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*Ministry of Higher Education*  
*and Scientific Research*  
*University of Babylon*  
*College of Engineering*



# **Design and Implementation of Security and Protection System Based on Cloud Computing**

**A Thesis**

**Submitted to the College of Engineering / University of Babylon in  
Partial Fulfillment of the Requirements for the Degree of Master  
in Engineering /Electrical Engineering /Communications**

**By**

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**2022 A.D**

**1444 A.H**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ  
وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ)

صَدَقَ اللَّهُ الْعَلِيِّ الْعَظِيمِ

سورة المجادلة : 11

*Dedication*

*To my beloved family*

*Mohammed. A. Yousif*

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*Mohammed. A. Yousif*

## *Abstract*

It is nice for the world to become an information cloud that allows information, and software technologies a wide space to facilitate the requirements of human life in terms of security. It includes the automatic entry system for people, the automatic entry system for vehicles, the fire alarm system, and the energy control system. Through this work, a low-cost, easy-to-use, security system was designed and implemented for sensing people's automated entry processes through a biometric fingerprint sensor, And automated vehicle entry processes through Radiofrequency identification, Infrared ray (RFID, and IR) sensors. And automated energy is controlled processes through an Infrared ray (IR) sensor, and a fire alarm system for protecting people from the danger of the gas produced by the fire through a smoke sensor, and displaying this data in real-time a distinct graphical user interface (GUI) in front of the supervisor's as well as to authorized persons to make crucial decisions regarding the institution eyes. These reports are transferred through the use of Internet communication. And presented to the competent higher authorities by designing a front interface to enter the system and a back interface to display reports, These processes can be made by using Personal Home Page, Cascading Style Sheets, Hypertext Markup Language, (PHP, CSS, HTML) languages and allocating hosting space on the (A2 Hosting) website, (Ann Arbor) is a city in the state of Michigan, USA, where the company is headquartered. The design is done by using a (GUI) for displaying data using PHP and C-Sharp languages and using the XAMPP program. This program that makes the process of data entry, presentation, and processing more easier for the supervisor. The system was tested in multiple cases and on different people and different identification cards, and it proved to be remarkably efficient. The alarms were also tested and proved effective during the occurrence of danger, whether in the case of Attempted unauthorized entry or a case of gas or smoke being emitted as a result of a fire.

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## **List of Abbreviations**

<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
IoT	Internet of Things
IT	Information Technology
MIT	Massachusetts Institute of Technology's
ITU	Information Technology Unit
DCs	Data Centers
IrDA	Infrared Data Association
UWB	Ultra-Wideband
NFC	Near Field Communication
RFID	Radio frequency Identification
CPUs	Center Processing Unit
ID	Identification
Wi-Fi	Wireless Fidelity
CCD	Charged-Coupled Device
IP	Internet Protocol
LAN	Local Area Network
IR	Infrared
MCU	Microcontroller Unit
PIC	Programmable Intelligent Computer
GSM	Global System for Mobile
SMS	Short Message
PC	Personal Computer
DTMF	Dual Tone Multi-Frequency
IC	Integrated Circuit
RF	Radio frequency
PIR	Passive Infrared
SIM	Subscriber Identity Module

<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
SD	Secure Digital
SOS	Save Our Souls Curriculum vitae
GPS	Global Positioning System
TCP	Transmission Control Protocol
USB	Universal Serial Bus
CV	Curriculum Vitae
etc	Et Cetera
LDR	Light-Dependent Resistor
AIDC	Automated Identification and Data Capture
VTLS	Virtual Tape Library System
LF	High Frequency
HF	Low Frequency
UHF	Ultra-High Frequency
DSP	Digital Signal Processing
TTL	Transistor-Transistor Logic
BJTs	Bipolar Transistors
F.P	Fingerprint
FTR	Total Internal Reflection
DPI	Dots Per Inch
AFIS	Automated Fingerprint Identification System
VOCs	Volatile Organic Compounds
TICs	Toxic Industrial Chemicals
NVR	Network Video Recorder
PTZ	Pan, Tilt, Zoom
IPv6	Internet Protocol Version 6
IDE	Integrated Development Environment

<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
AI	Artificial Intelligence
DODAG	Destination Oriented Directed Acyclic Graph
USB	Universal Serial Bus
LED	Light-Emitting Diode
DC	Direct Current
AC	Alternating Current
C#	C Sharp Language
Emp	Employees
CSS	Cascading Style Sheets
HTML	Hypertext Markup Language
PHP	Personal Home Page
My Sql	My Structured Query Language
FPGA	Field Programmable Gate Array

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## Chapter One

# Background and Introduction

### 1.1 Introduction:

The Internet of Things (IoT) is now available to people all around the world. Everything from sensors to cloud computing is included in the Internet of Things. It includes important network types such as distributed, grid, omnipresent, and vehicle networks, which have dominated the Information Technology (IT) sector for over a decade. Sensors are making their presence felt and play a critical part in the IoT, from parking automobiles to tracking vehicles, entering patient details to observing postsurgery, child care to elder care, and smart cards to near field cards [1]. IoT connects people and things via a variety of networks and protocols. Security threats and vulnerabilities exist in any network, and to show possible threats to be addressed and mitigated to achieve secure communication over the IoT [2]. The Massachusetts Institute of Technology's (MIT) Auto-ID laboratory presented the Internet of Things concept in 1999. It was first released in China by the ITU in 2005 [3]. IoT is defined as "data and gadgets that are constantly available over the Internet". IoT is the interconnection of items (things) that can be addressed clearly and connected wirelessly or wired.

According to Goldman Sachs, there are 28 billion reasons to care about the Internet of Things, They also stated that the fixed Internet could connect one billion end users in the 1990s, while the mobile Internet could connect two billion in the 2000s [4]. By 2020, the Internet of Things could have connected up to 28 billion "things". At this rate, the cost of things, sensors, bandwidth, computing, smartphones, and the switch to IPv6 could make IoT adoption easier than projected, and "Everything" is grouped under one umbrella [5]. The Internet of Things considers everything to be equal, and also views everything as the same including humans and machines. End users, data centers (DCs),

processing units, tablets, smartphones, ZigBee, Bluetooth, the Infrared Data Association (IrDA), sensors and chips, cellular networks, ultra-wideband (UWB), near field communication (NFC) DCs, RFID and their tags, Wi-Fi networks, household equipment, wrist watches, vehicles, and house doors are examples of things. In other words, IoT brings "real and virtual" together wherever and at any time, appealing to both "makers" and "hackers." [6]. The following are the primary aspects of IoT technology [7]:

- 1- Get real-time information in a worldwide setting.
- 2- The ability to track items and monitor the environment from anywhere.
- 3- Wireless solutions are available in both outdoor and interior settings.

The Internet of Things is one of the most crucial aspects of the evolution of the World Wide Web. While continuing to develop Internet technology and connecting a large number of things to the Internet, the IoT's structures are still in development [8]. The Internet of Things is currently very important in the economic, social, and technical spheres. The IoT architecture can be described as a collection of devices with sensors, actuators, and CPUs that collaborate to produce the intended outcomes. The Internet of Things took advantage of the infrastructure and technology available to turn unconnected things into networked smart devices [9]. Security became the most necessary for preserving people's lives and personal and public property at the end of the twenty-first century. With the advancement of technology and expanding human horizons, security systems and methods have evolved. With the very quick development of technology, automatic control has become the most essential feature of IoT. The ability to manage protection and warning systems from a distance, for several reasons, including lower material costs and reduced human work [10].

The security system has represented the detection of unwanted access and impediments to a protected area or building, as well as the denial of such unauthorized access to safeguard property and human safety., security systems are employed to deter theft and property damage, as well as to provide personal

safety from intruders [11]. The reliability of this system increases with the use of the Wi-Fi camera that takes the picture while scanning the fingerprint, reads the RFID sensor to ID cards and uploads these data on the cloud in real-time, and make a warning when anyone tries to hack the system, As a result, will obtain a multi-security system [11].

## 1.2 Literature Review:

The difference demonstrates theories, methods, and arguments that can be stated in the following survey.

- **(C. Science et al., 2012)** [12], A digital CCD camera was used to examine the iris of the eye and detect the vein, and consider these two processes as a basis for entering the private deposit rooms in the bank. A database of people is formed by linking them to a microcontroller 8051 with a storage unit and a display screen so that they are connected using IoT.
- **(O. O. Alice et al., 2013)** [13], The system was designed using a digital code lock, a PIC16F84 microcontroller unit, and a computer unit. The input codes consist of six codes through the input keyboard consisting of 9 numbers. In addition to the codes, the processing unit compares the entered code with the codes stored in the memory unit and instructs the lock to open or not. It is used as a security system in cars or locks electrical devices such as television and others using IoT.
- **(I. Yugashini et al., 2013)** [14], This system was designed using human face recognition cameras as a webcam based on the geometrical features of the face represented by the size of the eyes or the distance between the eyes that represent the specific face of humans and by creating an algorithm to compare the people for whom images were taken and the database in the microcontroller unit and instructs the lock to open or not. It is used as a security system to unlock doors automatically using IoT.
- **(Z. Peng et al., 2016)** [15], The Internet of Things was used to create a home security system based on three terms, firstly sensing danger through

the door opening push sensor and sending or receiving data through the microcontroller unit, secondly directing the robot when sensing danger to increase the illumination and take pictures of the thief through the home camera and then directing the drone via Wi-Fi It that tracks the thief while escaping, so this system is a multi-safety system.

•(G S. N. G.Sowjanya M et al., 2016) [11], This system was designed based on the Internet of Things, the biometric fingerprint sensor, and the Raspberry Pi2 microcontroller unit. In addition to sensors: vibration, gas leakage, heat, and fire, buzzer. When entering the fingerprint, it is compared with the database, if there is an actual match, the person will enter the password and then answer the security question to open the door and enter, but if the fingerprint does not match the database returned three times, and the bell rings which giving a warning of danger and the processor sends a text message with danger to the numbers installed in the system.

•(A. Paul al., 2016) [16], This system is designed using the Arduino Uno R3 (microcontroller unit) with a PIR motion sensor, temp sensor, and buzzer, with a display screen with a built-in Wi-Fi card port equipped with a SIM card. The data is uploaded to the cloud when the danger is detected, the bell rings giving a warning of danger and the data is uploaded to the cloud, displayed through any browser connected to the Internet, and it is considered a security system home using the Internet of Things.

•(M. A. Abu et al., 2018) [17], This system came to home security through the use of the infrared (IR) sensor, the passive infrared sensor (PIR), and the Espresso Lite V2.0 control unit. The Blynk application was used to turn them on or off the system, and the FAVORITO platform was used to receive data sent from the control unit that connected to the Internet. The system that monitors the surroundings of the house and transmits information to the web server, and sends an alert to the user via

the mobile phone. The system via IoT works only when the user is not at home.

•**(R. Maurya et al., 2020)** [18], This system came to home security through the use of image analysis for authorized persons to enter through an algorithm for image analysis and facial recognition. The Raspberry Pi microcontroller was used with the Arduino Uno R3 and a database was created for close people and guests. When you press the house bell, the system provides a Welcome message to the guest and the Raspberry Pi console sends a text message via e-mail to the homeowner that includes a picture of the guest while the algorithm analyzes the image and diagnoses the guest through the database and sends a detailed report via another text message to the homeowner after which the owner instructs to the console Raspberry Pi, who is guiding directing the Arduino to open the door and welcome the guest again. This system is used to enter guests and acquaintances more reliably when the owner of the house is not present via IoT.

•**(W. Li et al., 2021)** [19], A university management system has been proposed, which focuses mainly on creating an infrastructure platform that works both wired and wireless through the use of smart cameras, and the internet of things, whose purpose is to manage to teach, access student housing, and calculate the recycling information for students. Information is processed side by side through cloud computing technologies with the design of a university application that contributes to facilitating teaching and the rest of the procedures for organizing and managing university institutions.

•**(C. Stolojescu-Crisan et al., 2021)** [20], A proposed home automation system based on the Internet of things using a Raspberry Pi 4 microcontroller and an ESP 8266 Wi-Fi module with the use of the Toggl application to control programmable systems remotely with the use of a

temperature sensor and energy meter. The goal of this remote control of all electrical units of the house Such as lighting and controlling the air conditioning and other devices is considered a control system for energy consumption through the Internet of things.

Reference was made by grouping the security-related work, the largest part of which was designed and implemented, while the other part was only theoretical, and no system is without flaws or lack of comprehensiveness. Table 1.1 shows the results of the literature review.

Table 1.1 shows the results of the literature review

Ref	year	Online	Offline	Cost as per today's rate
[12]	2012	no	yes	450\$
[13]	2013	no	yes	200\$
[14]	2013	no	yes	600\$
[15]	2016	no	yes	1200\$
[11]	2016	yes	yes	350\$
[16]	2016	yes	yes	1000\$
[17]	2018	yes	yes	550\$
[18]	2020	no	yes	850\$
[19]	2021	yes	yes	2500\$
[20]	2021	no	yes	500\$

The proposed system has been designed and implemented for a security institution that operates on the IoT. It is a multi-security system with a decrease in the cost of implementation. The system also provides instant reports for all cases with real pictures of people via a wi-fi camera that is shown through a Graphical user interface. The system also includes alarm units that help the supervisor handle cases that predict danger to the organization.

### 1.3 Problem Definition:

Most regions of the world face a challenge in how to protect property from thieves, in addition to the high rates of societal crimes related to human life or

property. It is very difficult to control such a challenge in remote areas with few people, so the demand for security systems has increased in recent years with the presence of Some of the challenges that users face in the field of security and security related to the Internet of Things, and these challenges are:

- 1- The available fingerprint devices cannot monitor from everywhere.
- 2- There is no such device that includes both fingerprint and vehicle ID for the same person.
- 3-you need some devices to control the security of persons, and vehicles, and monitor the building from theft and fire with controlling the energy and using the camera these are problems since their maintenance of them is high.
- 4-The cost of manufacturing and implementing and wiring these devices is high.
- 5-Little accuracy of firing and their smoke detector with energy control. since there is a difference between the smoke of fire and cigarettes.

#### **1.4 Aim of Thesis:**

The objective of this system, that designed and implemented practically is to obtain an entry permit for people in a manner commensurate with the work of the security establishment and to prevent unauthorized persons from entering an establishment.

A system includes the entry of vehicles into the security establishment and the entry of people into the security workplaces Gas and smoke sensors were also used to protect individuals from the danger of suffocation or the risk of fire. The system also includes an infrared sensor for movement, through which the lighting devices inside the establishment are controlled, which contributes to rationalizing the consumption of electrical energy. The main objectives of the system can be represented as follows:

- 1- The design of a security system made the fingerprint devices and the rest of the sensors monitored from everywhere.

- 2- Building a security system that improves security institutions' control management, and keeps monitoring all the entrances that are often used by people and cars (authorized or unauthorized).
- 3- An integrated security system consisting of four systems in one system represented by the automatic entry for vehicles, automatic entry for people, fire alarm system, and energy control system. This system does not require the intervention of specialized companies for its maintenance.
- 4- A security system that is easy to implement and develop that achieves the appropriate environment for institutions and reduces the use of human resources. The use of the GUI has made viewing reports and exchanging information very convenient.
- 5- Early detection of any gas leakage or fires, with a prior warning sent to the supervisor, and reporting to the decision-makers immediately, with the rationalization of electrical energy consumption automatically, considering energy as one of the basic components of civilized societies.

## **Chapter Two**

# **Concepts of sensors, other devices, and the Internet of things**

### **2.1 Introduction:**

There are many applications for the Internet of Things with different types of sensors and how they work. Still, they focus on one direction, which is to facilitate the nature of human life and to invest in technology in its correct form the applications differ according to the need for them, in other words, the applications differ according to the different sensors through their consumption of energy, their cost rate, their response rate to the application in which it is used, and the extent of their interrelationship with the Internet of things.

The sensors used in various security applications are called biometric sensors, RF wireless sensors, motion sensors, and smoke & gas sensors. Sensors are devices that receive a signal, a pulse, or a stimulus and respond to it in the form of signal electrical. The outgoing signals can correspond to certain electrical signals in various ways, such as current and voltage. Sensors are classified into types, including biological, chemical, and physical, based on the input signals, whether they are biological, chemical, or physical, and a method of Converting them into an electrical signal in the output, in addition to the applications used and the materials involved in the properties of the sensors such as accuracy or cost...etc [27]. In this chapter, an overview of the functions and characteristics of some sensors is presented and discussed, with the basic shapes of these sensors presented.

### **2.2 General type of Sensors:**

Most sensors are commonly used in many applications in human life [28]. Generally, sensors are classified based on physical properties, such as pressure, temperature, and resistance. The most traditional of the sensor can be depicted as follows:-

- ❖ Temp sensor
- ❖ Light sensors
- ❖ Sound sensors
- ❖ Pressure sensors
- ❖ Ultrasonic sensors
- ❖ Touch sensors
- ❖ Humidity sensors
- ❖ Chemical sensors
- ❖ Color sensors
- ❖ Wireless sensors

### 2.3 Comparison of different sensors:

A tabular comparison of the aforementioned sensors will be presented in terms of advantages and disadvantages[28], according to Table 2.1

Table 2.1 Comparison of different sensors.

Sensors	Advantages	Disadvantages
Temperature sensors	<ul style="list-style-type: none"><li>• Fast response time</li><li>• Simple to read</li><li>• Long-lasting</li></ul>	<ul style="list-style-type: none"><li>• Difficult to calibrate due to self-heating error caused by applied power</li></ul>
Sound sensor	<ul style="list-style-type: none"><li>• used in speech recognition</li><li>• Easy real-time audio processing</li><li>• No cables required compared to a microphone</li></ul>	<ul style="list-style-type: none"><li>• Sound files necessitate more memory.</li><li>• Requires cancellation of the interference in the sound waves.</li><li>•The coverage area is limited.</li></ul>
Light sensor	<ul style="list-style-type: none"><li>• Requires very little power and voltage</li></ul>	<ul style="list-style-type: none"><li>• Characteristics that are not linear</li></ul>

	<ul style="list-style-type: none"> <li>• Comes in a variety of forms and sizes</li> <li>• Is simple to integrate into a lighting system</li> <li>• Has a quick response time and is inexpensive</li> </ul>	<ul style="list-style-type: none"> <li>• If the applied voltage is too high, the photoresistor will be irreversibly damaged.</li> <li>• Sensitive to temperature</li> <li>• Susceptible to spikes and surges</li> </ul>
Infrared sensor	<ul style="list-style-type: none"> <li>• Requires little power to operate</li> <li>• Does not necessitate object contact</li> <li>• Excellent noise resistance</li> </ul>	<ul style="list-style-type: none"> <li>• The range is limited</li> <li>• Environmental factors have an impact</li> <li>• The data transmission rate is slow</li> </ul>
Pressure sensor	<ul style="list-style-type: none"> <li>• The output signal is a high level</li> <li>• cheap and cost-effective</li> <li>• Robustness of technology</li> </ul>	<ul style="list-style-type: none"> <li>• Hysteresis is relatively high</li> <li>• Vibration sensitivity</li> </ul>
Ultrasonic sensor	<ul style="list-style-type: none"> <li>• Capable of sensing all materials</li> <li>• Unaffected by dust, rain, snow, and other elements</li> <li>• Higher sensing for longer distances</li> <li>• Unaffected by object color or transparency</li> </ul>	<ul style="list-style-type: none"> <li>• Sensitive to temperature fluctuations</li> <li>• Reading reflections from soft, curvy, thin, and small objects is difficult.</li> <li>• Inability to work in a vacuum</li> </ul>

		<ul style="list-style-type: none"> <li>• Soft materials have an impact on sensing accuracy.</li> </ul>
Humidity sensor	<ul style="list-style-type: none"> <li>• Doesn't necessitate a lot of upkeep</li> <li>• Usability flexibility</li> <li>• long term</li> </ul>	<ul style="list-style-type: none"> <li>• Sensitive to dew and Affected by Chemicals</li> <li>• Measurement range and precision are limited.</li> </ul>
Chemical sensor	<ul style="list-style-type: none"> <li>• Linear output, low power consumption</li> <li>• Excellent accuracy with the possibility of repetition</li> </ul>	<ul style="list-style-type: none"> <li>• Temperature range is narrow or limited.</li> <li>• Life span is short or limited.</li> <li>• Cross-response to other gases</li> </ul>
Color sensor	<ul style="list-style-type: none"> <li>• Setups can be changed or modified without having to re-program the sensor device.</li> <li>• Simple to install</li> </ul>	<ul style="list-style-type: none"> <li>• The sensor lens is subject to contamination</li> <li>• It is affected by color reflections</li> </ul>

**2.4 A Detailed Overview of The Sensors Used in The Research:**

The functioning technique of each sensor is testified, based on the practical implementation of the research and theoretical information of the sensors used.

