile fire alarm system

The basis of the program the fire alarm system is the language of software Android phone and used the language of Arduino parts of sensors and wireless network connecting.

3.2. Mobile Application

International is contracting with the boom of cell smartphone technology. As the range of users is increasing every day, centers are also growing. Starting with easy regular handsets which were used just for making smartphone calls, mobiles have changed our lives and feature turns out to be a part of it. Now they're not used only for making calls but they have innumerable makes use of and may be used as a digital camera, music player, tablet computer, T.V., internet browser and so forth. With the new technology, new software program and operating systems are required.

3.2.1. Android Architecture

The Android working contraption takes after a blame tolerant, quiet and green plan. It comprises of center applications like program, touch and address, a utility framework that grants reuse and substitution of parts, stand-out libraries for sight and sound, database, insurance and additional and a Linux bit this is liable for memory administration and security issues, all of these are shown in fig. 3.2 below.

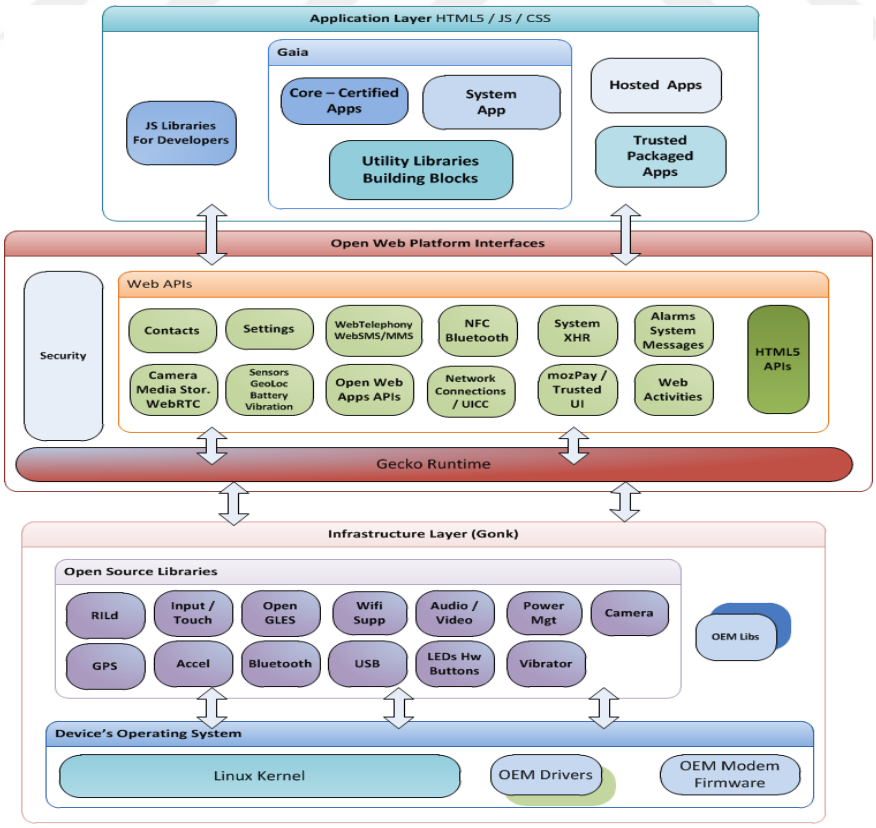


Figure 3.2 Android architecture

4. HARDWARE ARCHITECTURE

4.1. Hardware Design and Implementation

Hardware section is the main part of the fire alarm system which consists of three sensors (flame, gas, heat and humidity) and integrated wireless base chiefly with the Arduino base as we explained earlier in the third chapter of our research and electronic components.

Fig. 4.1 demonstrates the Arduino WIFI Shield enable an Arduino circuit to connect to the internet by the WIFI wireless applications. Monitoring node includes microcontroller module, a sensor module, display and an alarm module, wireless transmission module and power module. Microcontroller module adopts Arduino-UNO-R3 microprocessor WIFI shield CC300, which can improve the speed of data processing and information acquisition precision and reduce power dissipation. Fig. 4.1 represents the block diagram of monitoring node.

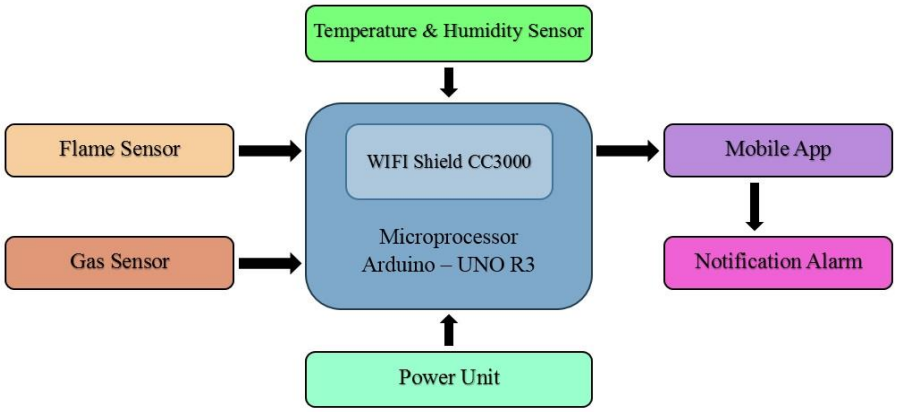


Figure 4.1 Block diagram of monitoring node

4.2. Sensors

We have used in the search of three sensors (such as flame and gas, temperature, humidity), these sensors have a relationship with each other. The program depends on data these sensors in order to be an environment that is far from the fire happened.