**2.4.1RFID RC-522 Sensor:**

Radiofrequency identification (RFID) is one of the most exciting and rapidly growing technologies for increasing productivity and profitability today. RFID is a technology that combines a computer chip with a tiny radio antenna. When RFID was initially developed during World War II, the British utilized it to identify their aircraft. Early in the 1980s, the new Radio Frequency Identification (RFID) technology made its debut and was used for access control

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and item tracking[29]. Because they enable non-contact reading or writing of data, these wireless automatic identification data capture devices are especially beneficial in manufacturing and other applications. RFID has been used in a variety of fields since the 1980s, including livestock, retail sales, wireless transactions, courier and logistics, publishing, automated vehicle identifying systems, and so on. AIDC (automated identification and data capture) technology is used innovatively with RFID. Similar to a standard barcode system, RFID technology allows you to assign an ID to an item and read that ID to complete circulation or take inventory in a library context. RFID tags are typically placed in boxes and covered with a property sticker. Antennas of varying sizes are used to read the tags and manage the various library operations, depending on the type of application[30]. The RFID RC522 Sensor is shown in fig 2.1

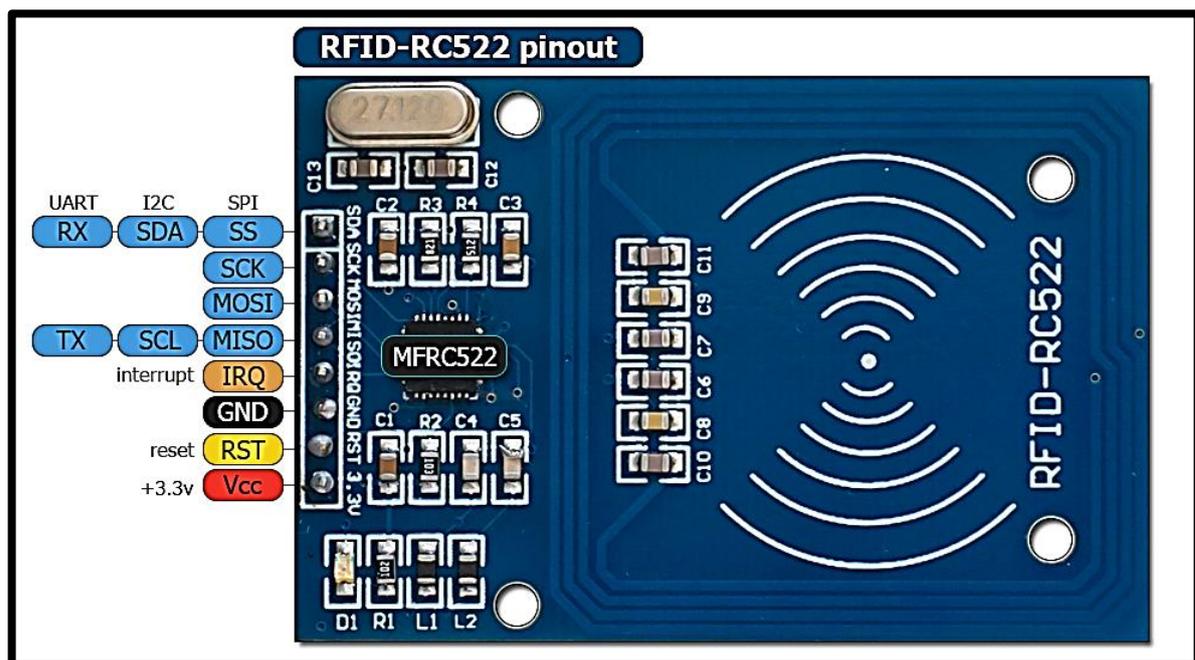


Fig 2.1 RFID RC522 Sensor

A typical RFID sensor is made up of four basic components[31]:

- ❖ RF Tags: Smart labels that are flexible and thin as paper and can be applied directly to library objects. Each RFID tag comprises a small silicon microchip[32]. That stores information to identify things in a group and is

both readable and written on it for saves security when necessary, information to support sorting systems in library programs as shown in fig 2.2

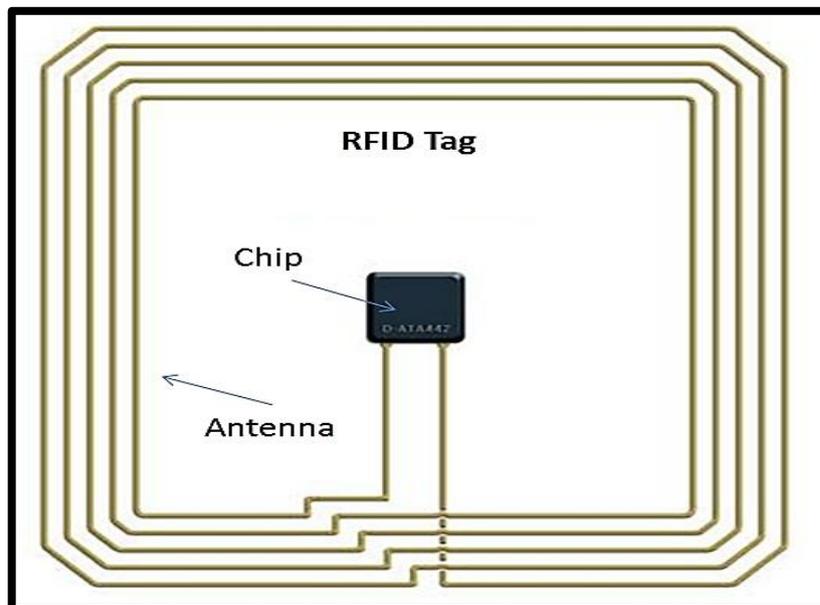


Fig 2.2 RFID Tags

- ❖ **Antenna:** Between RFID tags and the coupler, there is a channel. Radio waves generated by RFID antennas activate RFID tags as they travel across the activation field. When a tag is turned on, it can send and receive data to and from the coupler. RFID antennas include patch antennas, linear polarized antennas, stick antennas, gate antennas, and Omni directional antennas, as shown in fig 2.3.

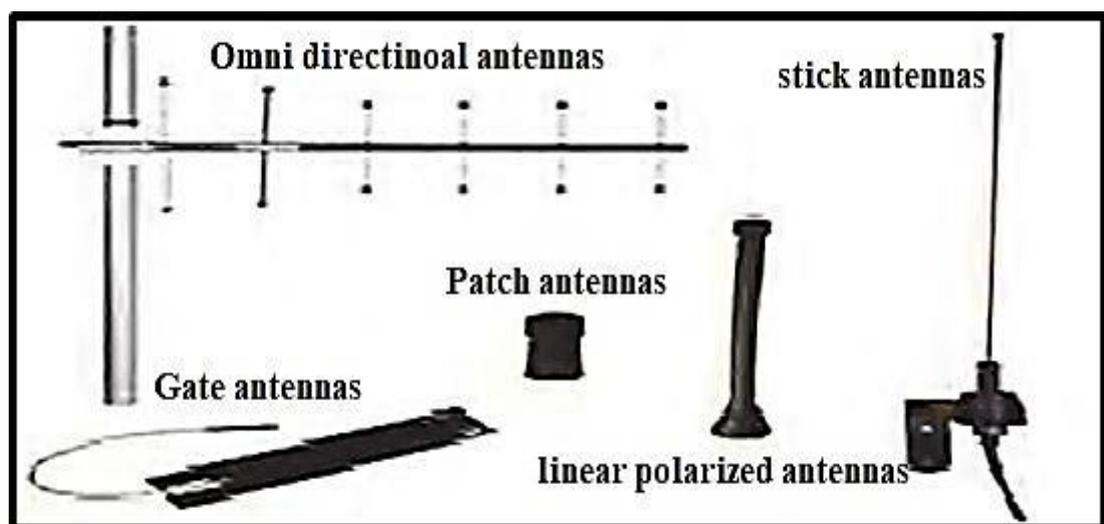


Fig 2.3 RFID Antenna types

❖ **Coupler:** It is the component that connects RFID tags to a computer. Both reading data from an RFID tag and sending it to a computer (read mode) as well as reading data from a computer and sending it to an RFID tag are possible with the coupler (write mode). There are two types of coupling, Inductive Coupling, and Backscatter Coupling. Inductive Coupling is defined as the reader antenna coil generating a magnetic field that penetrates the cross-section of the coil area of the tag and the area around it. Part of the emitted field traverses the transmitter and receiver antenna by induction and generates a voltage in the transmitter and receiver antenna coil. Backscatter Coupling is defined as the reflected signal by things that are bigger than the wave's half-wavelength. Another antenna can detect this backscattering. Pc: the connection between your library automation system and the coupler. VTL S (Virtual Tape Library System) has created software that runs on your computer to connect your RFID devices to your library automation system.

Table 2.2 shows which radio frequencies are used by various types of RFID systems. The read distance, power consumption, and performance of each radio frequency are different. The frequency that should be used depends on the application. RFID technology primarily employs four types of frequencies [33]:

Table 2.2 RFID operating frequency

Types of Frequency	Frequency range	Passive read distance
Low-Frequency LF	120-140 KHZ	10-20 cm
High-Frequency HF	13.56 MHz	10-20 cm
Ultra-High Frequency UHF	868-928 MHz	3 meters
Microwave	2.45 & 5.8 GHz	2 meters

A passive tag is devoid of its power source. The reader provides the power to the chip in this tag. As shown in fig 2.4. The reader antenna sends a radio frequency wave signal to the tag. LF and HF tags use inductive coupling to

extract energy from RF waves, while UHF tags use backscatter coupling.

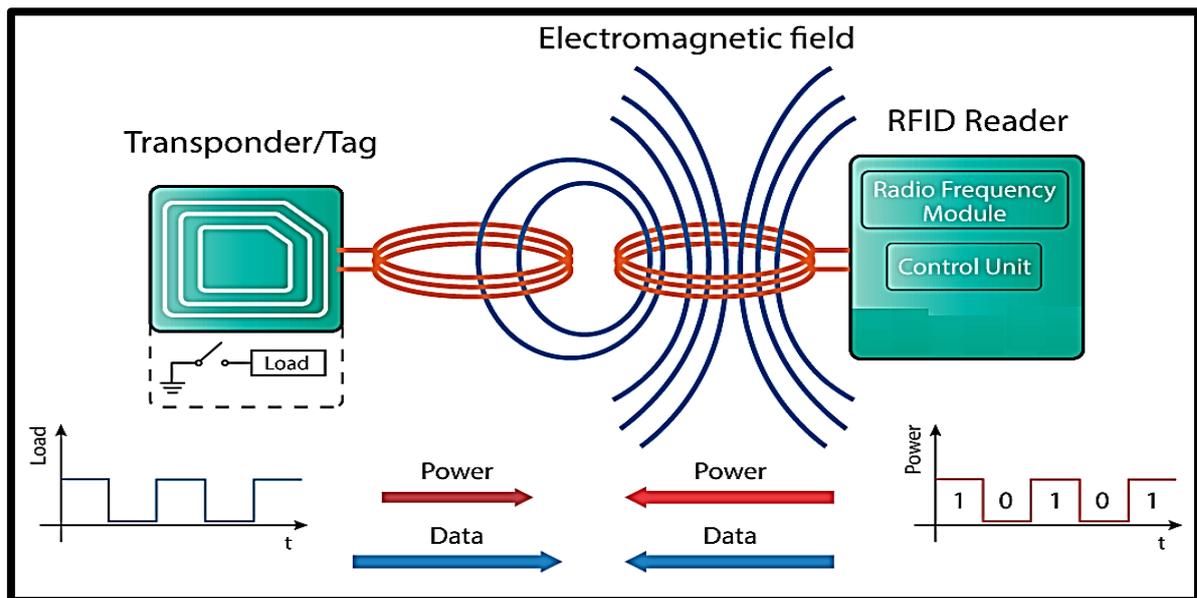


Fig 2.4 RFID Tags Operation.

RFID technology offers many benefits, but it also has certain drawbacks.

Table 2.3 lists the benefits and drawbacks of RFID

Table 2.3 Advantages and disadvantages of RFID [32].

Advantage	Disadvantage
<ul style="list-style-type: none"> <li>• Extremely fast</li> <li>• Multi-format and multi-purpose</li> <li>• Cut down on manpower</li> <li>• High precision</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• Some materials can cause signal issues</li> <li>• Reading from over (fail to read)</li> </ul>

RC522 RFID Module has many features

- ❖ 13.56MHz RFID module
- ❖ Operating voltage: 2.5V to 3.3V
- ❖ Communication: SPI, I2C protocol, UART
- ❖ Maximum Data Rate: 10Mbps
- ❖ Read Range: 5cm
- ❖ Current Consumption: 13-26mA
- ❖ Power down mode consumption: 10uA (min)

RFID technology has received great interest in many areas such as agriculture, hospitality, manufacturing companies [34], parking management, industries [35], and transportation sectors. The main applications of RFID are as follows : [36], [39].

- ❖ Security Applications
- ❖ Toll Road Applications

### 2.4.2 IR FC-51Sensor:

IR sensors (infrared sensors) are electronic instruments that generate infrared radiation to detect the movement of an object. Night vision devices, hyperspectral imaging, meteorology, gas detectors, rail safety, and petroleum exploitation all make use of infrared sensors [40]. William Herschel, an astronomer, unintentionally discovered infrared rays around the year 1800. While testing the temperature of each color of light, he discovered that the temperature just beyond the red light was the highest (separated by a prism). Because IR has a longer wavelength than visible light, Its wavelengths span from 760 nanometers to one millimeter, and It can't be seen by the naked eye (though it is still on the same electromagnetic spectrum). There are two types of infrared sensors: active and passive. Active infrared sensors are commonly used in obstacle detection systems as proximity sensors Since everything that emits heat (anything with a temperature over approximately five degrees Kelvin) emits infrared radiation (such as in robots). [41].

The IR Transceiver is an infrared-based proximity sensor that is primarily used for detecting and avoiding obstacles. It comprises an infrared transmitter and receiver attached to a small PCB printed circuit board, as well as two indications 2 LEDs using to :

- ❖ A single onboard LED indicates whether the module is correctly attached.
- ❖ Another onboard LED shows that an obstacle has been detected. The infrared beam is sent out by the transmitter, which is reflected and received by the

receiver (photo-transistor). The module can be used to find an obstruction [42]. As explained and shown in figure 2.5

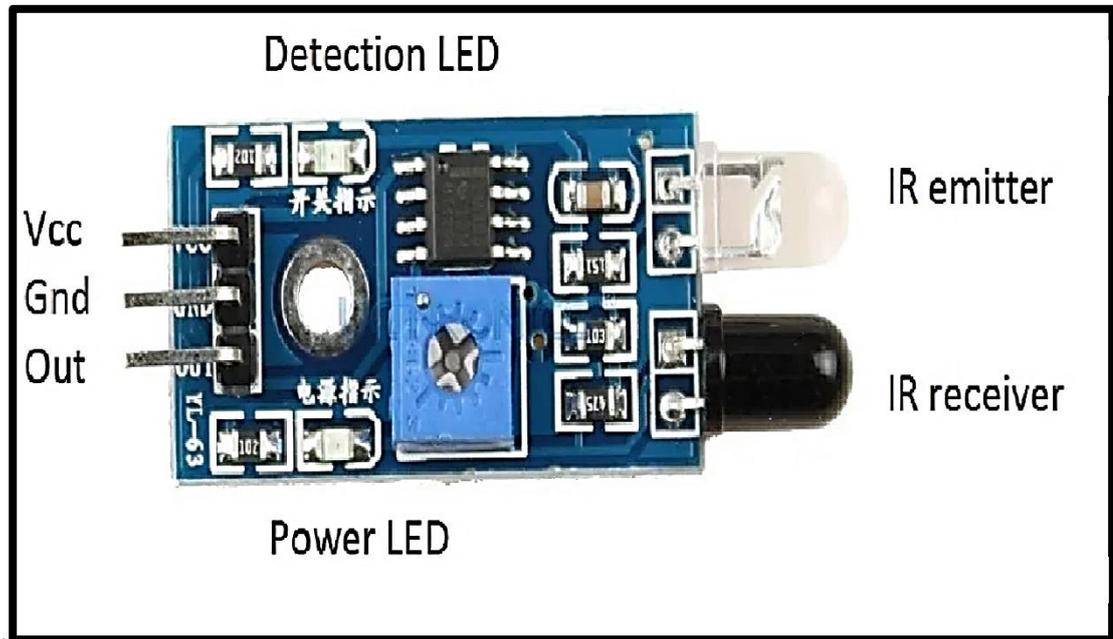


Fig 2.5 IR FC-51 Sensor Components

When the infrared transmitter IR LED emits light, it reaches the object, and some of the light reflects the infrared receiver IR photodiode. The IR receiver can decide the sensor output based on the intensity testify response. As shown in fig 2.6.

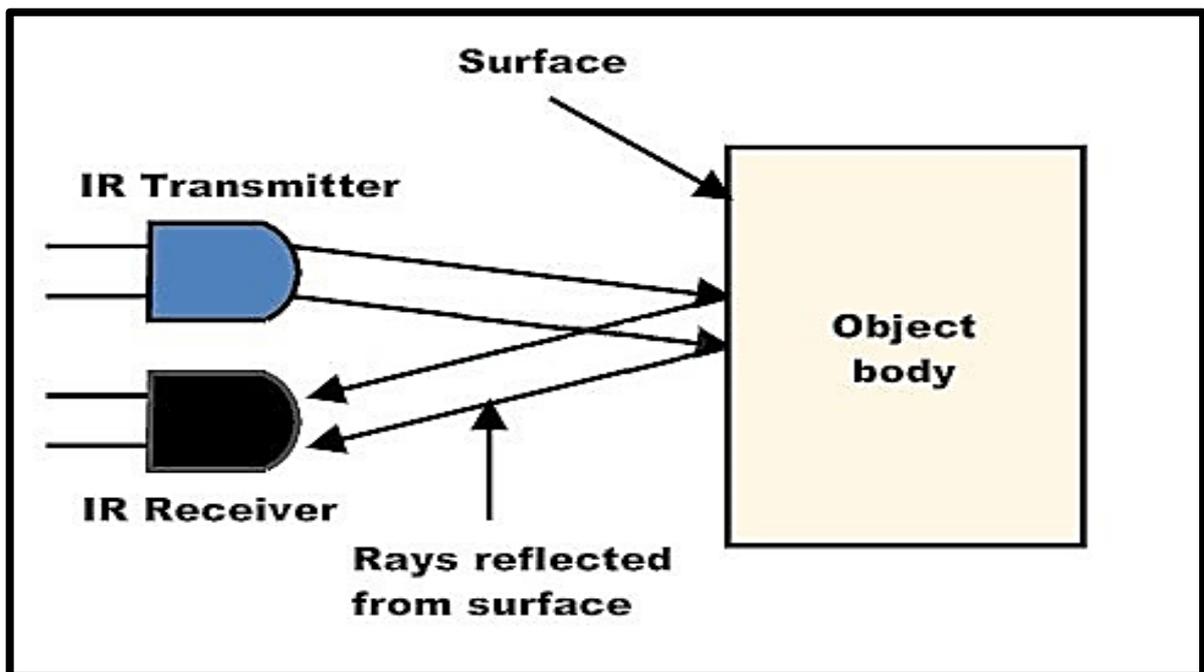


Fig 2.6 Infrared reflection process

IR technology offers many benefits, but it also has certain drawbacks. The advantages and disadvantages of IR Sensors are listed in Table 2.4 [27].

Table 2.4 Advantages and disadvantages of IR Sensors

Advantage	Disadvantage
<ul style="list-style-type: none"><li>• Low power consumption</li><li>• The presence or absence of light does not affect sensor sensing, does not require object contact</li><li>• Corrosion and oxidation resistance</li><li>• Noise immunity</li></ul>	<ul style="list-style-type: none"><li>• Line-of-sight deployment is required.</li><li>• The sensor is affected by the barriers, the range is limited.</li><li>• Environmental factors have an impact</li><li>• The data transmission rate is slow.</li></ul>

### FC-51 IR Module Datasheet

- ❖ Model Number: FC-51
- ❖ Detection angle: 35 °.
- ❖ Operating Voltage: 3.0V – 6.0V.
- ❖ Detection range: 2cm – 30cm (Adjustable using potentiometer).
- ❖ PCB size: 3.1 cm (L) x 1.4 cm (W).
- ❖ Overall Dimension: 4.5cm (L) x 1.4 cm (W), 0.7cm (H).
- ❖ Outputs Low logic level when the obstacle is detected.
- ❖ Outputs High logic level when the obstacle is not detected.

There are many applications for infrared sensors. The main applications of RFID are as follows : [40], [44], [45].

- ❖ Traffic Light applications
- ❖ Remote control Applications
- ❖ Smart Parking Applications

### 2.4.3 Fingerprint Module Sensor FPM10A:

The fingerprint Sensor Module is seen in fig. 2.7. Adding fingerprint detection and verification will be a breeze with the all-in-one optical fingerprint sensor. A high-powered DSP chip will compare and identifies fingerprint images in these machines, which are generally employed in safes. The fingerprint sensor uses serial TTL (Transistor-Transistor Logic). Which is a series of digital circuits based on bipolar transistors (BJTs) and resistors, to interface with any microcontroller or system. You can also register fresh fingerprints directly; the built-in FLASH memory can hold up to 127 fingerprints. During fingerprint capture, a red LED indication in the lens illuminates [46]. There are many ways to capture fingerprints, However, optical techniques including Frustrated Total Internal Reflection (FTR), are the most common and used. It is the first direct scanning method [47].

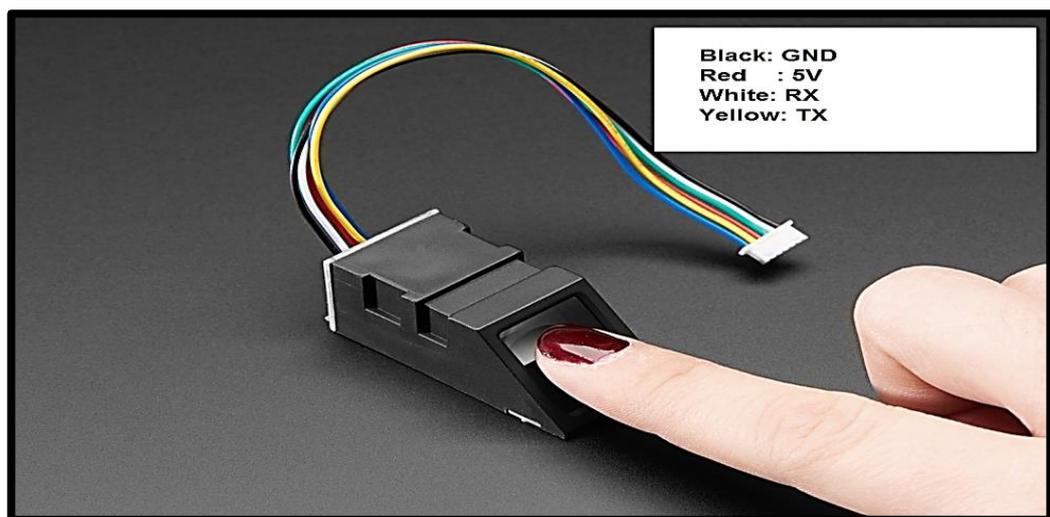


Fig 2.7 Biometric Fingerprint

Inside the biometric fingerprint sensor is a device known as a CCD (charged coupled device) which is a matrix of diodes known as photosites whose task is to sense light and generate electrical signals in response to light units. The sensor also contains a processing unit that compares and processes fingerprints. Each element of photosites represents a part of the image or what is known as a pixel[48], in addition to a storage space for storing fingerprints. Fig 2.8 shows the CCD device.

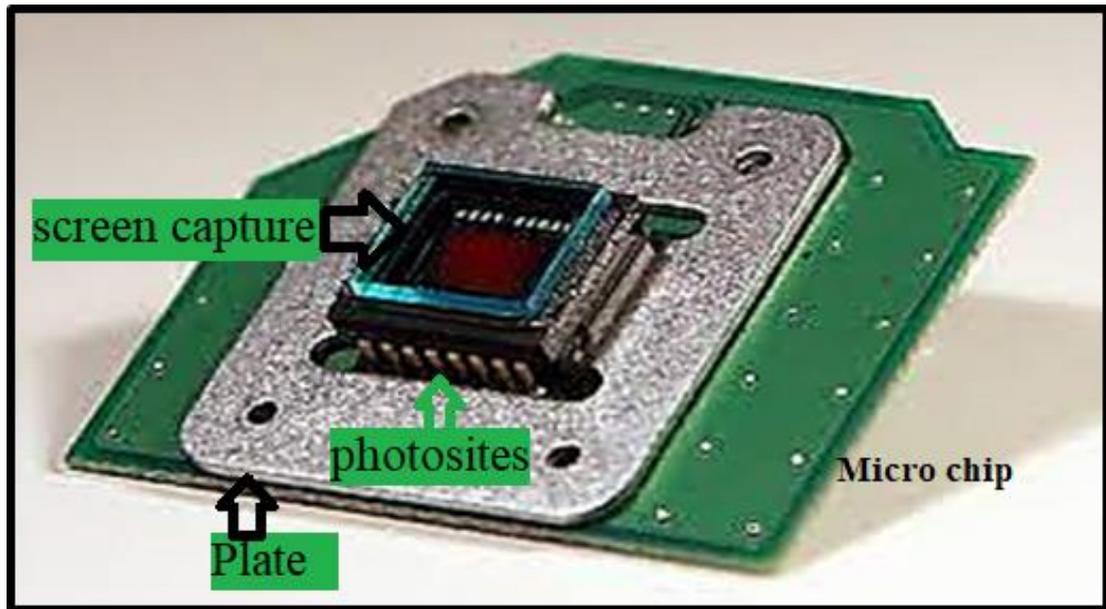


Fig 2.8 CCD (charged coupled device)

The skin on the hand or finger is composed of pores and what are known as "friction ridges." The ridges begin during the ninth week of fetal development and persist throughout life, only growing in size as an adult [49]. When a finger touches the top of the prism, a camera on its underside records the signal that is reflected. Using any (CCD), the fingerprint picture is converted into a model image with a scale of 1 inch by 1 inch and converted to 500 dots per inch (DPI) [47]. As a result of aliasing and grooves in the fingerprint, these points are processed in terms of darkness and reflected light, and then translated into digital electrical signals and stored in the memory unit, as shown in Fig 2.9.

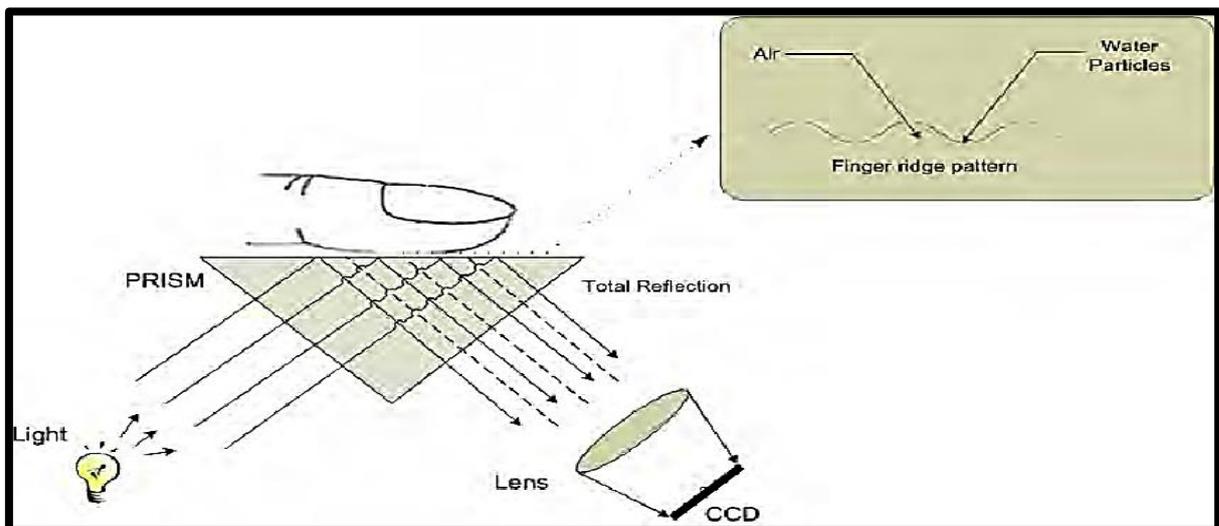


Fig 2.9 Optical fingerprint sensing by frustrated total internal reflection.

Fingerprint technology has many advantages but has certain drawbacks as well. The benefits and drawbacks of fingerprint systems are listed in Table 2.5 [50].

Table 2.5 Advantages and disadvantages of the fingerprints system

Advantage	Disadvantage
<ul style="list-style-type: none"><li>• Security – It is a significant improvement over passwords and identity cards in terms of security. Fingerprints are far more difficult to imitate.</li><li>• User-friendliness — they are straightforward to use. You won't have to worry about forgetting your last password. Your fingerprints are always with you.</li><li>• Fingerprints are non-transferable, thus no sharing of passwords or 'clocking in' on behalf of another colleague is possible. This enables more precise worker tracking.</li><li>• Cost-effective –Fingerprint recognition is now a cost-effective security option from the standpoint of technology management.</li></ul>	<ul style="list-style-type: none"><li>• The same technological issues and restrictions that apply to other electronic identification systems, such as power outages, faults, and environmental factors, also apply to scanning systems.</li><li>• Cost - Even while fingerprint recognition systems are more cost-effective than ever, smaller enterprises may still be put off by the expense of implementation and maintenance. This drawback is decreasing as gadgets get cheaper and more cost-effective.</li><li>• Exclusions - Although a person's fingerprints are generally stable throughout their lifetime, some groups of people will not be able to use the system. People who have lost fingers or hands would not be eligible, and older people with a history of manual labor may find it challenging to enter worn prints into a system.</li></ul>

In addition, there are many applications of fingerprint sensors that can be depicted as follows: [51], [52].

- ❖ Automated Fingerprint Identification System (AFIS) Applications.
- ❖ Security Applications.

### 2.4.4 Smoke and Gas Sensor MQ-2 FC22:

The MQ-X series FC-22 sensors are a type of smoke gas sensor. The main advantage of these sensors is that the functions compatible with the sensors guarantee the determination of a separate group of gases' concentration, and it also allows for the provision of a wide range of information with the exchange of devices without changing the take-off algorithm [54]. Table 2.6 explain all types of compatible sensors [54]. It also has lower conductivity in clean air, while it is more conductivity when the gas density and concentration increase, the conductivity of the sensor turns into a successive output signal in direct proportion to the density of the gas [55]. Fig 2.10 Shows to smoke sensor.

Table 2.6 explain all types of MQ-X sensors.

Model	Target Gas	Model	Target Gas
MQ-2			General combustible gas
MQ-3B			Alcohol
MQ-4			Natural gas, Methane
MQ-5B			LPG, Natural gas, Coal gas
MQ-6			LPG, Propane
MQ-7B			Carbon Monoxide (CO)
MQ-8			Hydrogen
MQ-9B			CO and Combustible gas
MQ131			Ozone O <sub>3</sub>
MQ135			Air Quality Control (NH <sub>3</sub> , Benzene, Alcohol, smoke)
MQ136			Sulphuretted Hydrogen (H <sub>2</sub> S)
MQ137			Ammonia (NH <sub>3</sub> )
MQ138			VOC (Mellow, Benzene, Aldehyde, Ketone, Ester)

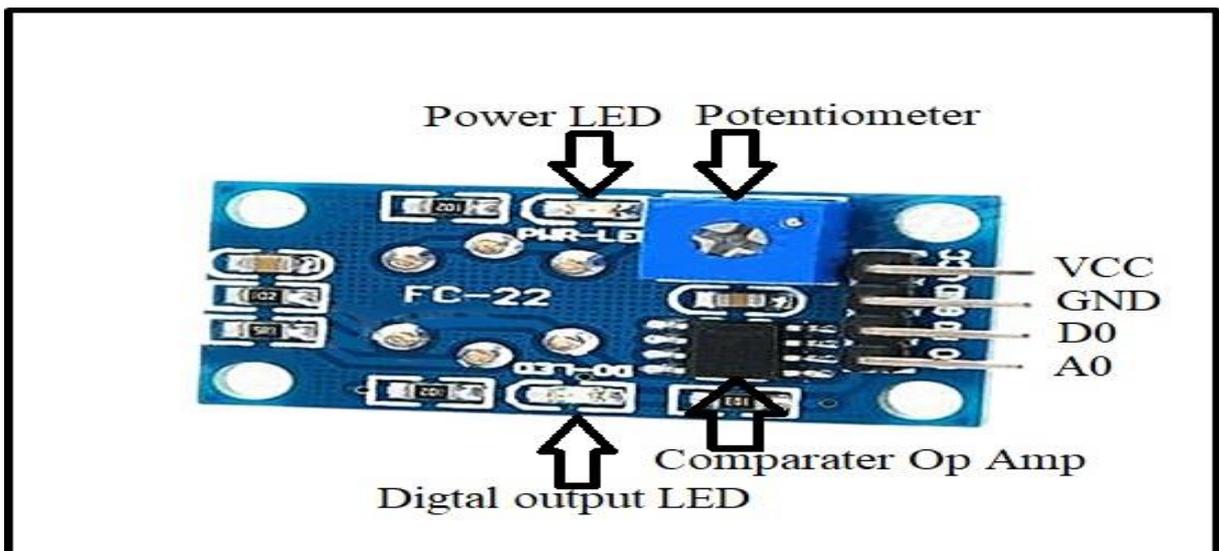


Fig 2.10 Smoke and Gas Sensor.

The smoke and gas sensor consists of a small ceramic tube, a sensitive layer of tin dioxide ( $\text{SnO}_2$ ), an electrode meter, a heater installed in a plastic shell, and an anti-explosion network which is a two-layer fine stainless steel mesh that surrounds the sensor. Sensing combustible gases ensures that the heater element inside the sensor does not trigger an explosion. The mesh is bound to the rest of the body via a copper-plated clamping ring. The MQ-2 sensor has 6 electrodes, 4 of which are used for sensing, and 2 are used to provide heating current[55]. The smoke and gas sensor can be shown in Fig 2.11 and Fig 2.12

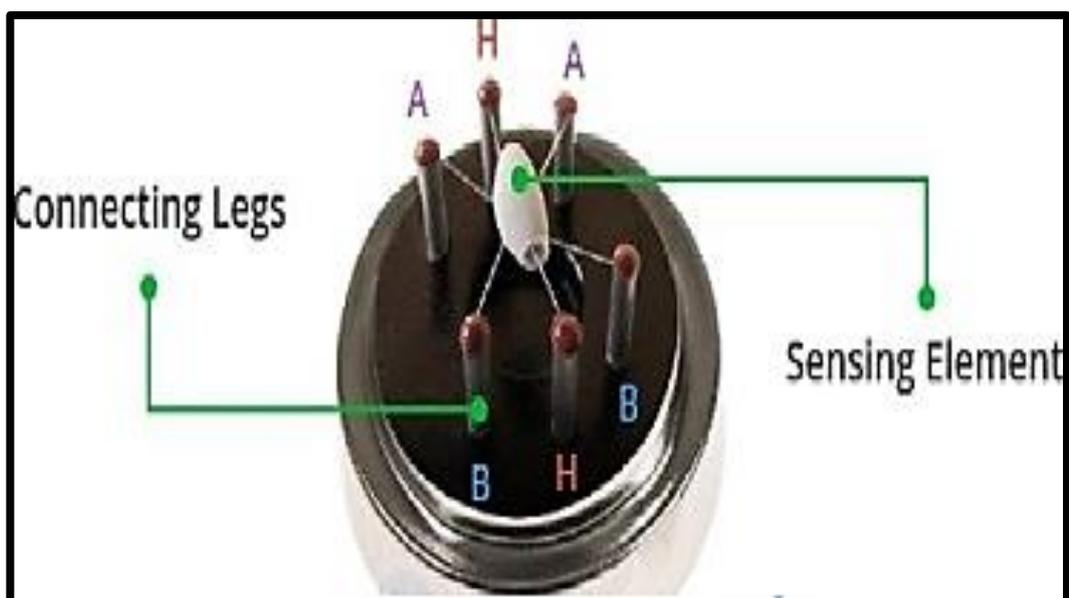


Fig 2.11 Smoke and Gas Sensor 6-Pins.



Fig 2.12 Smoke and Gas Sensor structure.

The MQ2 Gas Sensor runs on 5V DC and consumes about 800mW. It has a detection range of 200 to 10000ppm for LPG, Smoke, Alcohol, Propane, Hydrogen, Methane, and Carbon Monoxide. Smoke and gas sensor technology have a lot of benefits, but it also has some drawbacks. The advantages and drawbacks of Smoke and gas systems are listed in Table 2.7 [27].

Table 2.7 Advantages and disadvantages of the Smoke and Gas system

Advantage	Disadvantage
1- Measures the flammability of gases with simple and low-cost technology. 2- Linear output and low power requirements. 3- Wide measuring range. 4- Higher sensitivity, resolution, and reliability.	1- Requires air or oxygen to function. 2- The temperature range is narrow or limited.

The applications of this sensor can be summarised as follows: [56], [58].

- ❖ Security Applications
- ❖ Environmental Applications

**2.5 Additional Devices Used in the Research:**

**2.5.1 Micro Servo Motor (SG90):**

Servo motors operate with the same principles and methods as standard types of motors, but on a smaller scale [59]. The small size, lightweight, and the possibility of rotation to the angle of 180, which is equivalent to 90 degrees in each direction, make it very distinguished in the technical uses and scientific research of researchers. It comes with three arms as in Figure 2.13.



Fig 2.13 Servo Motor (SG90).

It also comes in standard dimensions, as shown in fig 2.14. It is worked on a 5v DC Power Supply and the input signal is PWM.

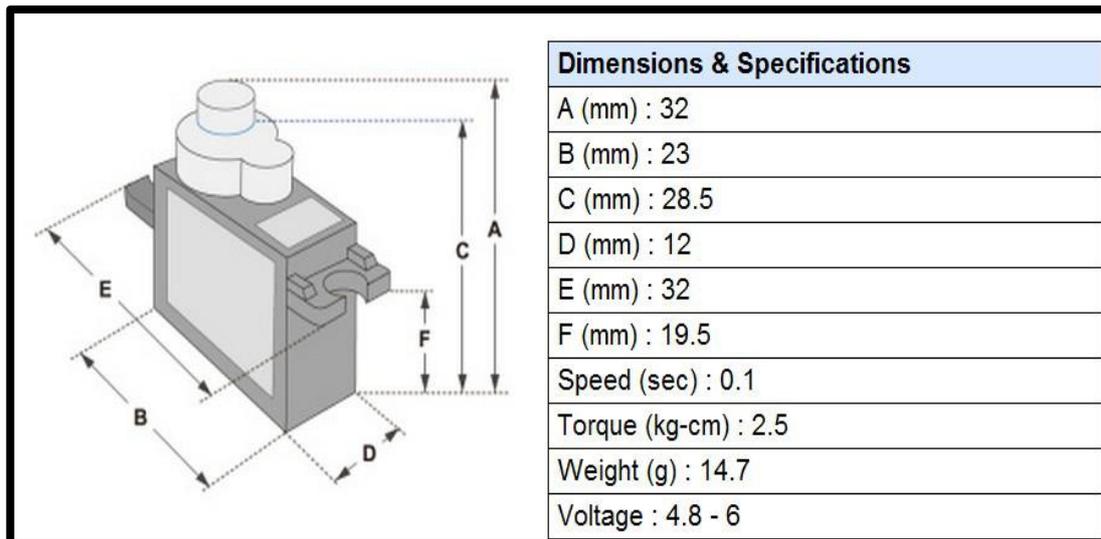


Fig 2.14 Servo Motor (SG90) dimensions.

### 2.5.2 Electric Spring Lock:

This type of lock consists of solenoids that are essentially electromagnets, The armature (a metal slug) is located in the center of a massive coil of copper wire. When the coil is electrified, the slug is attracted to the center. As a result, the solenoid can pull from only one end. With a slanted cut slug and a strong mounting bracket, this solenoid is exceptionally durable. It's a simple electronic lock that can be used on a safe, or door [60]. The solenoid slug is in the way while the lock is normally active, so you can't open the door. In this state, it makes no use of power. The slug pushes in when 12VDC is applied, allowing the door to be opened. As shown in Fig. 2.15, with a weight rating of 1 Kg and a current of 1.7A.

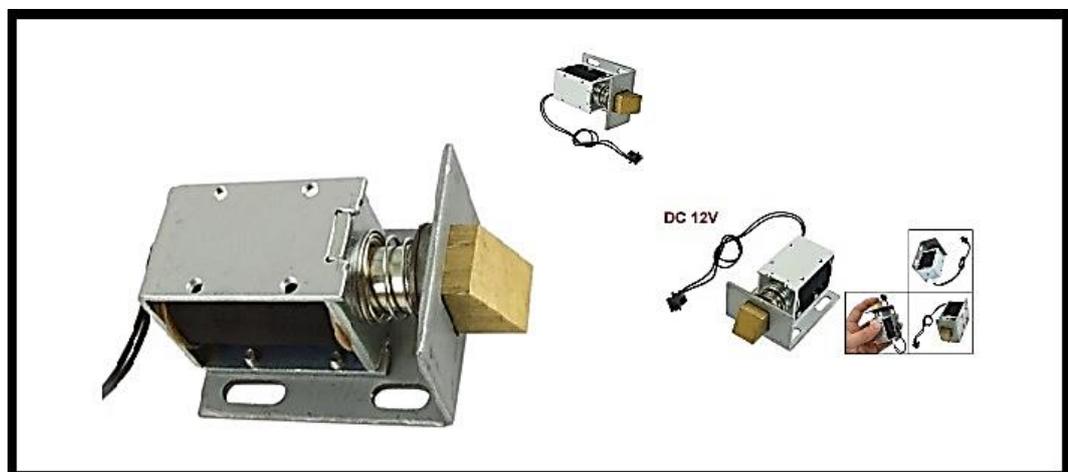


Fig 2.15 Electric spring lock.