4.2.1. Flame Sensor

Where the fumbles flame UV (Ultra-Violet) emitted from the fire and are sensing these rays through the photosensitive compound with the electronic circuit is converted to an electrical signal that it can be run inside hitched circle its resistance, and when read the system to this topic resistance given the signal to the presence of a fire as seen in fig. 4.2.

There are four pins written on them (Ground - Digital Data - Analog data – voltage 3.5V) are writing programming program Arduino that connect these are sensitive are the following.

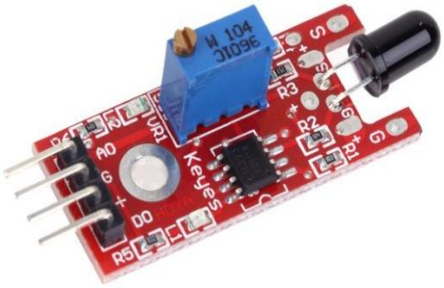


Figure 4.2 Flame sensor module device (Keys)

Link pin d (Digital Data - D) is the entrance into an integrated base (Arduino and Wi-Fi) through as pin (9), which is defined in the programming language defined variable (sensorValue1) . As well linked the pin (Analog Data - A) integrated base through the entrance identifier (A1) variable in programming Arduino as (sensor value).

4.2.2. GAS sensor

The electronic gas detector is a device that detects the presence of various gasses in a certain area is part of the safety device in institutions and homes. It is based detects a gas leak and then the simulation with the existing control system to deal with reference both to sound a warning to evacuate the place for the specialists to deal with the problem or possible send a message to a mobile phone or other competent according to the existing control system.

Figure 4.3 MQ-6 Gas sensor

The gas detector can detect combustible gasses, flammable and toxic, and the depletion of oxygen. Gas detectors are typically battery-powered. They convey warnings through a series of audible and visual signals such as alarms and flashing lights when it is detected dangerous levels of gas fumes, but there is also a new monitoring system remotely and the

disclosure of measuring the concentration of gas is produced by gas detectors operate as portable or fixed.

Since these sensors measure the hazardous gas ratios, the sensor sends a signal to the control system and upon the arrival of the gas concentration to a certain percentage sends a warning signal alarm to alert the user and when it arrived at a dangerous rate of issuers of high voices for personal sensors and it can be shouted down the industrial unit if they have been used and most gas sensors work that way, but different techniques.

In the fig. 4.3, there are four pins written on them (Ground - Digital Data - Analog data – voltage 5V) are writing programming program Arduino that connect these are sensitive are the following:

Link pin d (Digital Data - D) is the entrance into an integrated base (Arduino and Wi-Fi) through as pin (8), which is defined in the programming language defined variable (va1) . As well linked the pin (Analog Data - A) integrated base through the entrance identifier (A0) variable in programming Arduino as (va2).

4.2.3 DHT11 temperature and humidity sensor

Air humidity is the water vapor in the air intake, especially in the troposphere (lower) layer of the atmosphere. Humidity varies depending on the temperature and air pressure, the more the air was warmer increased water vapor carried by the amount and when the air contains the maximum amount of water vapor can carry it under the temperature and pressure of certain, then the air is said to be saturated with water vapor.

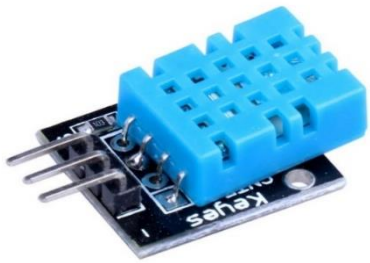


Figure 4.4 DHT11 Temperature and humidity sensor

As seen in fig. 4.4, there are three pins written on them (Ground - Digital Data - voltage), but in the data there are two readings, one of them (temperature) and last (humidity). Writing programming program Arduino that connect these are sensitive are the following:

Link pin (Digital Data - D) is the entrance into an integrated base (Arduino and Wi-Fi) through as pin (2), which is defined in the programming language defined variable (DHT11PIN2).

DHT11 computerized temperature and humidity sensor is a composite Sensor contains an aligned advanced flag yield of the temperature and dampness. Use of a devoted to computerized modules gathering innovation and the temperature and dampness detecting innovation, to guarantee that the item has high unwavering quality and incredible long haul strength. The sensor incorporates a resistive feeling of wet segments and a NTC temperature estimation gadgets and associated with a high-execution 8-bit microcontroller.

In this study, three sensor modules integrated were utilized in the board. Fig. 4.5 demonstrates the hardware design of the fire alarm system. It has been used three sensor modules and between WIFI and Arduino board. As illustrated parts connect with some of whom, the design of circles and connected according to our system.