**2.5.3 Relay (SRD-05 VDC-S L-C):**

Despite its modest size, this one-channel relay has a conversion capacity of 10 amperes, 250 volt AC, 30 volt DC, and operates at (50–60) mA with a DC voltage of 12 volts. Due to the material test, The temperatures range from (-40 – 85)°C. The low cost compared to the work it does, the plastic that is resistant to high temperatures includes a good magnetic relay circuit [61]. As depicted in Fig 2.16

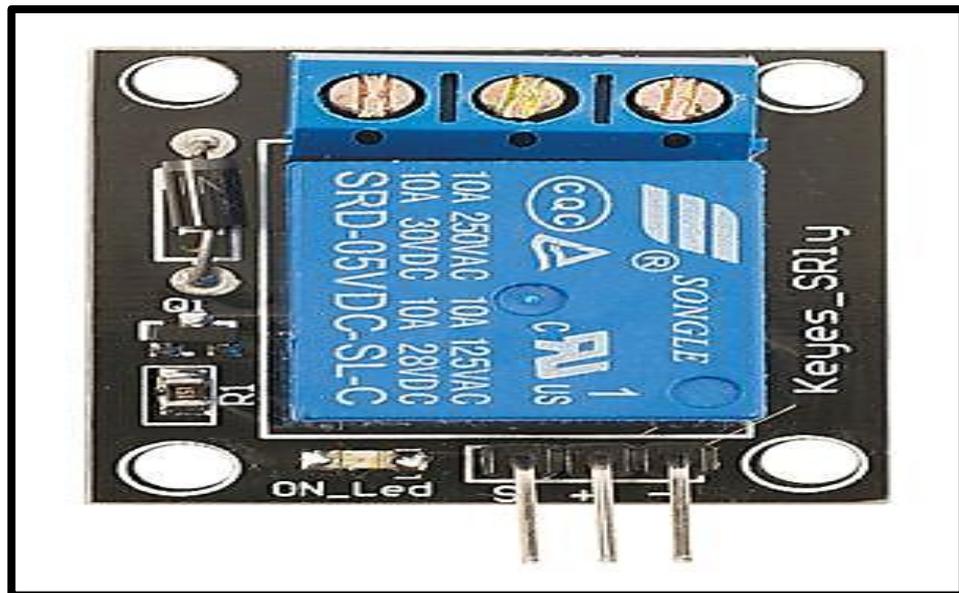


Fig 2.16 Relay (SRD-05 VDC-S L-C).

**2.5.4 Wired Loud Alarm Siren Horn for Security Protection System:**

It works with a 12-volt DC power supply, a 10-watt output, a current of 0.5-1 amp, and a sound level of 105 decibels. As depicted in Fig 2.17



Fig 2.17 Wired Loud Alarm Siren Horn.

### 2.5.5 Colored Led (Red, Green):

The color quality of lighting products is an important thing to consider. Individual LEDs are often called strips of light in a narrow range of wavelength, and they give a monochromatic appearance to the source. In LED lights and luminaries, many spectral components, which can be formed directly or by phosphor conversion, are mixed to form a mixture that appears white to the human eye [62]. As depicted in Fig 2.18



Fig 2.18 Colored Led.

### 2.5.6 WI-FI Camera:

An external camera with a resolution of 2 megapixels, 1080 megapixels, and Wi-Fi, that is waterproof, and features (PTZ) Pan, Tilt, Rotatable Zoom, Day/night vision, SD storage, the cutting-edge V380 application, and support for NVR (Network video recorders) are all included. It works on 12 volts of DC. As shown in Fig 2.19



Fig 2.19 WI-FI Camera.

### 2.5.7 Router Model TL-WR840N:

This Router has the advantage of creating an access point via Wi-Fi. The Mode of the Range Extender is supported to improve current wireless coverage at that location. It is Compatible with IPv6 (Internet Protocol Version 6). Wireless type 802.11n with a frequency of 2.4 GHz and wireless transmission rate of 300Mbps making it ideal for simple or high-bandwidth tasks. As shown in Fig 2.20



Fig 2.20 WI-FI Router.

### 2.5.8 Flash Light Alarm:

The alarm devices, acoustic and light warning siren, work on 12 volts directly and with a current not exceeding 280 milliamps, giving a strong warning sound with a capacity of 115 dB/ 1m and intermittent lighting operation (flashes) to alert parallel to the siren and in red color. It can be used in indoor and outdoor applications In projects, homes, offices, and factories. As shown in Fig 2.21



Fig 2.21 Wired Flash Light Alarm.

### 2.5.9 Arduino Unit:

Hernando Barragan, a Colombian student at the Ivrea Interactive Design Institute in Ivrea, Italy, designed the Wiring Development Platform of the arduino unit in 2004. The intention was to offer clear, inexpensive tools that non-engineers can build digital projects. The wiring platform consists of a PCB with an ATmega128 microcontroller and an integrated development environment (IDE) that makes it simple to program microcontrollers using library and processing functions. Support for the less expensive ATmega8 microprocessor was introduced to Wiring by Massimo Banzi, David Mellis, and David Cuartielles in 2005. Instead of continuing to work on Wiring, they forked (or copied) the source code and began operating it as a new project called Arduino. Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis were among the first members of the Arduino core team. The name "Arduino" is derived from a pub in Ivrea where the project's founders used to gather. Ivrea's Arduino was the name of the pub [63]. After that, the Arduino Uno board has an ESP8266 Wi-Fi module is built-in, and you can program both

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of them and use them together to build any project or application that requires an Internet or local network connection. As shown in Fig 2.22.

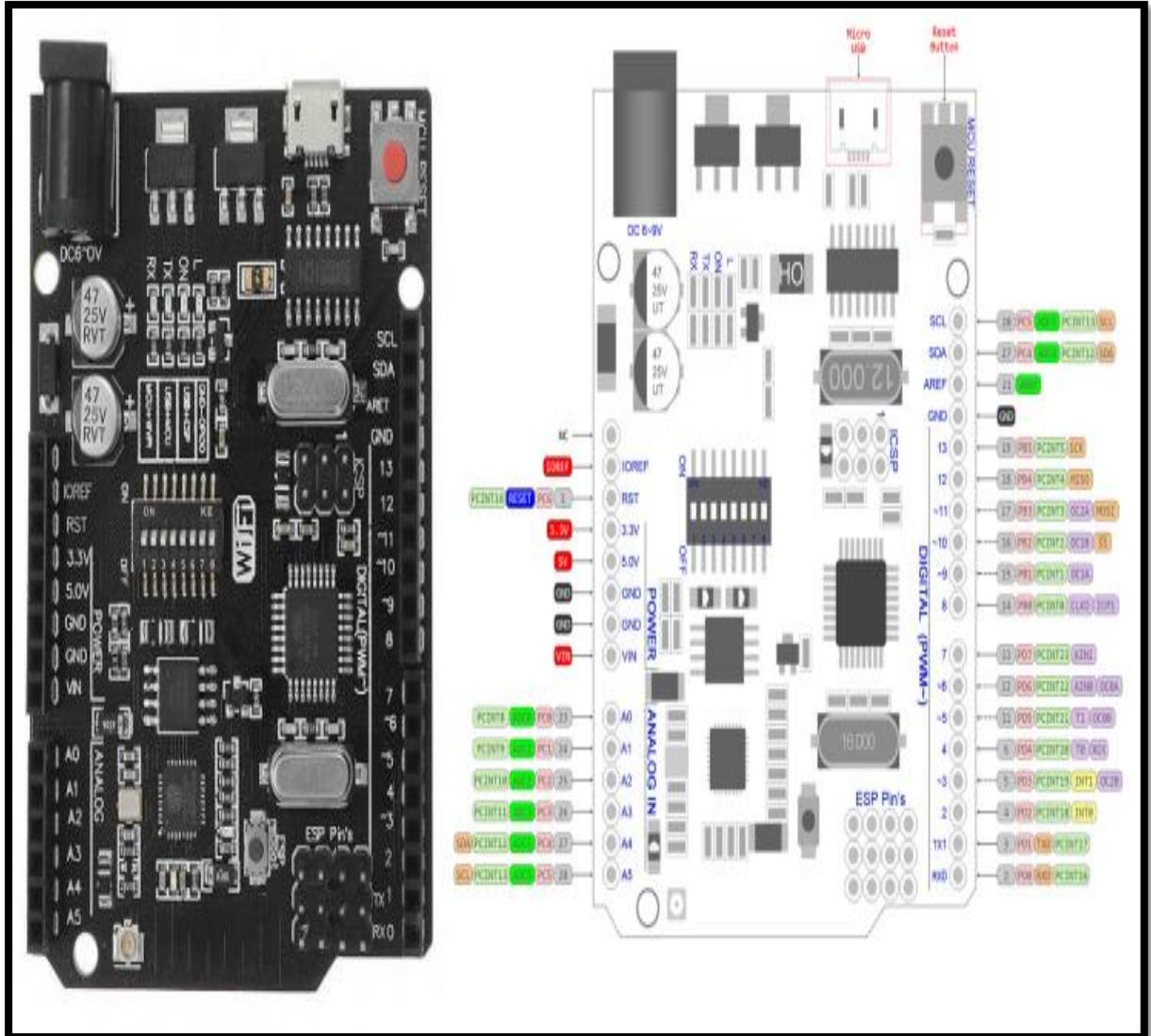


Fig 2.22 UNO + WiFi R3 Arduino Board .

Table 2.8 shows the ATmega328 microprocessor which is based on the Arduino UNO microcontroller board. This board has 14 digital input/output pins, A 16 MHz crystal oscillator, six analog inputs, a USB port, a power jack, an ICSP header, and a reset button are all included. It comes with everything you need to get started with the microcontroller; all you have to do is use a USB cable to connect it to a computer or an AC-to-DC adapter or battery to power it [64]. It has a 5v operating voltage, 40mA DC per I/O pin, and 50mA DC per

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3.3v pin. It has a 16MHz clock speed, 2KB of SRAM, and 1KB of EEPROM [65]. As shown in Fig 2.23.

Table 2.8 shows all Arduino features in a simplified form.

Microcontroller	ATmega328
Operation Voltage	5 V
Input Voltage (Recommended)	7-12 V
Input Voltage (limits)	6-20 V
DC Current per I/O Pin	40 mA
DC Current for 3.3 V Pin	50 mA
Analog Input Pins	6
Flash Memory	32 KB (ATmega328) of which 0.5 KB is used by the boot loader
Digital I/O Pins	14 (of which 6 provide PWM output)
Clock Speed	16 MHz
EEPROM	1 KB (ATmega328)
SRAM	2KB (ATmega328)

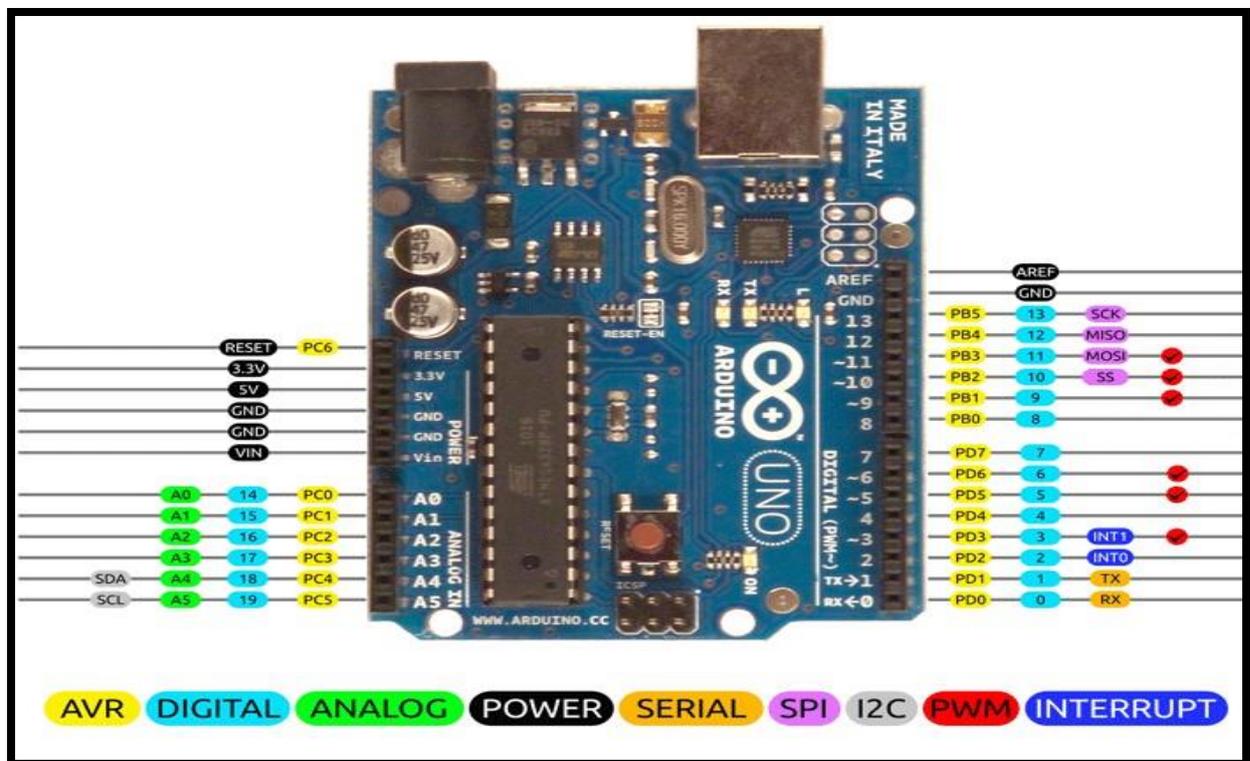


Fig 2.23 Arduino UNO R3 Board .

**2.6 Internet of Things (IoT):**

The development of the IoT has already begun to blossom and change into a worldwide computing network as a result of enormous and constant progress in the sectors of technology. The IoT offers numerous potential as a result of its rapid development, and it is a hot study area. There is an increase in the number of devices connecting to the Internet via wired or wirelessly at this time. Connecting all of these devices to the Internet will create a powerful information source [66]. The IoT's major goal is to connect all smart objects and let them interact and share information with people anywhere, at any time, over any path, network, or service. Fig (2.24) shows that goal [67].

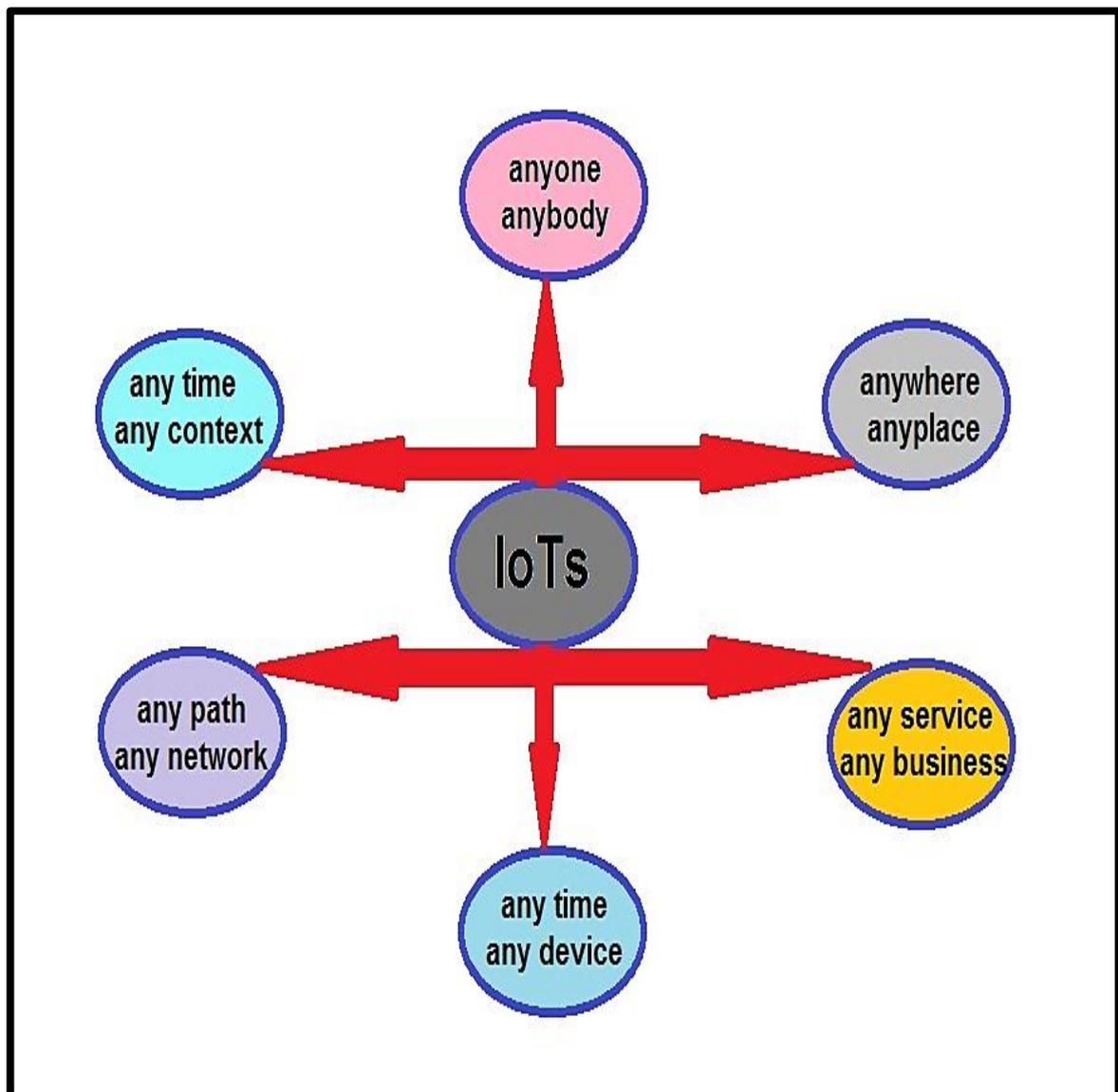


Fig 2.24 The IoT's major goal.

### **2.6.1 IoT Key Features:**

The artificial intelligence feature, the sharing efficiency, the internet connection efficiency, numerous sensors, the development of the data gathering process, and compact size devices are all key elements of the IoT that occur in all areas of life and business. [68]:

### **2.6.2 IoT Applications:**

The main IoT applications can be seen as follows. [69]:

- ❖ IoT is employed in industrial systems with sensors that monitor all industrial processes as well as product quality and equipment status.
- ❖ The Internet of Things is employed in security systems with smart sensors. The information gathered is used to determine people's whereabouts, the condition of the building, and the control of building systems such as heating, air conditioning, purification, and lighting control systems to decrease work and running costs. IoT is used in smart cities that contain sensors to monitor pedestrian and car traffic. It is also used in vehicles that contain sensors, and these devices are connected to the network to monitor the mechanical and electrical condition of the car.
- ❖ The Internet of Things is employed in medical systems that feature a variety of sensors that are used to monitor the health of patients. These sensors could be in the patient's house, in ambulances, in doctors' offices, or hospitals.

### **2.6.3 IoT Elements:**

IoT presents consumers with a plethora of benefits and features. Some aspects are required to properly use the IoT [70]. The IoT components used in the proposed system are discussed in this part.

#### **a. Cloud Computing:**

The Internet of Things (IoT) connects billions of devices and sensors to generate new applications. These applications require essential support, which necessitates the provision of a dependable, versatile, and agile platform. One of

these platforms that supports IoT is cloud computing [67]. Cloud computing may be described as a framework that offers a user with private network storage space as well as computer resources through a subscription-based technology model. The cloud allows the user to access his personal information from anywhere and at any time. A normal computer requires the user to be physically present at the data storage device. This step is no longer necessary thanks to the cloud. The cloud service provider gives the user the ability to own and construct the hardware and software required to run a business or residential or security applications. Depending on the user's demands [71].

### **b. Security:**

People keep a lot of personal information and potentially sensitive data on their computers, and this data is now being transported to the cloud. As a result, it's crucial that you understand the security procedure's importance in place at your cloud provider, as well as take personal actions to protect your data. The first thing you should look into is the security measures in place by your cloud provider. These differ depending on the cloud provider and the type of cloud [71].

### **c. Privacy:**

One of the most critical aspects is privacy, especially when sensitive personal information about individuals is held [72]. Many comforts and valuable services will be supplied to consumers as a result of the IoT's pervasive availability and interactions, which will create numerous potential for privacy violations. To overcome future difficulties connected to privacy in IoT applications, each system's privacy regulations must be limited [73].

### **2.6.4 Iot Architecture:**

Event-driven or aperiodic sampling is an important feature of the Internet of Things. Time-series data is produced through customary digital signal processing and command, which assumes periodic samples. Time series, on the other hand, use too much power at the nodes and network bandwidth. Aperiodic

data gathering is not appropriate for all applications. Distributed computation over sensor events is encouraged by power and bandwidth constraints. On a lot of data streams, relatively modest computers can perform useful processing. Edge processing reduces network bandwidth and energy use by identifying noteworthy events. Wireless communication consumes a lot of power [69].

**2.6.5 IoT Challenges:**

In fact, because of the numerous hurdles that exist, developing the ideal internet of things applications is still in its infancy. Listed below are a few of the most common challenges [74]. Fig 2.25 demonstrates IoT security challenges.

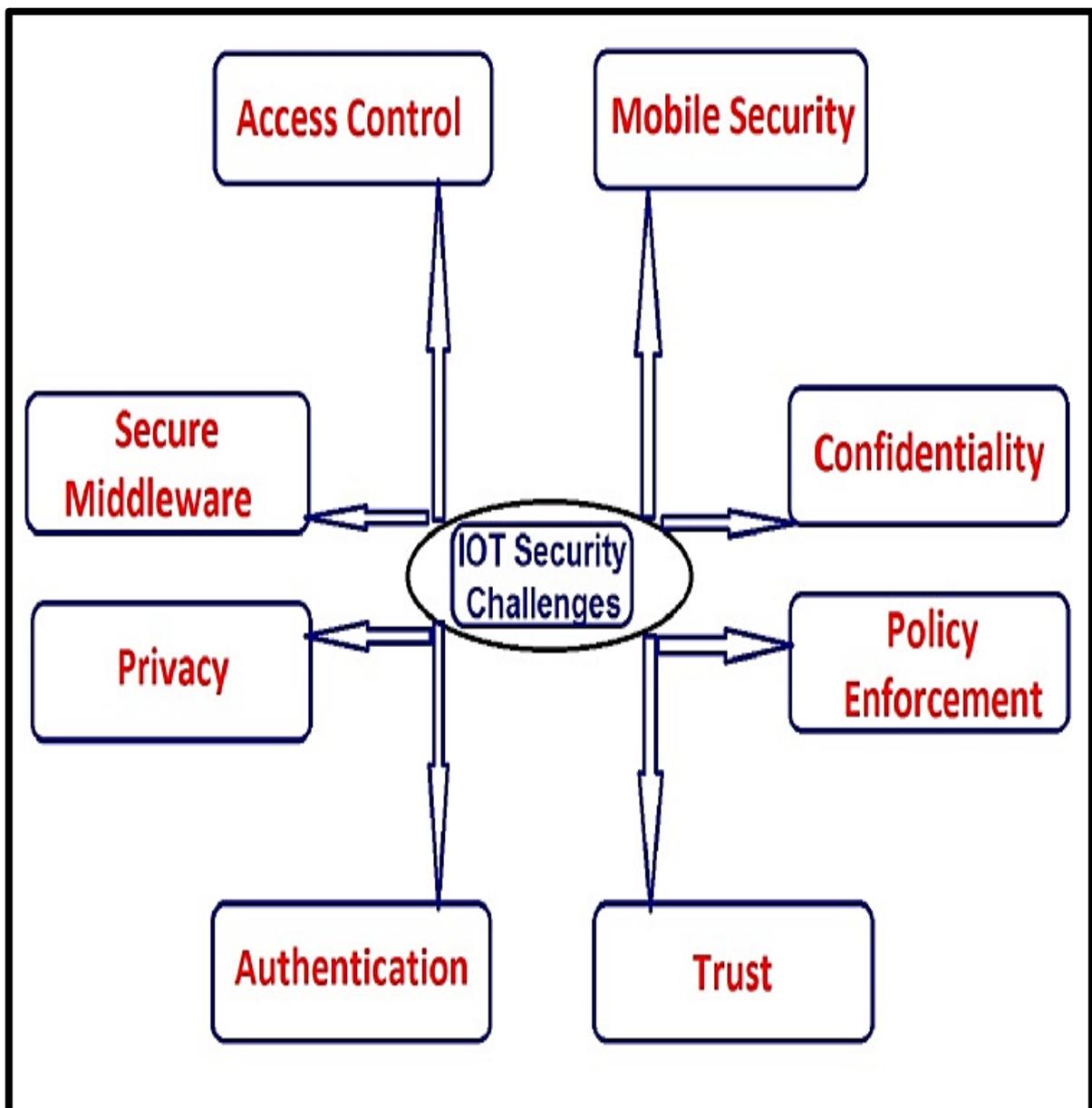


Fig 2.25 Security challenges in IoT.

## Chapter Three

### Proposed Design and Implementation with Graphical User Interface (GUI)

#### 3.1 Introduction:

The idea of this system is to design a multi-security system for a specific security institution based on the principle of the Internet of Things. Its objective is to exchange security information between the direct responsibility for the security establishment and the higher authority represented by the entry of employees and vehicles into the car park, in addition to securing the building from smoke or gas resulting from any fire inside the structures, with a lighting operating system to rationalize the consumption of electrical energy. This system documents the entry of employees through the vital signs via the biometric fingerprint sensor and the entry of cars by sensing the RFID card with documenting the indicators of the smoke sensor and the infrared sensor of the energy-saving system, this process is directly and in real-time by installing The case, processed, and stored directly to the cloud, to be presented in real-time to the direct administrator or who is higher in authority. This chapter presents hardware and software design, the general system used, and applicable system-specific advantages.

#### 3.2 Proposed System

The proposed system consists of a group of security institutions associated with the Supreme Security Institution. Each institution is distinguished by its system and each system is linked with the cloud, thus obtaining an integrated security system that covers all buildings in different geographical locations. Fig 3.1 shows the multiplicity of institutions and their connection to one security system. Each system can be described as follows:

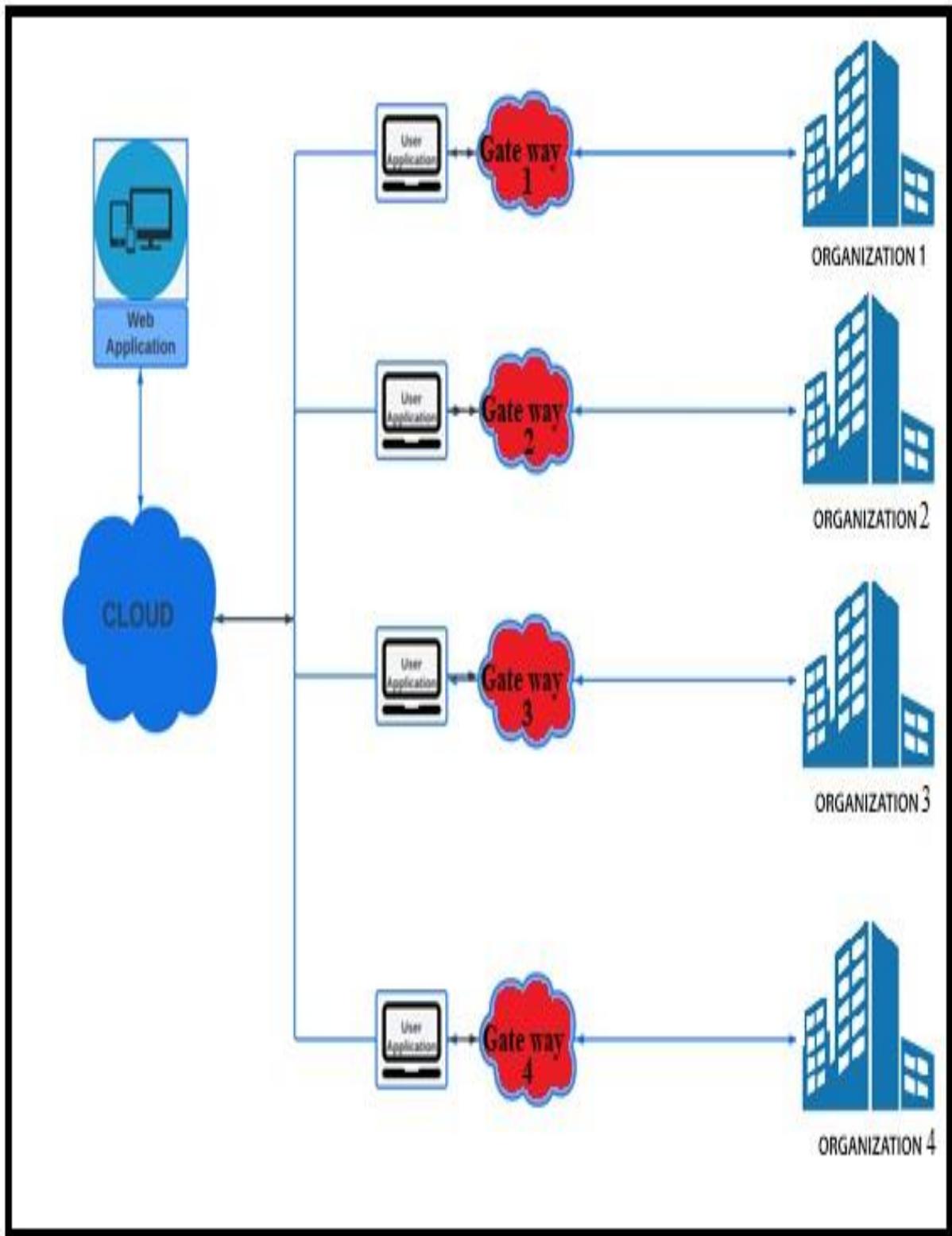


Fig 3.1 Block Diagram shows the systems of buildings linked to a cloud.

### 3.2.1 Automatic Entry System For Authorized Vehicles:

The features of the Internet of Things and the sensors used in this part of the research are shown in Fig 3.2. The system includes two main parts:

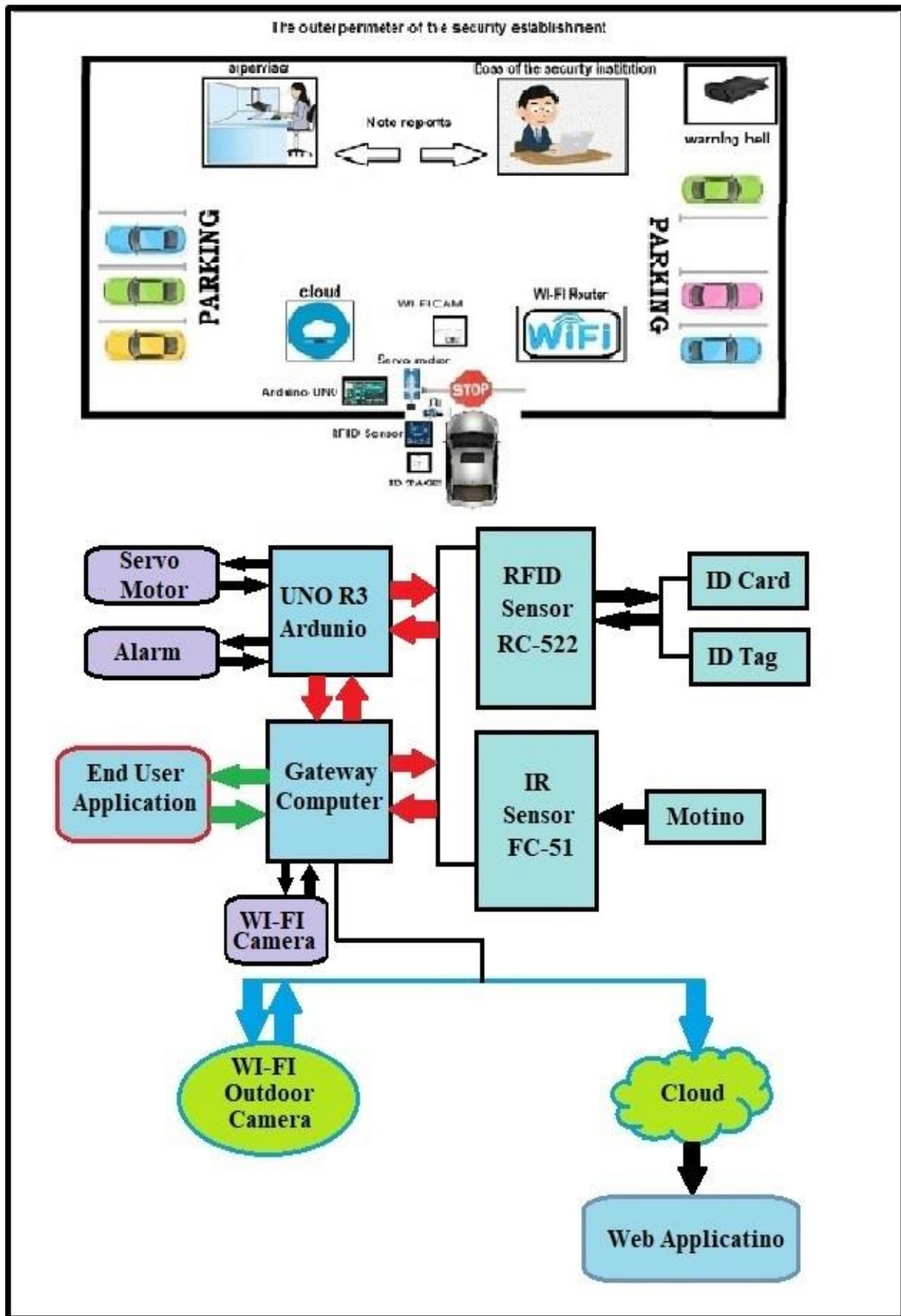


Fig 3.2 Block Diagram of RFID System

**A- Hardware:**

The work was designed and implemented by sensing a radio frequency identification sensor of a person's identification card stored in the database and converting this sensitization into an electrical output signal and transmitting it to the Arduino processing unit, which is directly connected to a computer via the USB port, where the data is displayed through the graphical user interface to monitor all Signs about entering the cars of known card holders, and the responsible person (Supervisor) is alerted if someone tries to use an unrecognized card to enter by activating an alarm to warn.

In both processes, whether the card is known or unknown, the system sends a signal to the Wi-Fi camera to take sequential images and store them on the cloud through any wireless device that provides a connection to the Internet of things until the end of the entry. It also performs the same process if trying to enter for more than three readings of an unknown card. Storing data on the cloud provides the opportunity to recover data directly from the administrator or whoever is a higher authority than him to make a specific decision or stop a breach process. Also, storing real photos of people with their cars during entry provides reliability for the system, and it is also possible to identify saboteurs, and people, easily through their photos stored on the cloud in real-time. Building a database for employees in any organization helps diagnose undesirable situations and increases the accuracy of the system's work in a manner commensurate with the security of the institution. Connecting the electronic circuit of this system is seen in Fig 3.3, and the task of each part of the hardware is:

- ❖ **RFID Sensor and ID Tag:** This sensor, along with the identification card, generates an electrical signal and transmits it to the Arduino UNO R3 processing unit.

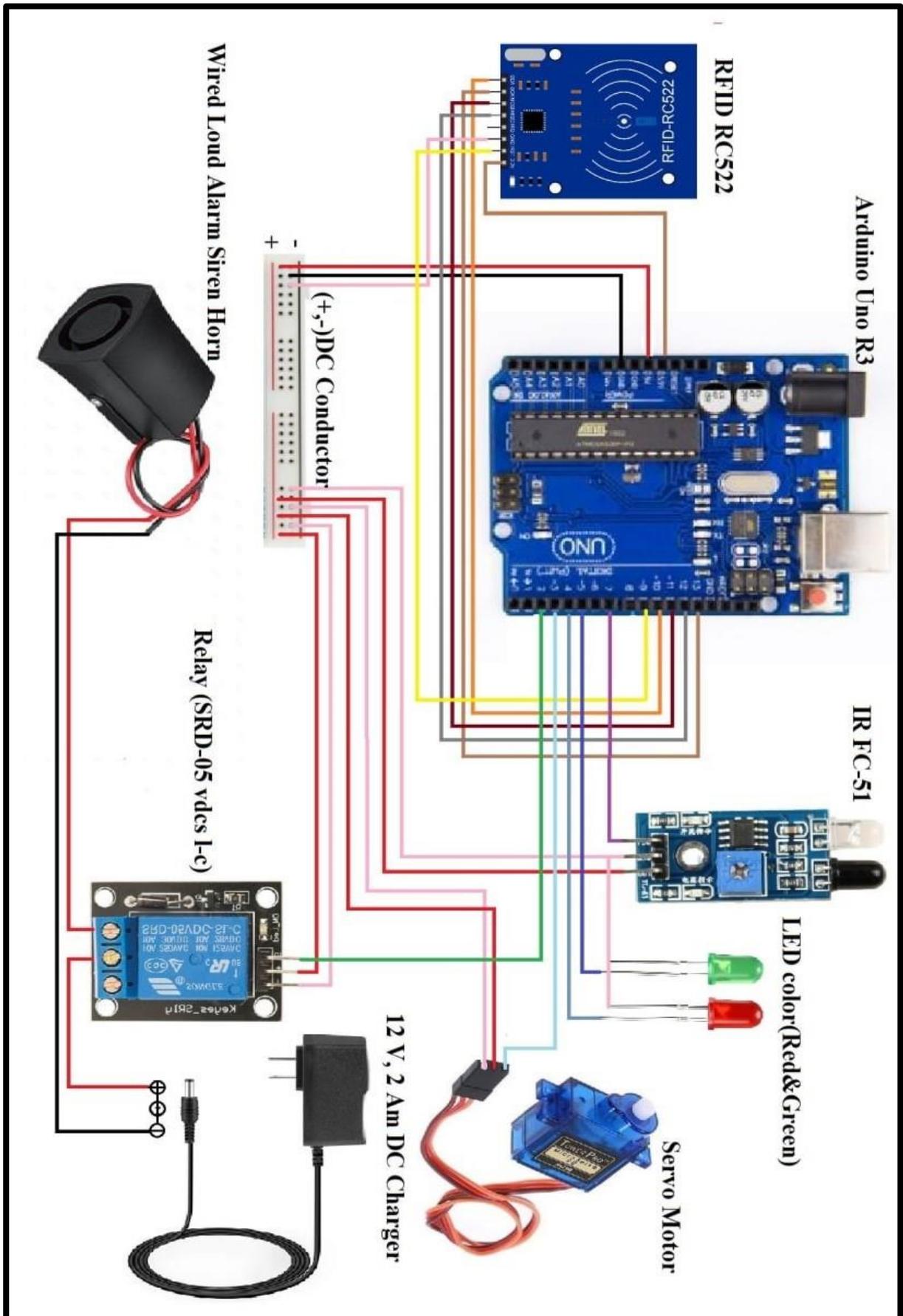


Fig 3.3 RFID System Circuit

- ❖ **Arduino UNO R3 unit:** The task of the processing unit is to receive the RFID signal, process it and verify the ID tag, whether it is known in the database or not. If the ID Tag is known, it sends a signal to the IR sensor to sense the movement of the vehicle near it, if it senses an obstacle from the nearby car chassis, it returns a signal to the Arduino processing unit, the latter sends two signals at the same time, the first to the green LED to light and the second to the servomotor to open. But if the ID Tague is unknown and has been sensed by RFID more than three times, the Arduino sends two signals at the same time, the first to the red LED to light and the second to the warning bell to warn the supervisor.
- ❖ **IR Sensor:** The task of the infrared sensor is to sense the presence of an obstacle from nearby objects such as cars and send it to the Arduino processing unit. The purpose of its presence is to protect the car from any touch or friction with the servomotor and secure it until the proper passage into the car garage and send a cut-off signal to the Arduino processing unit after the car passes safely, the servo motor will close after five seconds from the arrival of the cut-off infrared sensor signal, The time delay which is (5 sec) determined in the treatment unit.
- ❖ **Servo Motor:** The task of the servomotor is to receive the final signal from the Arduino processing unit to open or close the arm of the beam, which allows or prevents the entry of the car. It serves as a pivotal device in this system.
- ❖ **WI-FI Camera:** The task of the Wi-Fi camera is to receive the signal from the system through the program designed to display and read the processing data of the Arduino unit using C#, the main purpose of which is to take pictures and send them via the Internet to the cloud.
- ❖ **computer unit:** The task of the computer unit is to display all the data related to Arduino. It also contains the program for the local server. It is considered a comprehensive processor for the system through which data

is entered, stored, and processed, in addition to the importance of this unit in sending and receiving the signal to all system devices and coordinating between them through the Internet of Things.

- ❖ Colored LED: The task of the colored LED is to add some luster to the system by lighting the green LED with a permit to enter but in the case of lighting the red LED with a prevent entry, this part of the system is considered among the complementary accessories to the system.
- ❖ WI-FI Router: The task of a Wi-Fi router is to connect the devices used wirelessly while providing an Internet connection service. Through this device, the signal is sent to the camera wirelessly to capture images, and through the router, images are sent to the cloud to store and process.

### **B- Software:**

The design of the system is based on several commands to meet the needs of its design and implementation, as shown in Fig 3.4 which is represented by FLOW CHART for all the software instructions that were used in the process of entering cars automatically without the need for human effort as checkpoints.

The process starts with START and then the format that contains the logic operations, equations, and initial values where it contains all the variables X is a counter of the number of unknown ID cards.

Y is a digital signal of the IR sensor (motion).

The initial value of X is equal to zero, and the initial value of Y is equal to zero.

### **Case One:-**

ID Tag is known, the system checks the motion from the IR sensor if  $Y=0$ , which means no motion the system goes to the first step. But if  $Y=1$ , which means motion exists, the system sends two signals at the same time, one to the servo motor to open and the second to the Wi-Fi camera to take pictures, then the system returns to check whether there is motion or not, if ( $Y$  not equal to 0), the system continues to open the servo motor and take pictures. but if  $Y=0$ , the

system waits for 5 seconds and directs the servo motor to close its arm, stop taking pictures, and the system goes to the end.