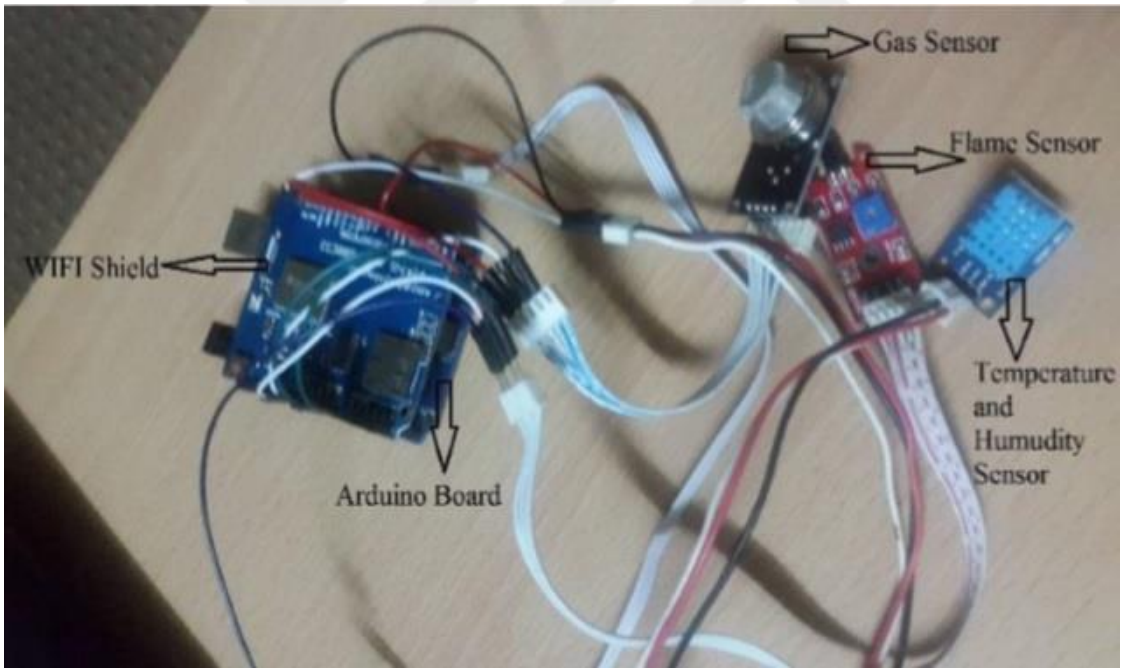


Figure 4.5 Hardware design of the fire alarm system

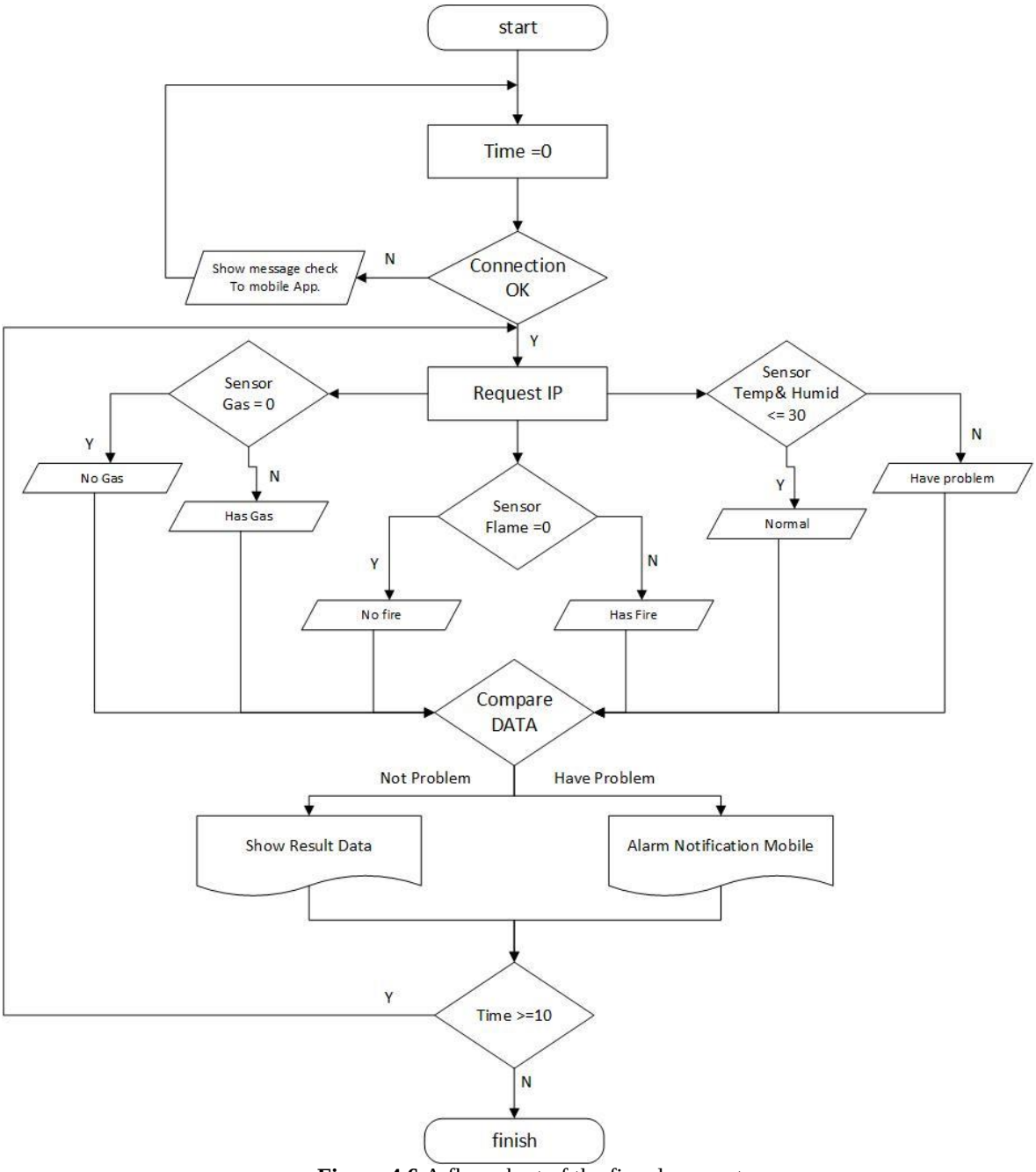
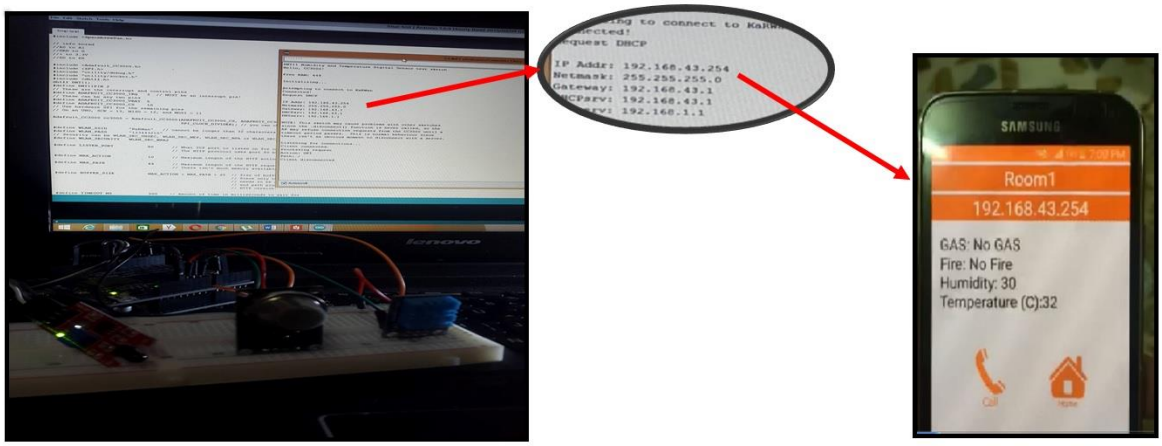


Figure 4.6 A flow chart of the fire alarm system

Values obtained from the sensors are transferred to the mobile device via network connection installed. Sensors evaluate the existence and absence the physical measurements and sensations as logical 1 and logical 0, respectively. In the measurements performed with designed sensor nodes in different home rooms, therefore, the temperature has ranged between 26°C and 29 °C and humidity ranged between 28 and 29 %. In this way, 30 °C and 30% as average values were selected as threshold values for temperature and humidity in this study, respectively. Fig. 4.6 presents a flow chart of the fire alarm system, if flame sensor

senses the presence of flame or gas sensor senses the presence of gas or temperature indicate 30 °C or above or humidity is 30% or above, a system will alarm as “Has Problem” message to the users. In other conditions, the system will give “No Problem” message. Gratitude to this notification on mobile devices, users can intervene in possible fire calamity. In the Fig (4.7), explain how to download the program Arduino to Sensing devices, and how to take (IP) to we enter into Mobile software to read the data show.



(a). Setup Arduino coding to the devices. (b). Show data in mobile

Figure 4.7 Steps transmmsion data devices to mobile

4.3. Arduino Architecture

Arduino is an electronic board is to develop, based on a physical hardware - hardware and software - easy to use and learn. It can be used by professional and junior alike and is used in everything possible that you can think of.

Arduino can communicate with the surrounding environment through a number of sensors and can affect the surroundings through the engines or small lights and other electronic parts control. Fig. 4.8 shows the Arduino UNO R3 Board. The programmable controller is minimum amount (Micro-controller) on the board by the language of the Arduino (Arduino Programming language) is easy to learn and mediated by the integrated development environment (Arduino IDE, Integrated Development Environment) also own for Arduino. Arduino projects can be integrated -Arduino connected to electronic sensors only- and a piece or be connected to the Arduino and communicates with the existing computer programs, such as processing and MaxMSP and the MATLAB software.

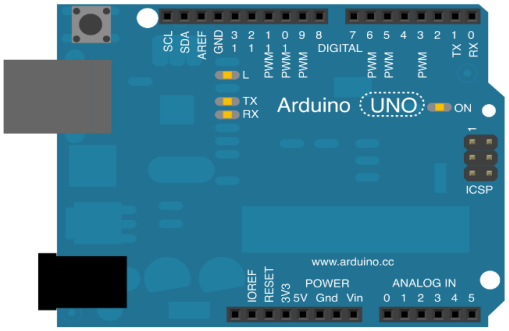


Figure 4.8 Arduino UNO R3 board

4.4. Network Level

We have used a wireless board of the class CC3000. Three wireless boards are required, each of which will be installed on top of the Arduino board. Each of these boards will be connected to an Access Points, which is a TP-LINK brand, through the wireless boards. In this manner, a local network is created. Each of the Arduino boards will get an IP allocated by the DHCP of the Access point, and then we statically set the IP the Arduino board by the Mac Address of the Arduino board so that it will choose the same IP over and over again. Each of the devices are placed alone on top of the Arduino boards.

The integrated devices after they have been defined and taking IP and MAC- address for each device .So we have to access control to the router for availability and reserve locations and not to manipulate it when you turn on or off as you see in the figure (4.9) below.