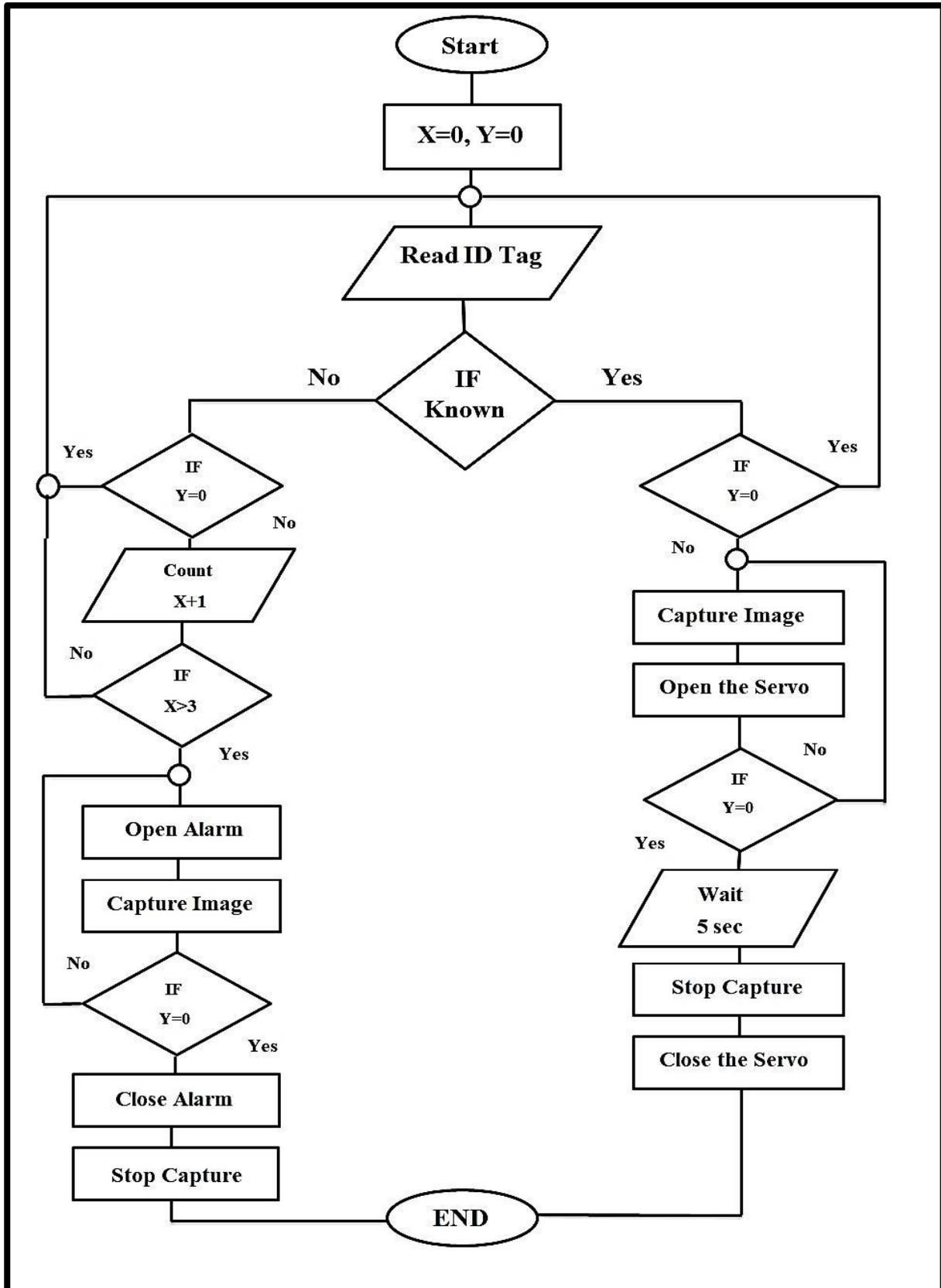


Fig 3.4 Flow Chart of Software Instructions

**Case Two:-**

ID Tags unknown, The system counts consecutive times for unknown identification cards within the database to reach the value of  $X > 3$ , the system sends two signals at the same time, one to the alarm bell to alert the supervisor and the second to the Wi-Fi camera to take pictures, then the system returns to check whether there is motion or not, if ( $Y$  not equal to 0), the system continues to warn the supervisor through the alarm and take pictures. But if  $Y = 0$ , the system waits for 5 seconds and closes the alarm, stops taking pictures, and goes to the end.

**3.2.2 Fire Protection system and Automatic Lighting Control System:**

The features of the Internet of Things and the sensors used in this part of the research as shown in Fig 3.5, the system includes two main parts:

**A- Hardware:**

The work was designed and implemented at the level of one room of the security establishment through the use of smoke/gas sensor MQ2 FC-22 with infrared sensor IR FC-51.

The smoke/gas sensor and the IR sensor convert the condition that happened to an electrical output signal and transmit it to the Arduino processing unit, which is connected directly to a computer via the USB port.

Where the data is displayed through a graphical user interface to monitor all signals related to gas/smoke emission or door open sensor The responsible person (supervisor) is alerted if gas/smoke is emitted as a result of a fire by activating a warning alarm. In both processes, whether sensing a gas/smoke sensor or an IR sensing, the system sends a detailed report to the cloud via any wireless device that provides an IoT connection until the sensing process is finished.

Storing and displaying reports on the cloud provides an opportunity to be directly informed by the administrator or higher authority to make a specific decision or address an early fire outbreak.

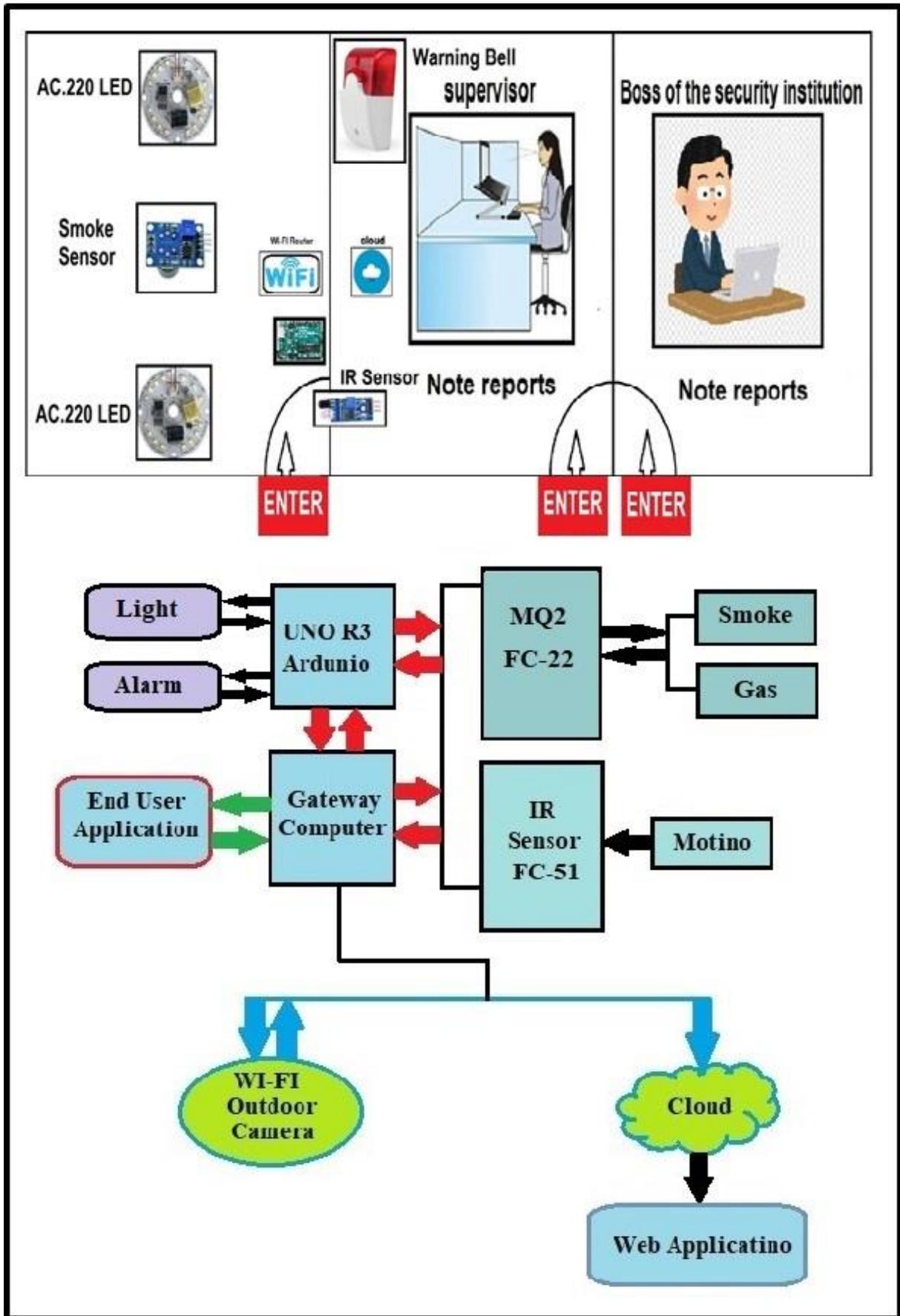


Fig 3.5 Fire Protection and automatic lighting control System Block Diagram

Fig 3.6 shows the circuit connection for this part of the system, and the task of each part of the hardware is:

- ❖ IR FC-51: The infrared sensor senses the presence of an obstacle as a result of opening the door by the employees inside the security establishment, which leads it to convert this sensitivity into an electrical signal sent to the Arduino processing unit.
- ❖ Smoke\Gas Sensor MQ2 FC-22: The gas/smoke sensor senses the presence of gases or smoke associated with the outbreak of fires, which leads it to convert this sensor into an electrical signal that is sent to the Arduino processing unit.
- ❖ Flash Light Alarm: The task of the flashlight is to receive the signal from the Arduino via relay to alert the supervisor to avoid the fire or take other measures.
- ❖ Arduino UNO R3 Module: The task of the processing unit is to receive and process the signal of the IR, MQ2 FC-22 sensors. If the received signal is from the IR sensor, the Arduino unit sends a signal to the lighting system and makes it open, but if the signal is from the smoke sensor, the Arduino unit sends a signal to the warning bell system to warn the supervisor.
- ❖ computer unit: The task of the computer unit is to display all the data related to Arduino. It also contains local server software. It is considered a comprehensive system processor through which reports are submitted and displayed, in addition to the importance of this unit in sending and receiving the signal to all system devices and coordinating among them through the Internet of Things.
- ❖ WI-FI Router: The task of a Wi-Fi router is to wirelessly connect the devices used while providing an Internet connection. Through this device, reports are sent to the cloud, and through the router, these reports are processed periodically.



**B- Software:**

The system design is based on several commands to meet the needs of its design and implementation, as shown in Figure 3.7, which is represented by the Flow Chart of all software instructions that were used in the process of fire protection system for people and automatic lighting control system.

The process starts with START and then the format that contains the logic operations, equations, and initial values where it contains all the variables

A is an analog signal of the MQ2 sensor.

Y is a digital signal of the IR sensor (motion).

The initial value of A is equal to zero, and the initial value of Y is equal to zero.

**Case One:**

the system checks whether there is motion or not, if  $Y=0$ , the system returns to the first step. but if ( $Y$  is not equal to 0), the motion exists, the system sends a signal to open the light and wait 15 mins and check the value of  $Y$ . If ( $Y$  is not equal to 0), the system continues to open the light, but if  $Y=0$ , the system closed the light and goes to the end.

**Case Two:**

The system checks whether there is smoke or gas or not, if  $A=0$ , the system returns to the first step. but if ( $A$  is not equal to 0), the fire exists, and the system sends a signal to open the flashlight alarm to warn the supervisor and wait 5 sec and check the value of  $A$ . If ( $A$  is not equal to 0), the system continues to open the flashlight alarm to warn the supervisor, but if  $A=0$ , the system closed the alarm and goes to the end.

Therefore, this system is considered particularly effective to protect people and property from fire damage or to avoid the occurrence of fire at an early date. It also contributes to reducing energy consumption when there are no people inside the rooms of the building. Thus, it is an energy-saving system.

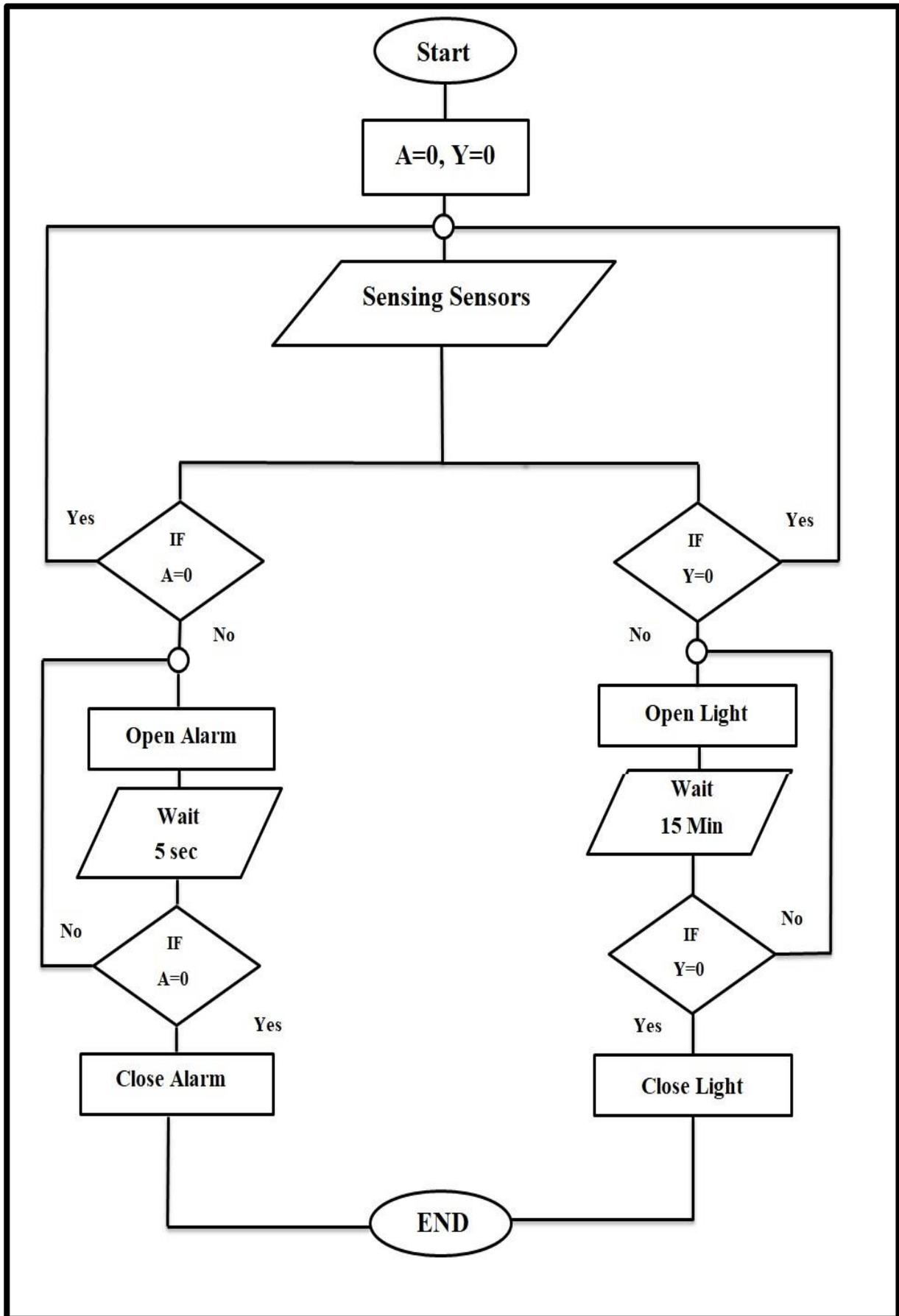


Fig 3.7 Flow Chart of Software Instructions

**3.2.3 Automatic Entry System of Authorized Persons:**

The features of the Internet of Things and the sensors used for this part of the research as shown in Fig 3.8, the system includes two main parts:

**A- Hardware:**

The work is designed and implemented by sensing a person's fingerprint biomarkers stored in the database, converting this sensing into an electrical output signal, and transmitting it to an Arduino processing unit, which is connected directly to a computer via the USB port, where the data is displayed through a graphical user interface to monitor all Signs related to the entry of people (employees) into the security institution whose fingerprints have been kept in the database and distinguish them as known. The responsible person (the supervisor) is alerted when the system is sensing three unknown fingerprints which are repeated, it will activate an alarm to warn when someone tries to use his unknown fingerprint as entering other than the previously-stored fingerprint in the database or expose the fingerprint to environmental factors that prevent it from being detected by the biometric fingerprint sensor, or subject the person to amputation of the finger.

In both processes, whether the fingerprint is known or unknown, the system sends a signal to the Wi-Fi camera to take a picture and store it on the cloud via any wireless device that provides an IoT connection. It also performs the same process if a person tries to access more than three unknown fingerprint readings.

Storing data on the cloud provides an opportunity to recover data directly from the administrator or his higher authority to make a specific decision or stop the hacking process.

Also, storing the real photos of people as they enter provides reliability to the system, and it is also possible to easily identify vandals and unwanted people by their photos stored on the cloud in real time.

Building a database of employees in any organization helps in diagnosing unwanted situations and increases the accuracy of the system's work in a way that is commensurate with the security of the organization. The connected electronic circuit of this system as in Figure 3.9, and the task of each part of the hardware is as follows :

- ❖ **Fingerprint Biometric Sensor:** This sensor, generates an electrical signal and sends it to the Arduino UNO R3 processor.
- ❖ **Arduino UNO R3 unit:** The task of the processing unit is to receive, process, and verify the fingerprint sensor signal whether is known in the database or not. If the fingerprint is known, it sends a signal to the electric lock device to unlock at time 5sec and sends a signal to the Wi-Fi camera to take a picture at the same time, but if the fingerprint is unknown and is sensed by the fingerprint sensor more than three times, the Arduino sends a signal to the alarm To warn the supervisor and at the same time sends a signal to the Wi-Fi camera to take a picture.
- ❖ **WI-FI Camera:** The task of the Wi-Fi camera is to receive the signal from the system through the program designed to display and read the processing data of the Arduino unit using C#, the main purpose of which is to take pictures and send them via the Internet to the cloud.
- ❖ **WI-FI Router:** The task of a Wi-Fi router is to connect the devices used wirelessly while providing an Internet connection service. Through this device, the signal is sent to the camera wirelessly to capture images, and through the router, images are sent to the cloud to store and process.
- ❖ **Electric Spring Lock Door:** The task of this device is to receive the signal from the Arduino via Relay to close and open the door for employees to enter the headquarters of the main building.

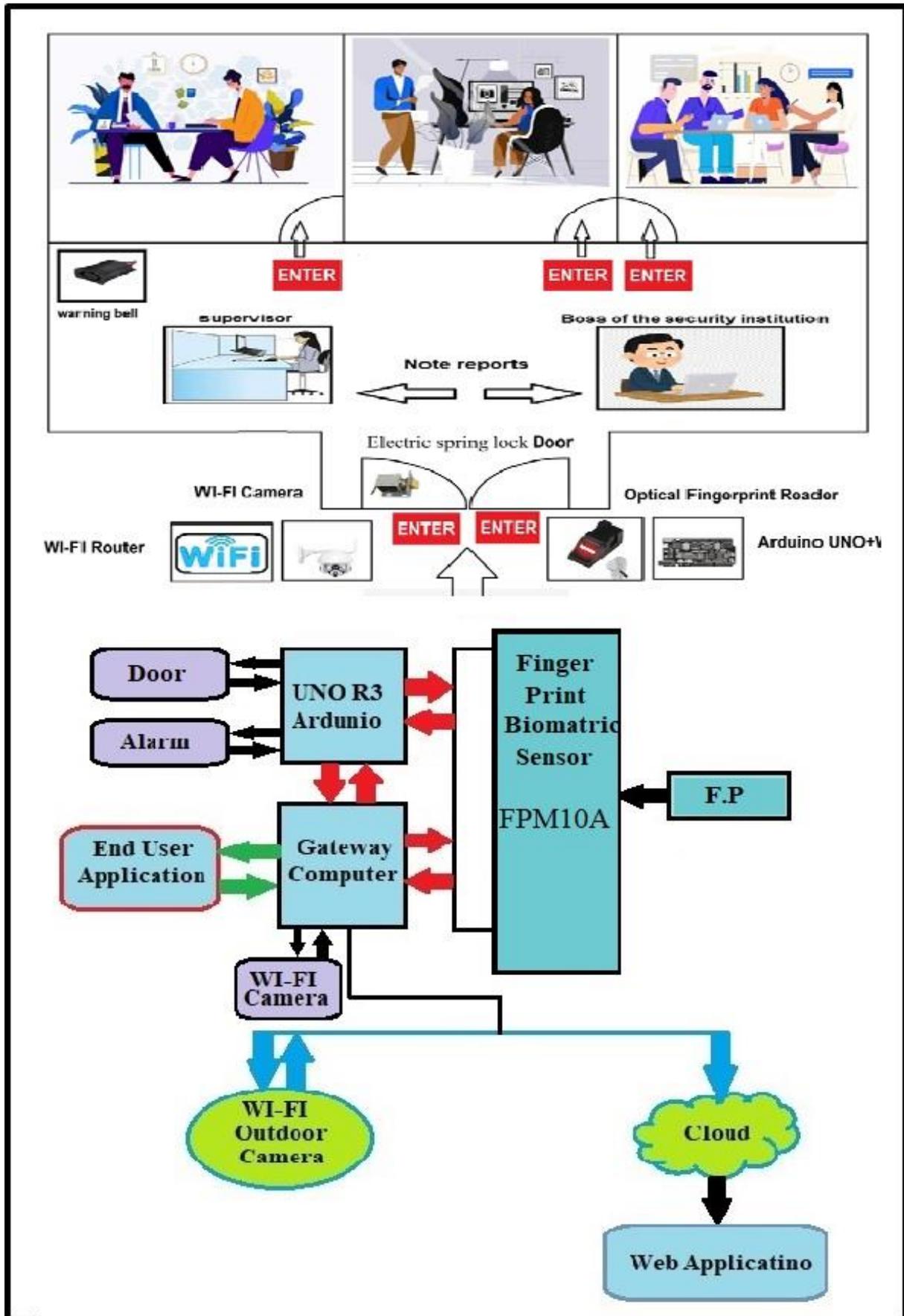


Fig 3.8 Automatic Entry System for Authorized Persons Block Diagram.