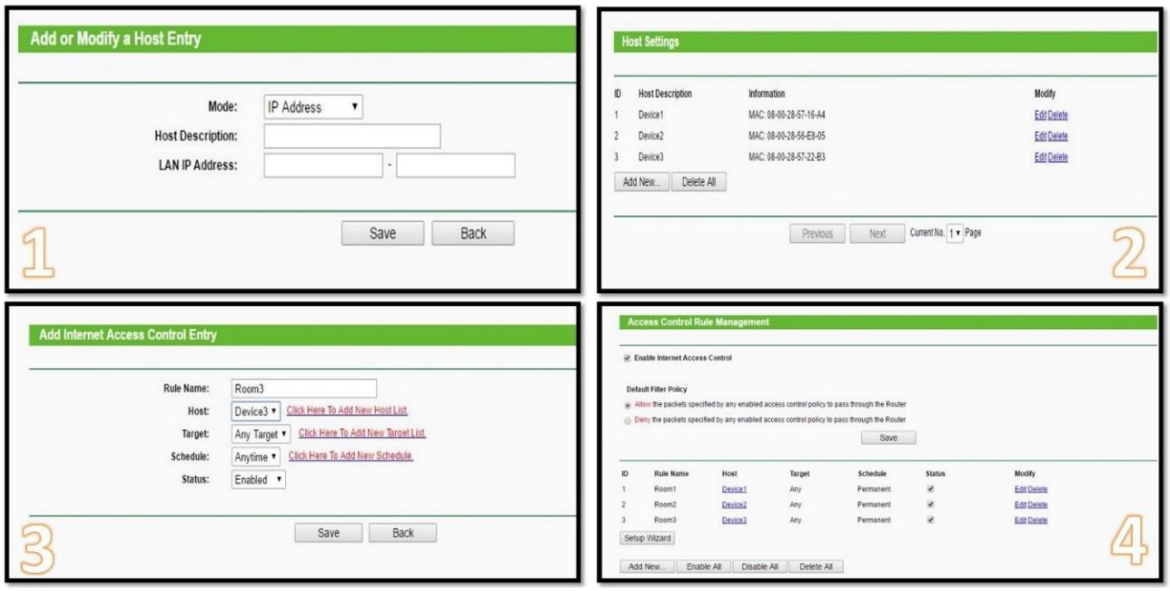


Figure 4.9 Steps network level for booking (IP and MAC) devices

5. CONSRUCTION OF FRAME-APPLICATION MOBILE SYSTEM

5.1. Mobile Applied Implementation and Design

We made it clear in previous chapters that the programming language to be our mobile (Android) is used because the system is programmed open source helps us or facilitate the completion of our system without many complications.

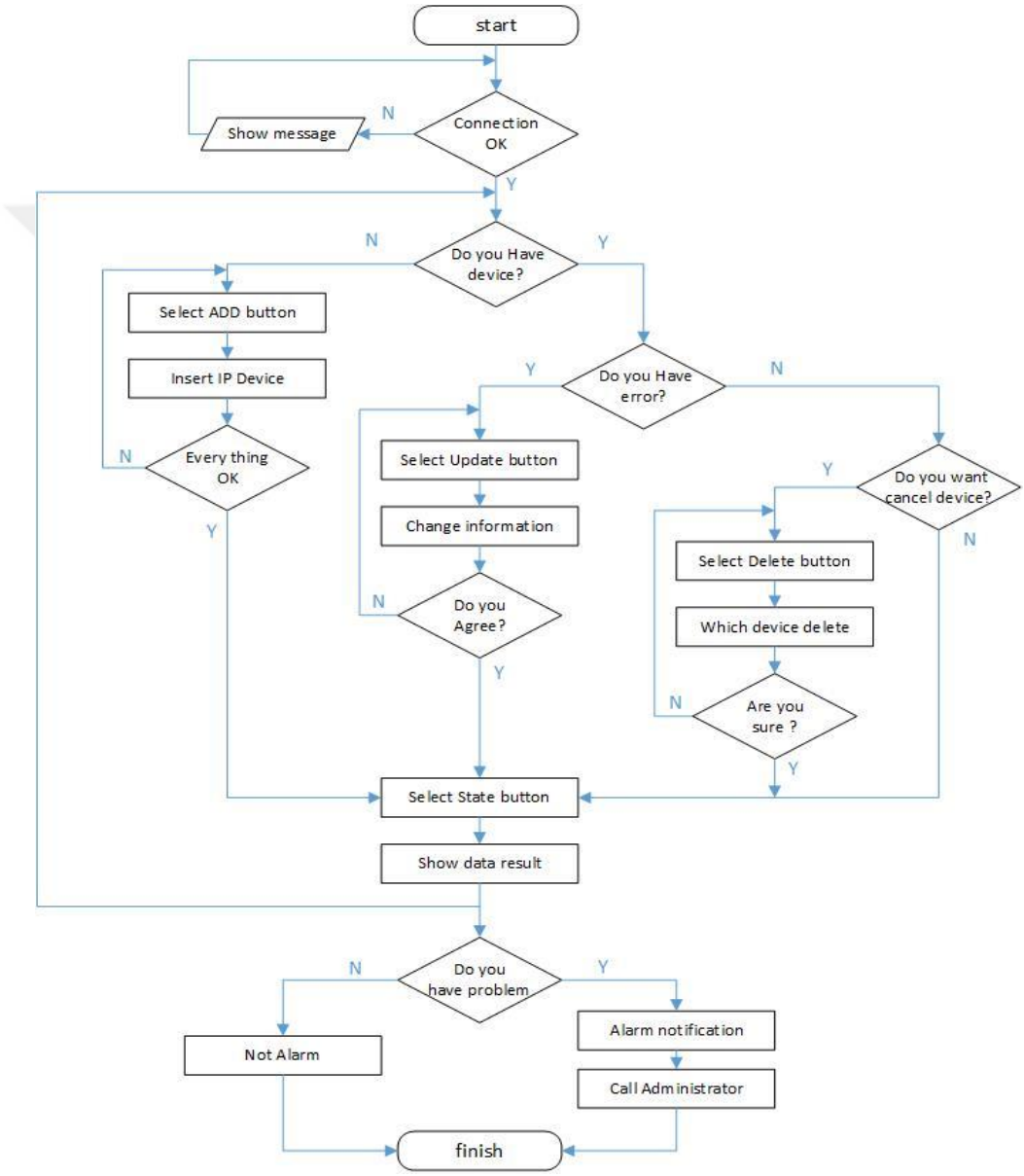


Figure 5.1 Flowchart of the mobile application

According to flowchart as shown in the fig. 5.1, we have designed our system in terms of structuring the work and the work with the other thread. We designed the fire alarm system in a simple work of it as a user without unambiguous.

In fig. 5.2, to explain briefly, mobile design steps program, which we designed to warn or inform us the presence or risk of a defect in one of the rooms, we can read the data for each room so that analyze data received from the sensors used in the system. When we look at the basics of the system, it identifies us to the work of the fire alarm. First step to confirm a mobile connection to the same internal network (router) used in programming for our organs Arduino-electronics.

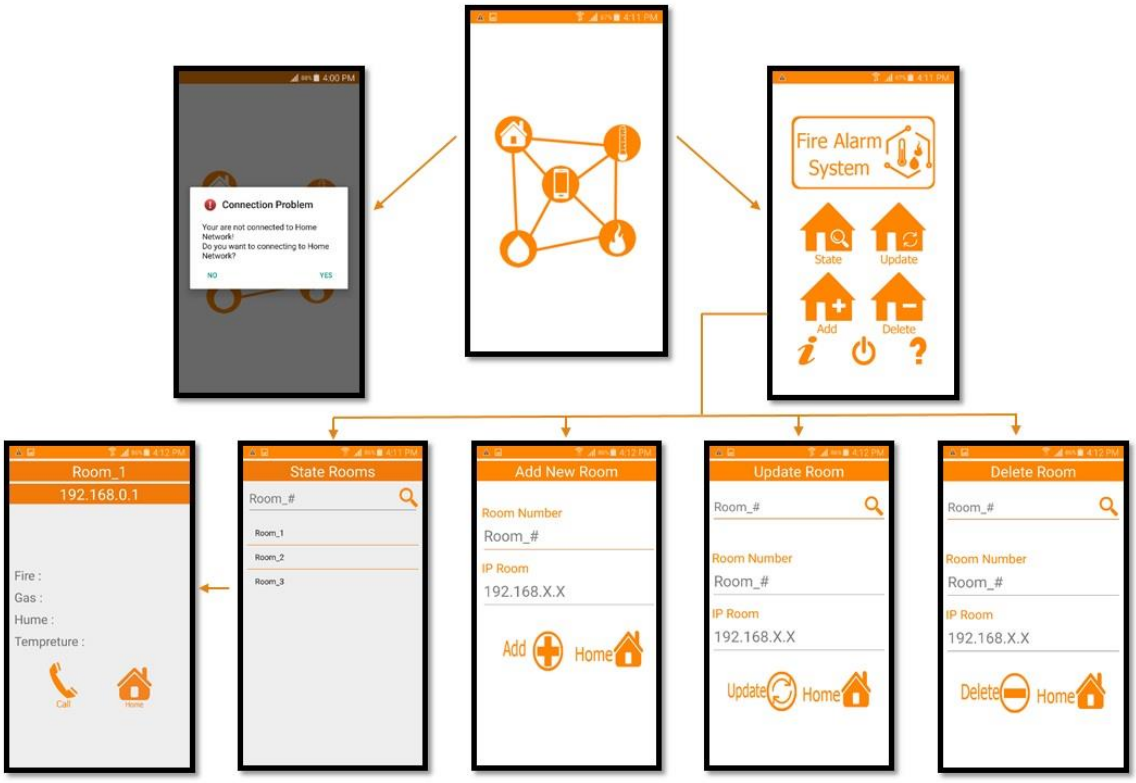


Figure 5.2 Mobile Interface (GUI) and Database Distribution

Then we have established database which is fragmented into four parts (state, update, delete, add) we will explain in detail these parts. Each device sensors gives us (IP) when running and through this, mobile includes it in the program and received and read data from a mobile phone.

5.2. State Operate

State operate button as seen in fig. 5.3, is used to show the data that we get from the sensors before by (IP) down to a practical program of fire alarm when pressing a list showing the number of rooms (i.e. the number of electronic devices - Arduino) when choosing one difference shows the results. Results in this interface contain four read a (flame - Gas - heat and humidity) and at the bottom of the screen there is a button to open the inventory file data inside it when updating readings.

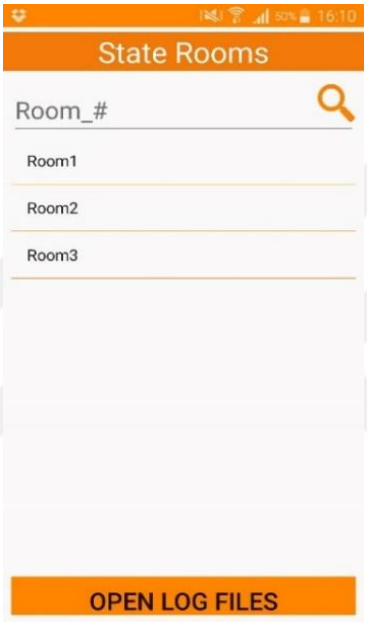
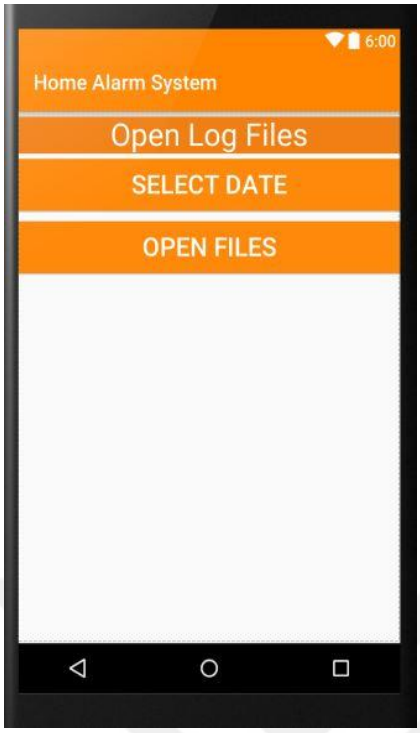