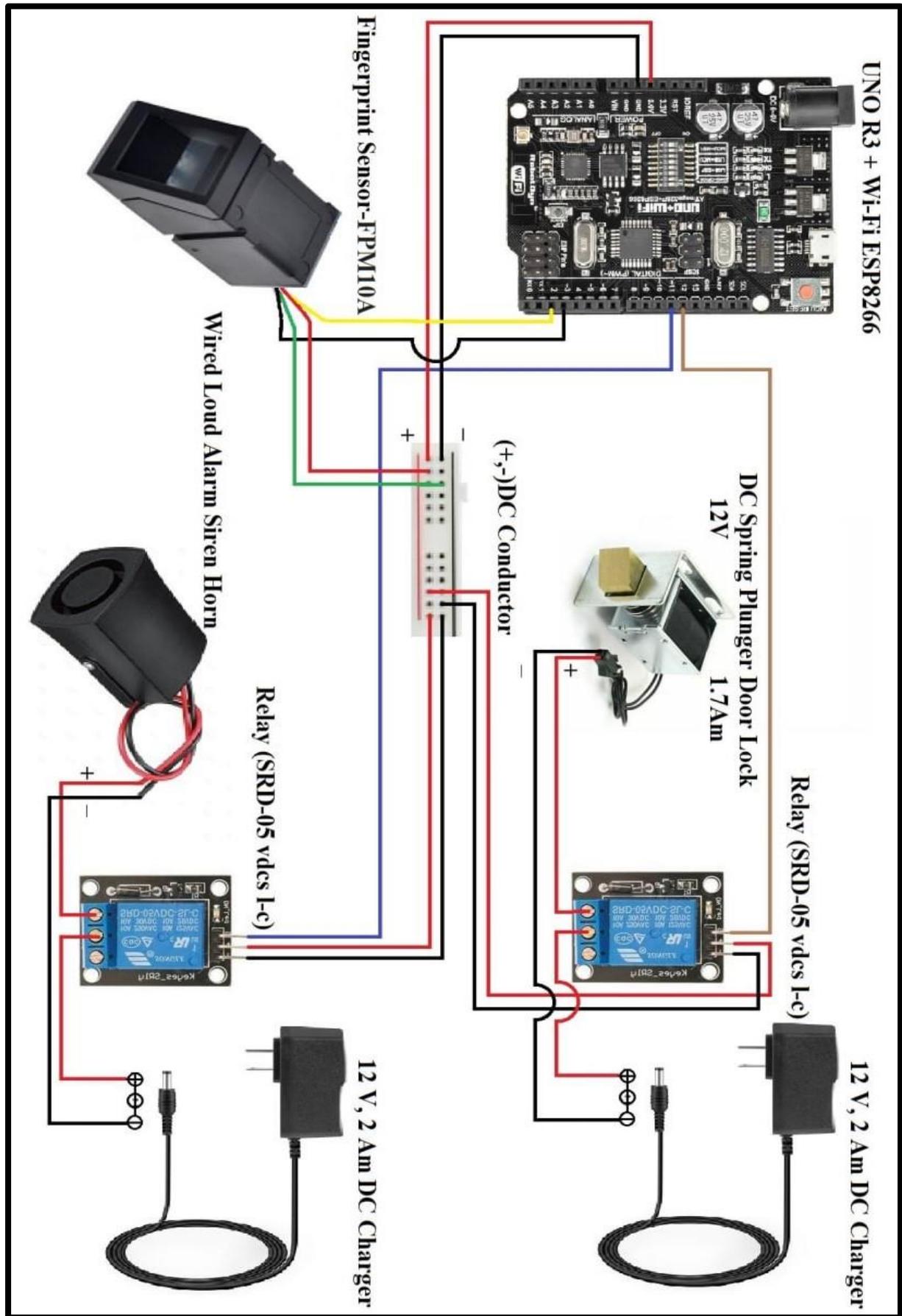


Fig 3.9 Automatic Entry System for Authorized Persons Circuit.

**B. Software:**

The design of the system is based on several commands to meet the needs of its design and implementation, as shown in Fig 3.10, which is represented by FLOW CHART for all the software instructions that were used in the process of entering authorized persons automatically, without the need for human effort as checkpoints.

The process starts with START and then the format that contains the logic operations, equations, and initial values where it contains all the variables X is the counter to the unknown fingerprint.

The initial value of X is equal to zero.

**Case One:**

The fingerprint is known in the database, the system sends two signals one to open the door electric lock and the other to the wi-fi camera to capture, wait 5 sec and close the door and stop the capture, and goes to the end.

**Case Two:**

The fingerprint is unknown, The system counts the number of unknown fingerprint scans to become  $X > 3$ . The system sends two signals, one to the alarm bell to alert the supervisor and the other to the Wi-Fi camera to take a picture. Then the system waits 5 seconds and sends a signal to the door to close and the camera to stop and goes to the end.

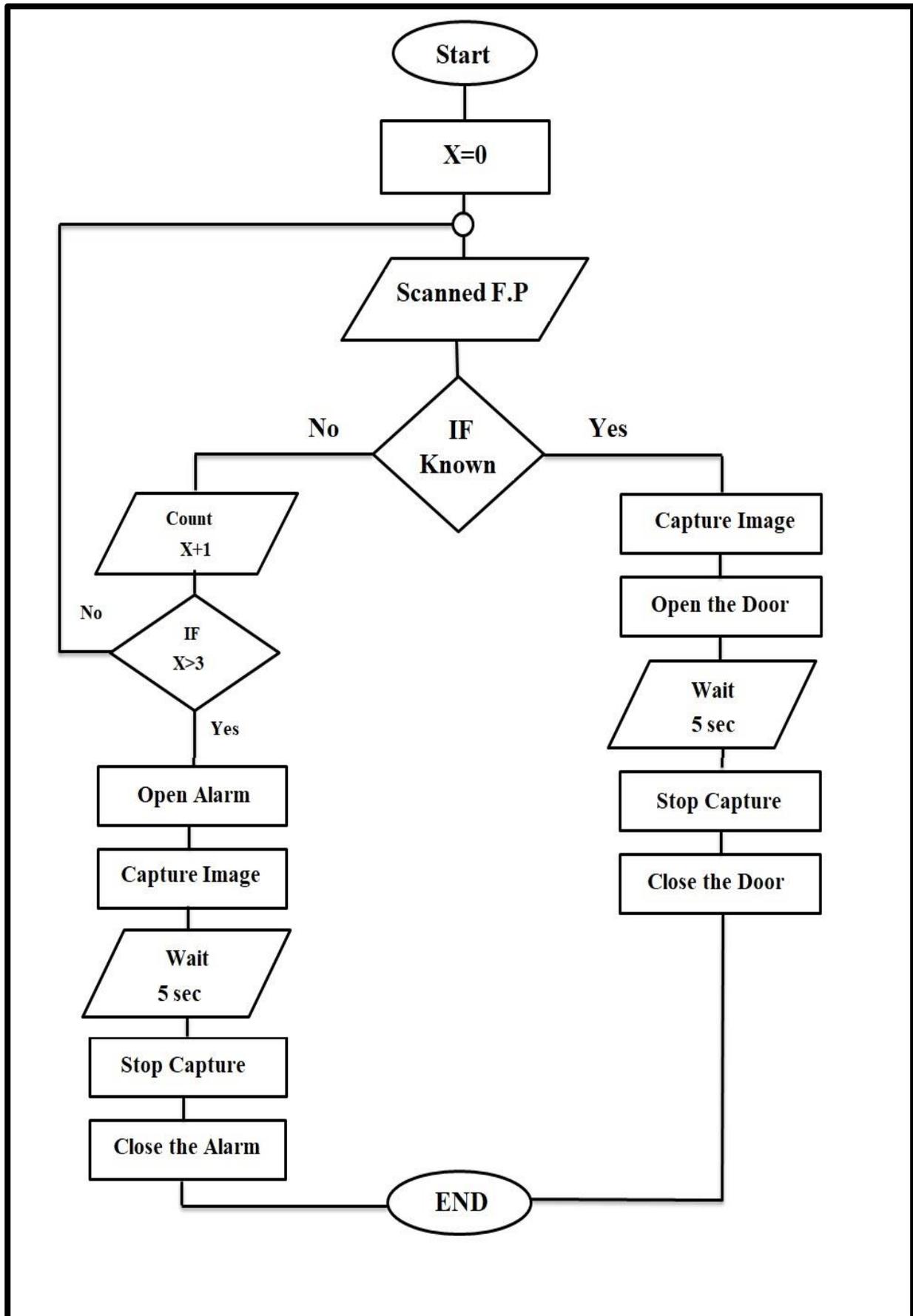


Fig 3.10 Flow Chart of Software Instructions

### 3.3 Local Server

The design of a system that contains a number of sensors and devices needs to be treated appropriately for which it was designed. Therefore, a database must be set up to examine the operation of the system and its ability to process and provide accurate real results. The MySQL database is one of the most famous and most widely used databases in creating databases for systems compared to other databases, due to its speed and strength at the same time. The database in general required a graphical interface to enter and display it.

There are two ways to deal with the database, either the command line method, which is an advanced method used in large servers, or the graphical interface method which is widely used in most applications and technical and engineering research. The graphical interface phpMyAdmin was used for this purpose as it can deal with the MySQL database easily. Through the use of XAMPP program ver 3.3, which provides a software package that can deal with PHP language (Personal Home Page) that is used in the final design of the MySQL database.

When XAMPP is running and instruction (Apache, MySQL) is activated, and by clicking on the Admin button of the MySQL database as shown in Fig 3.11, it will go to the browser PHPMyAdmin interface <http://localhost/phpmyadmin/> as shown in Fig 3.12.

When writing the system database, its name was chosen `security_db`, the `d` symbol is shown to the data, and the `b` symbol is shown to the base, as shown in Fig 3.12.

It contains the headers of the database shown in Fig 3.13 including `door-log`, `emp`, `rfid`, and `users`. The most important headings are the employees (`emp`). When entering this window, it contains the columns for the employees' data as shown in Fig 3.14.



Fig 3.11 XAMPP Run

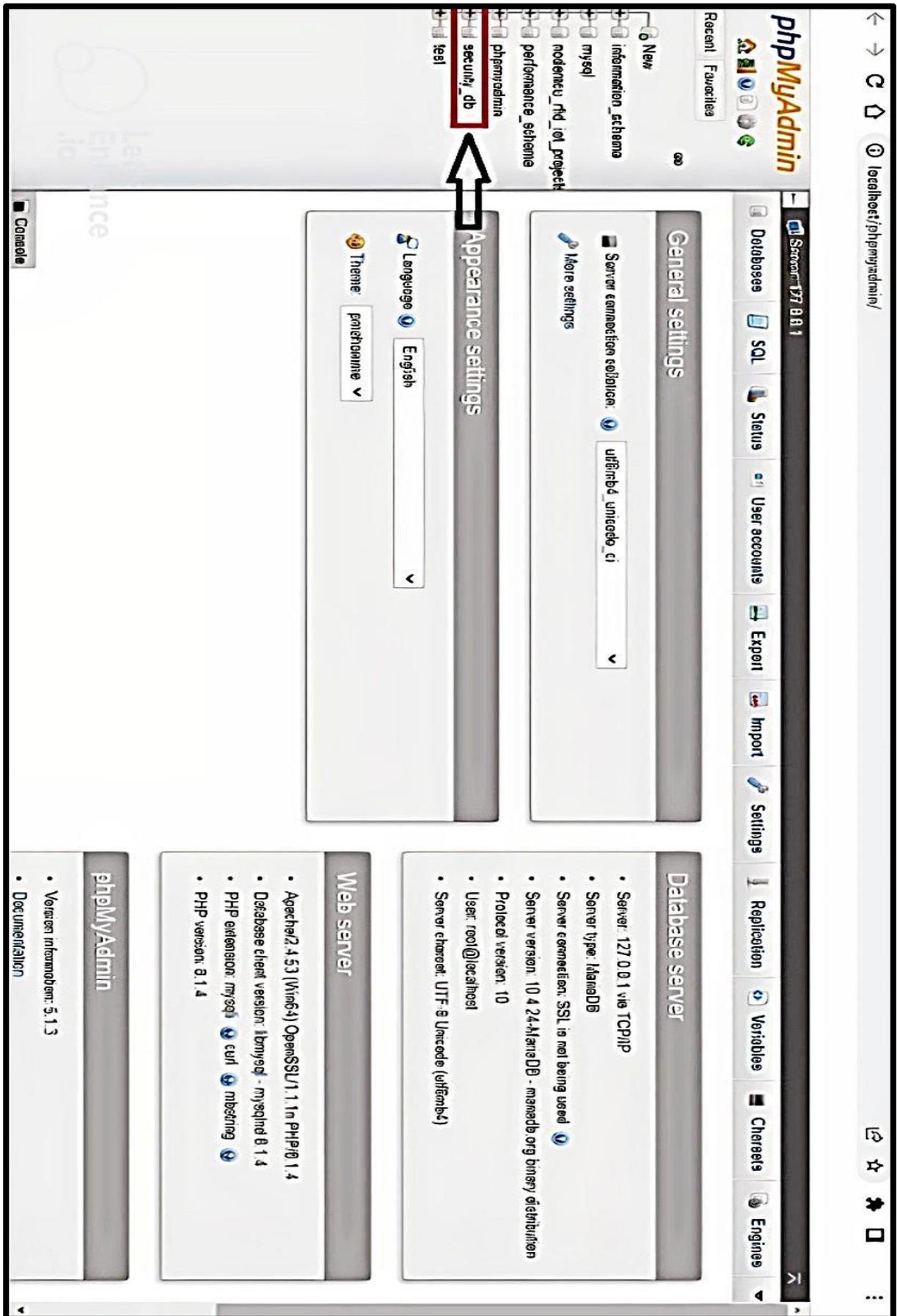


Fig 3.12 PHPMYAdmin interface

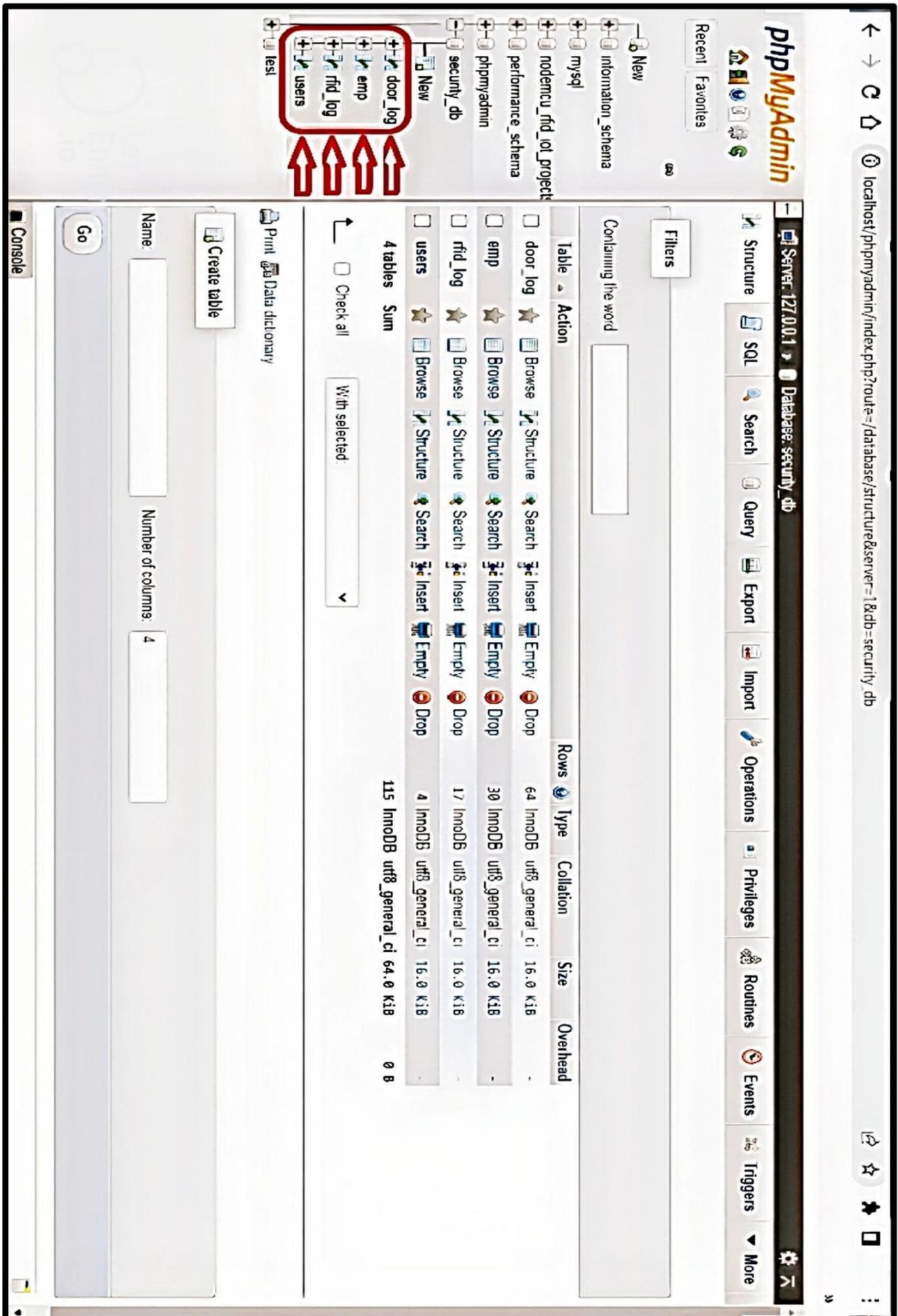


Fig 3.13 System database headlines

id	name	phone_number	email	address	job	image	ip	if id	create	car no	car type	car color
1	Mohammed Aiaa YOUSIF	07711920985	mohammedaiaa8484@gmail.com	Iraq-Babil Almohtarbeen	Employee	tempEmp1641970433.bmp	49 33	A2 8D	0	A123	NISSAN	RED
2	Mohammed Ameer Abdalee	07727396143	eqw81@yahoo.com	Iraq-Karbalaa Alwatata	Employee	tempEmp1641970734.bmp			0			
3	Mohamad Rzaeg Swatee	07801190085	mohameds2@yahoo.com	Iraq-Babil Mosaab	Employee	tempEmp1641971382.bmp			0			
4	Hosham Helo Mahdi	07813453723	hoshamhe084@gmail.com	Iraq-Babil Mosab	Employee	tempEmp1641971682.bmp			0			
5	nadom isnaeel naif	07709026688	nadom_1987@yahoo.com	Iraq-Babil 60stiret	Employee	tempEmp1642670934.bmp			0			
6	sarif shaouq fadik	07813257971	sarifshaouq@gmail.com	Iraq-Babil	Employee	tempEmp1642534468.bmp			0			
7	haider saih mohee	07827809083	haider84@gmail.com	Iraq-Babil	Employee	tempEmp1642534684.bmp			0			
8	abdalah ayad kaareem	07827819720	abdalahayad@gmail.com	Iraq-Babil 80stiret	Employee	tempEmp1642535796.bmp			0			
9	Firas Nadum Sahb	07903636600	frasnadum81@gmail.com	Iraq-Babil Abokaraq	Employee	tempEmp1641971991.bmp	16 40	B8 F0	0	B456	BMW	BREEN
10	ali hasan sahb	07809683007	ali_1987@yahoo.com	Iraq-Babil abogaraq	Employee	tempEmp1642668055.bmp			0			
11	Saif Saad	07831016890	ss1542439@gmail.com	Iraq-Babil	Employee	tempEmp1641972152.bmp			0			

Fig 3.14 employees' data

Employee data contains name, phone number, email, address, job, image, fp.id (fingerprint ID), rfid (ID tag number), car number, car type, and car color. After completing the storage of the database for the employees, the system needs to display the process of processing the sensors and the Arduino unit, so the application that was designed will display these processes and commands of the system that works on the computer-supported by the Windows system.

This application was designed in C Sharp language, which is the development of C++ language. When you run the designed security program, go to enter the main interface that contains the headlines of adding employee, fingerprint server, RFID server, smoke & door.

Through the add employee window, the supervisor can add the data of a new employee without referring to the previous MySql database. As for the rest of the windows, they are for displaying the processing of sensors and Arduino, which was designed with its console.

When accessing the fingerprint server, the program displays all the instructions for this part of the fingerprint scanning and compared it with the database and gives the final result and sends it to the cloud, and instructs to take a picture and upload it to the cloud.

When accessing the RFID server, the program displays all the instructions for this part of the RFID sensor card reading and compares them with the codes in the database and gives a definitive result and sends it to the cloud, and instructs the camera to take pictures sequentially and send it to the cloud. About entering the last window, the program will send the readings of the Arduino to the cloud, because there is no database in this part. All of these procedures for this application of the local server are illustrated shown in Fig 3.15.