Figure 5.3 Interface state operation

When pressing the button (open log files) for opening a new interface, this interface is stored data on the work of our fire alarm by reading sensors used these data, it can be seen to be accurate about the state of the environment in the room variables (flame and gas and the heat and humidity). It stores on a daily basis and when choosing the calendar from the button (Select date). As shown in the fig. 5.4, we choose who we want to know the history of the variables in the data (fig. 5.4.a) and then push the button (select dates, fig. 5.4.b) to show (figure 5.4.c) all the data so with the knowledge of the history of time.



a. open interface (open file)

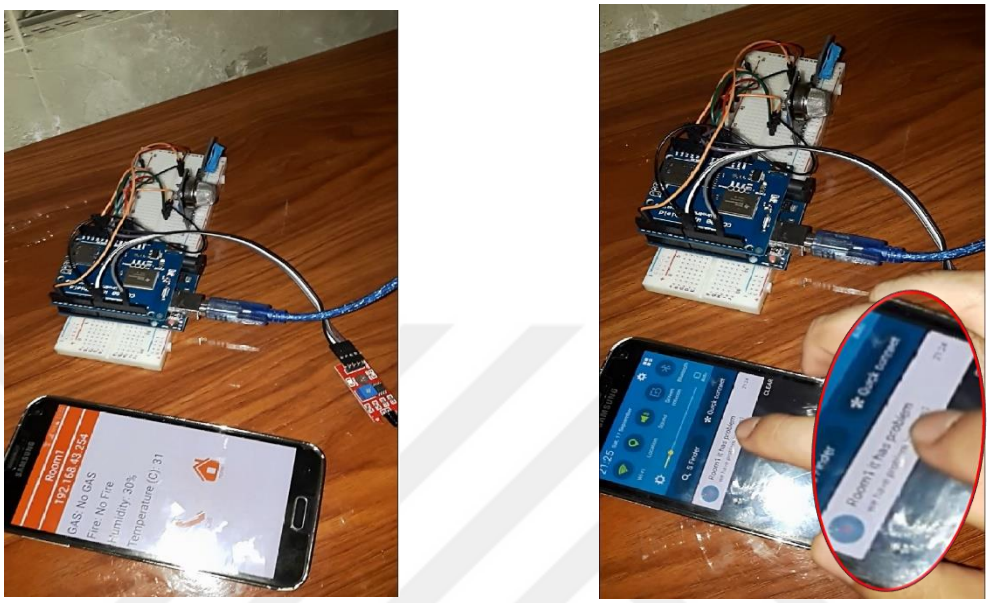
b. select date

c. showing data

Figure 5.4 Open log files operation

5.3. Experimental Results

Figure 5.5. (a) Demonstrates the results obtained from the Room 1 on the mobile phone. It is obviously seen due to the fact that temperature is 31 °C and humidity is 30%, the notification message is “Has Problem”, as shown in Figure 5.5.(b).



(a) Reading and showing data obtained (b) Notification alarm

Figure 5.5 Mobile and Arduino interface of the system

It took a sample of the data of the room first for the data analysis of randomly chosen hour between the (9:30:00 up to 9:50:00) twenty-five reading device sensors. Room first found after more than a minute and a half over there we saw one gas data missing for that because of the manipulation voltage in the device not to send the full voltage of the sensor as shown in the Table 1 below.

TABLE 1. Reading and saving data from room1

Room 1				
Time	**Gas**	**fire**	**Temperature**	**Humidity**
9:30:00	no	no	27	29
9:30:50	no	no	27	29
9:31:40	no	no	28	29
9:32:30	no	no	27	28
9:33:20	no	has fire	26	28
9:34:10	no	no	26	28
9:35:00	no	no	26	30
9:35:50	no	no	25	30

9:36:40	no	no	27	30
9:37:30	no	no	27	29
9:38:20	no	no	27	29
9:39:10	no	no	27	29
9:40:00	no	no	25	29
9:40:50	has gas	no	25	28
9:41:40	no	no	25	27
9:42:30	no	no	26	28
9:43:20	no	no	26	29
9:44:10	no	no	26	29
9:45:00	no	no	26	31
9:45:50	no	no	27	31
9:46:40	no	no	28	31
9:47:30	no	has fire	28	31
9:48:20	no	no	28	30
9:49:10	no	no	27	30
9:50:00	no	no	27	30

Experimental measurements and notification results which have done in other rooms having different network IP addresses, could be summarized as shown in Table 2.

TABLE 2. Notification results of the other home rooms

Home room	Gas	Flame	Humidity	Temperature	Notification Result
Room2	No Gas	No Fire	28	26	No Problem
Room3	Has Gas	No Fire	29	26	Has Problem
Room4	No Gas	Has Fire	35	28	Has Problem
Room5	No Gas	No Fire	29	27	No Problem

According to Table 2, because of not detected gas, fire and temperature and humidity values have not exceeded the determined threshold in the Room 2, it has been seen “No Problem” notification massage on the mobile phone. On the other hand, it has been detected and sensed gas in the Room 3, it can be clearly said that there may be a problem in the room and will be a “Has Problem” massage on the mobile device.

After that formed simulation especially for the treatment or control of what happened after we received the message alert to the presence of danger, as shown in the fig. 5.6. Control unit consists of two components if sending data to the control unit through a key condition for the handling and control of the situation.

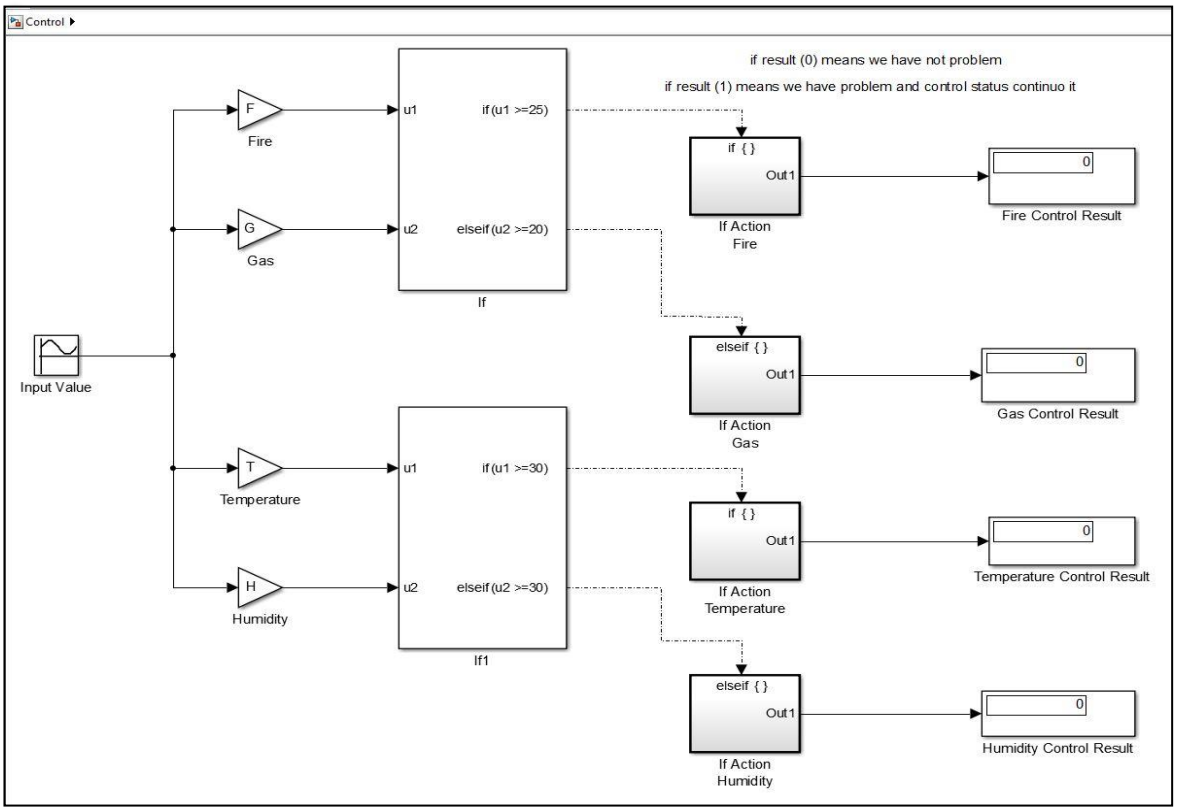


Figure 5.6 Simulation for control (Fire, Gas, Temperature and Humidity)

The control circuit to control the fire situation when (Has Fire) who shall run extinguisher which the result is one means working or on. But if it was the case of normal means (no fire), the result (zero) means off or stopping.

As well as of the state-controlled gas situation and control of when the case may be (Has Gas) is the closure of all the gas the key to any result show (Zero means Off) and if either no gas risk (no gas), the result of the control key becomes one means worker.

6. CONCLUSIONS

WSNs play significant role in real environment. This thesis presents a preliminary study of a smart WSN able to detect fire alarm. It has been set up useable a WSN with three sensors. An application was developed for determining physical 5 home rooms information with digital output. It has been designed a system android with Arduino hardware which consists of three sensors (flame, gas, heat) in home rooms. If these sensor readings values exceeds the pre-defined threshold level, the application system of the sensor network interface on mobile phone can be visible to users as notification form whenever wants. In this sense, it can be informed if the temperature rises, can be ready to prevent the possible fire disaster. This means that the application sends a piece of alarm as notification to the personal mobile in case of any alarm activity has been detected at home or office or build, etc. So, the users will be able to keep track of their safety.

Within the limits of the presence of the router connected between mobile phones and devices, this application has many such as decreasing routines in life human, making suggestion and making critical to any normal user visits and being low cost and offline of this work.

Compared with the previous acts or the technique used that analyzes the data within hardware device, we take only read the data from the sensors, so we configure the database as easily as we deal with the movement of organs or damage to equipment or leave, delete, or add other devices.

We dealt with a wireless network because we concluded the development of technology designed to use the phone and the development of its uses and establish service programs the most.

In the future, we can bind to server in order to useful more than one fire alarm and we have prepared a program (simulation) also add a control unit hardware so as to address the situation without causing risks.

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