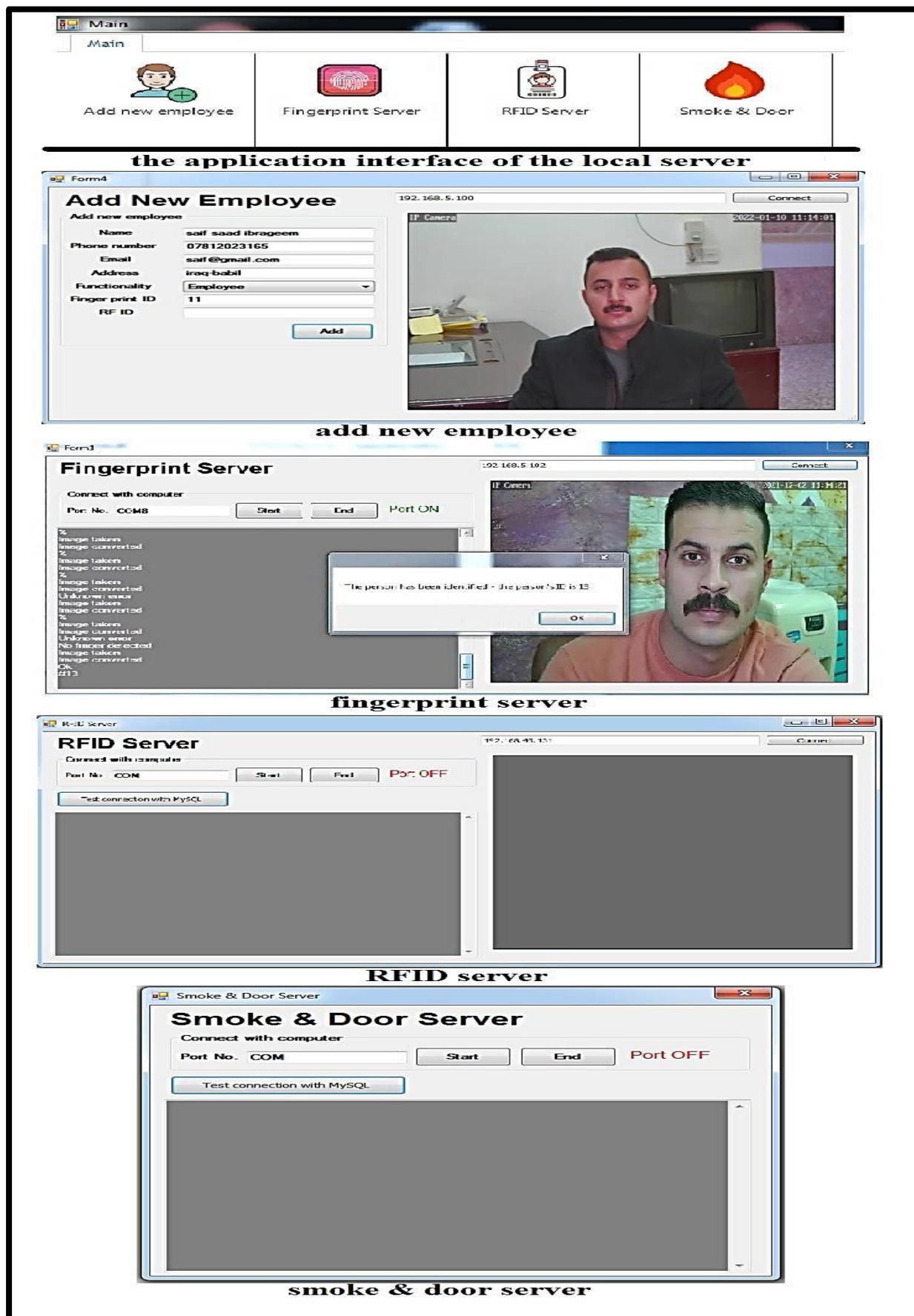


Fig 3.15 application of local server

### 3.4 Cloud Monitoring

After completing all the requirements for the system designed and implemented in practice, a cloud must be provided to display the daily reports and the database of the security institution to the responsible person or whoever is higher in authority than him. Since the enterprise database is a MySQL(My Structured Query Language) database type using the graphical interface phpMyAdmin, the online services will be designed through hosting on the A2 Hosting website, for more information, you can visit the website, [\(https://www.a2hosting.com/\)](https://www.a2hosting.com/).

All data, reports, and images from the local server are stored directly on the online server. CSS language It is an abbreviation for (Cascading Style Sheets). It is concerned with the fonts, colors, margins, widths, and heights, as well as the controls for website backdrops and images. Given that it works hand in hand with HTML when designing and building web pages, CSS is a friendly language. In addition, HTML (HyperText Markup Language) is a markup language used to create and design web pages and websites, it is used here to configure the final design of the website. Both CSS and HTML languages are involved in the design of the front-end and back-end of the online server. Therefore, the website address of the online server is  [\(https://www.security-camp.a2hosted.com/security/users/login\)](https://www.security-camp.a2hosted.com/security/users/login).

The front interface will appear login as shown in Fig 3.16, and when registering the email data is  [\(security@uobabylon.edu.iq\)](mailto:security@uobabylon.edu.iq) and the password [\(admin\)](#), it will move to the welcome interface that contains the logos of the Ministry of Education and the Ministry of Interior and a picture of the implemented system in practice. is shown in Fig 3.17.

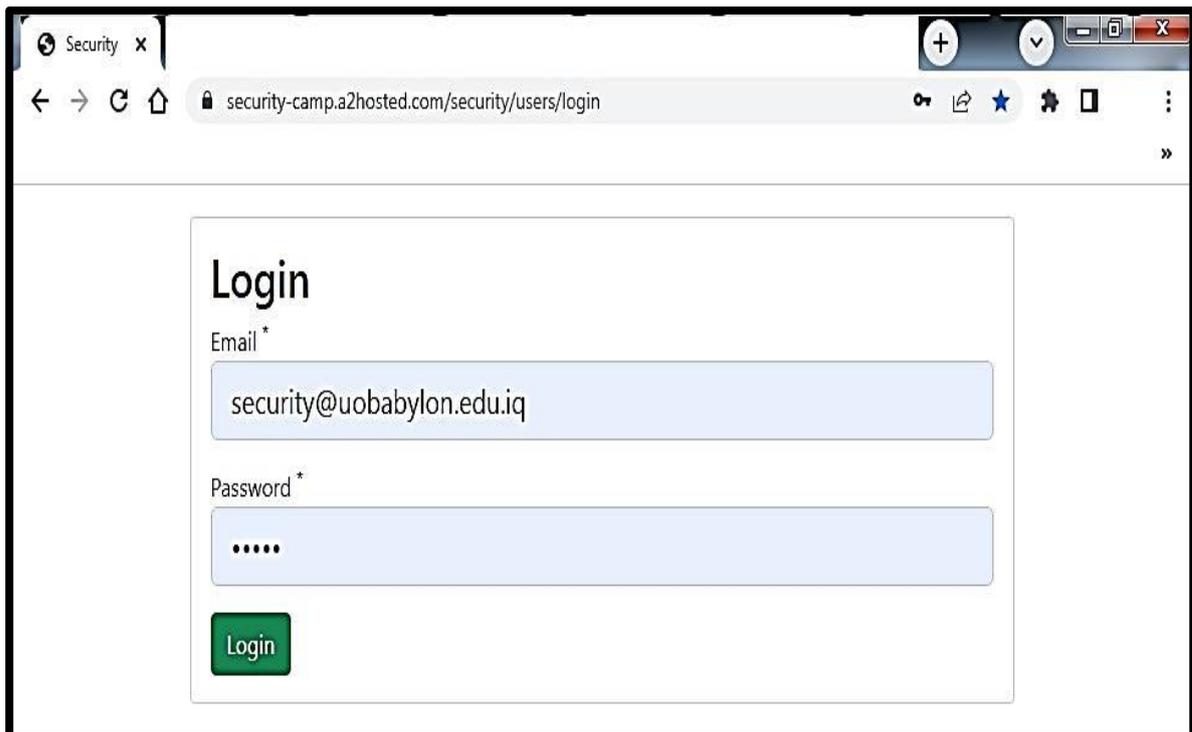


Fig 3.16 Login of online server

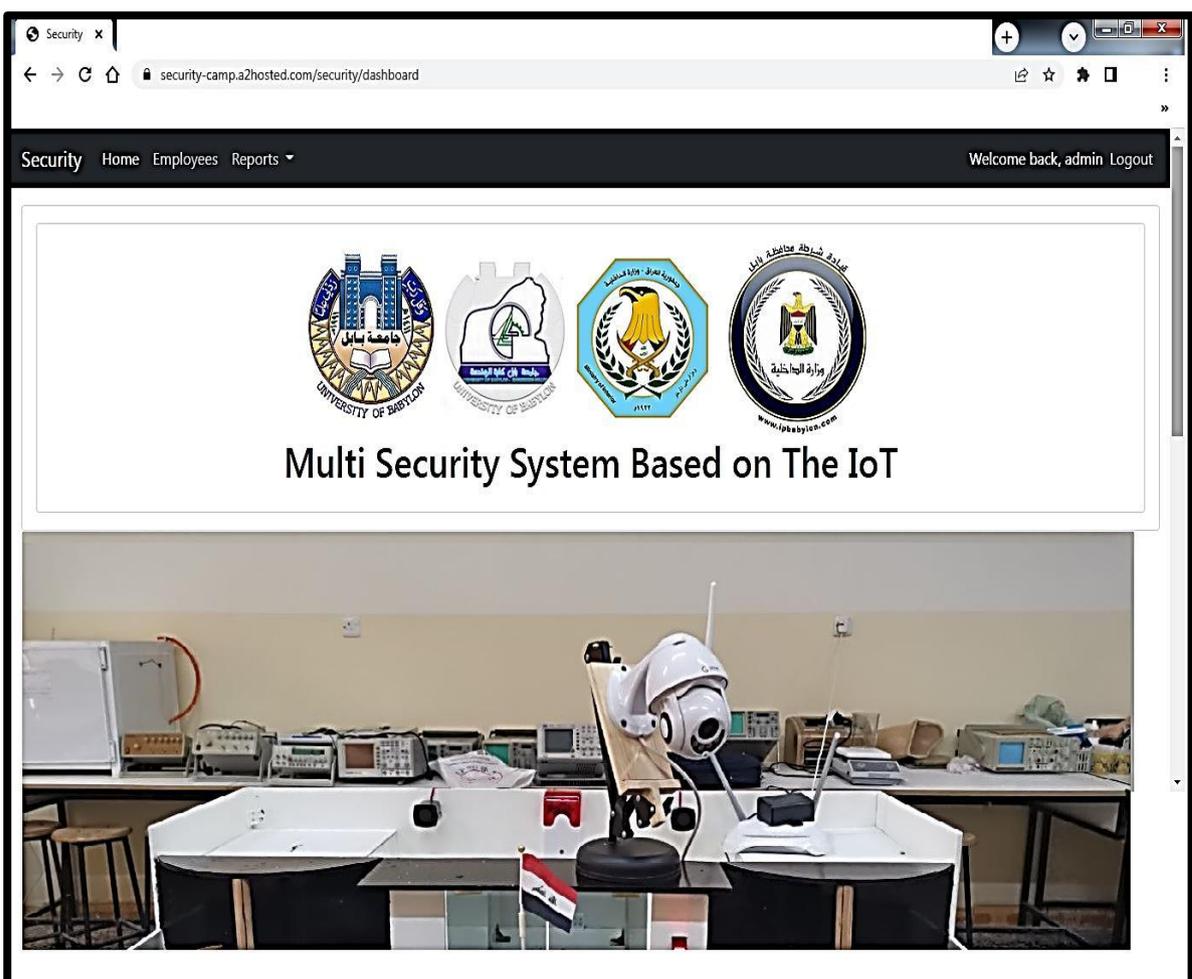


Fig 3.17 Home of online server

After entering the employee window, the interface is similar to what is in the local server. It was designed using PHP language, which is a shorthand for (Personal Home Pages) whose job is to generate dynamic web pages, which are those pages that are created or modified from the server before sending them to the client. The embedding of the online database the details indicated as shown in Fig 3.18

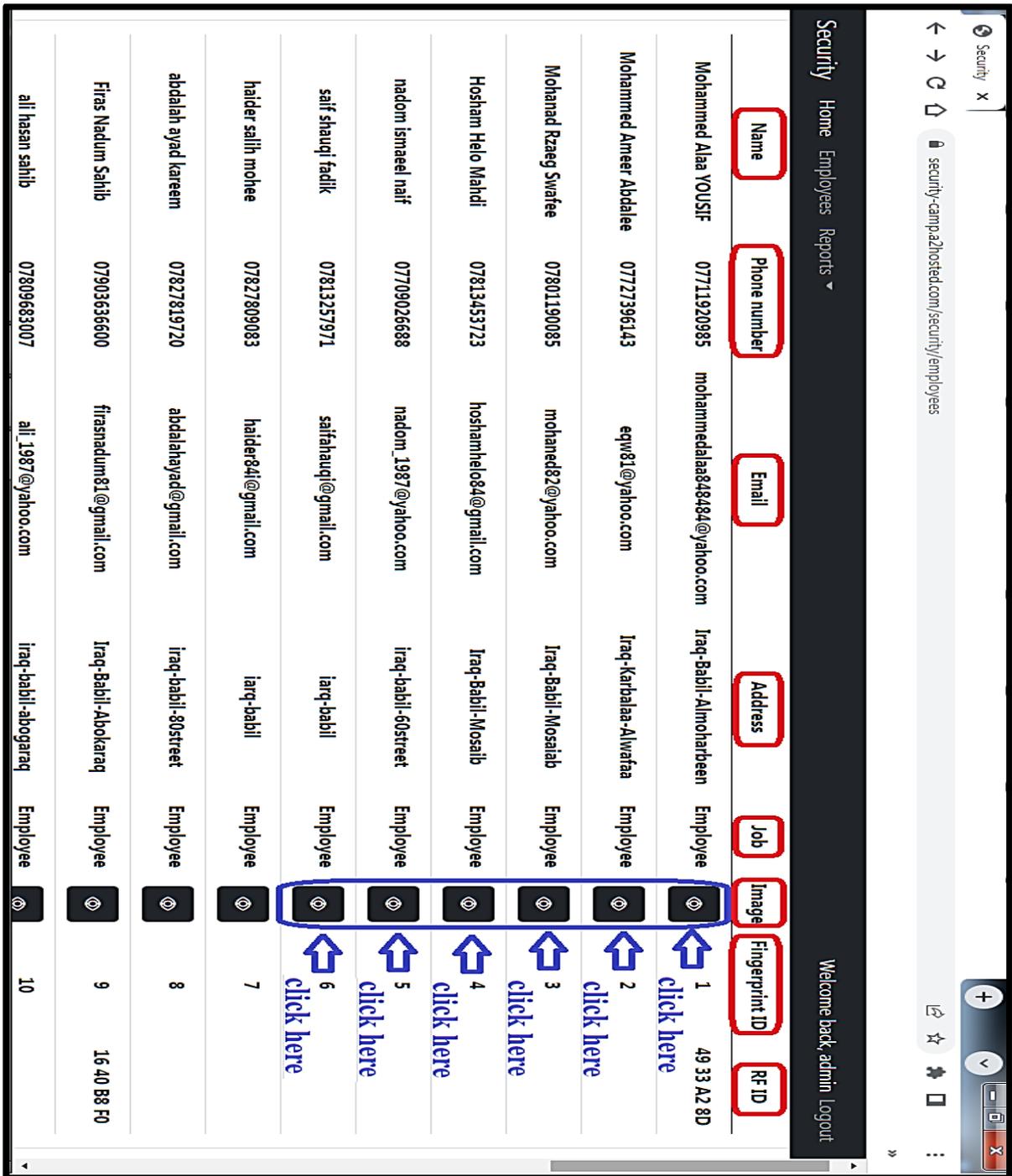


Fig 3.18 Database online

Fig 3.19 shows the photos of people that were displayed on the internet that are saved within the database for them, where each photo contains the date on which the employee's data was saved automatically via a Wi-Fi camera.



Fig 3.19 Images of people in the database online

### 3.5 Features of the System

The proposed system contains the following features:

- 1- A multi-security system reduces human efforts.
- 2- A multi-security system uses real-time.
- 3- The system enables the display of a graphical interface for the supervising person in all cases.
- 4 - The system enables higher authorities to follow up on institutions remotely and take appropriate decisions on this.
- 5- The system runs on a medium processor computer. Does not require giant processors to work.
- 6- The system enables the supervisor to warn in the event of any danger or breach through automatic alarms.
- 7- The low cost of implementing the system with all sensors and other auxiliary devices and processing units is approximately \$1350.
- 8- The implemented system is a comprehensive security system from the perimeter of the security institution to its interior.
- 9- The system is smooth and `flexible in operation and shows the results.
- 10- The reliability of the system in giving the true results in time and date.

## Chapter Four

### Results and Discussion

#### 4.1 Introduction:

All the obtained results confirm the system's work in an integrated and accurate manner with all the devices used in the design and implementation of the system in a practical way. Two parts will be discussed, the first part will discuss the method of operating the system and displaying the results of the local server before connecting it to the cloud, and the second part will discuss the final results that are recorded by the system after connecting it to the cloud, for the three parts that have been implemented and mentioned in the third chapter. In this chapter, the results recorded in the graphic interface will be explained after processing and uploading directly to the cloud. And the way to display them To the client (the supervisor or whoever is higher in authority than him).

The percentage of errors in the results and their causes will also be discussed when reading the reports on the cloud graphic interface. A cloud graphical interface is a graphical interface designed by the software used. The graphical user interface can be organized and made easier to use by adding text boxes, buttons, picture boxes, and other tools that facilitate the process of entering, exiting, and using correctly so that the person who uses it can know the result and take all suitable actions.

#### 4.2 Local Server Preliminary Results Before Cloud Connection:

This part, explained how the local server operates in the three parts and the preliminary results displayed in them before starting to activate the cloud as follows :

When start running the local server application for automatic entry of cars, the graphic interface of the local server will appear as shown in Fig 4.1. It shows the connection of the cable that connects the system to the COM3 of the

computer for the direct. The Wi-Fi camera is also connected through its IP 192.168.43.131, where All processed readings of the ID Tags appear in the processing interface surrounded by blue, while the images appear in the image display part surrounded by red.

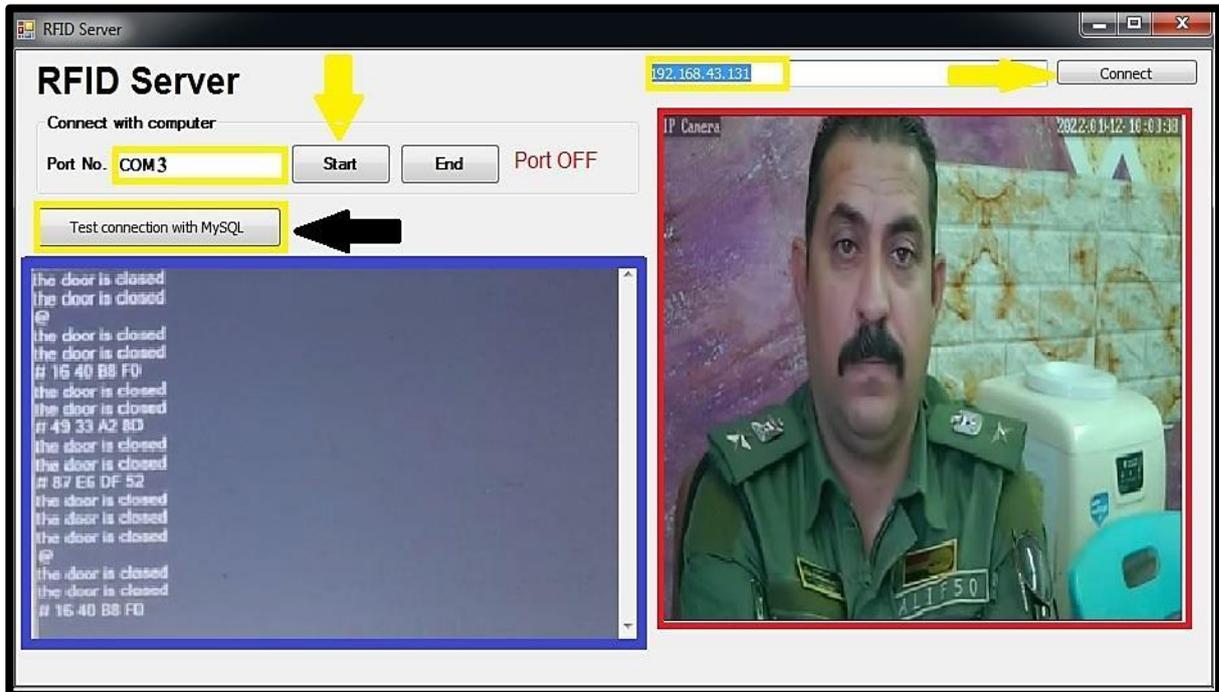


Fig 4.1 Local RFID server application operated

The processed data is loaded into the XAMPP program and within the PHPMyAdmin interface, the data is processed for the local server from the known or unknown card details with the image of its holder. The admin can compare the ID Tags and currently captured images and store them with the database on the local server. Through the ID Tags code, the holder's data is inferred, in addition to the image captured during reading from the RFID sensor. The preliminary results can be shown in appendix (A.1), and (A.2).

When start running the local server application for automatic entry of authorized persons, the graphic interface of the local server appears as shown in Fig 4.2, which shows the connection of the cable that connects the system to the COM8 of the computer. The Wi-Fi camera is also connected through its IP 192.168.5.102, where All processed readings of the fingerprints appear in the processing interface surrounded by blue, while the image appears in the image

display part surrounded by red. The preliminary results of connecting the local server can be shown in appendix (A.3), (A.4).

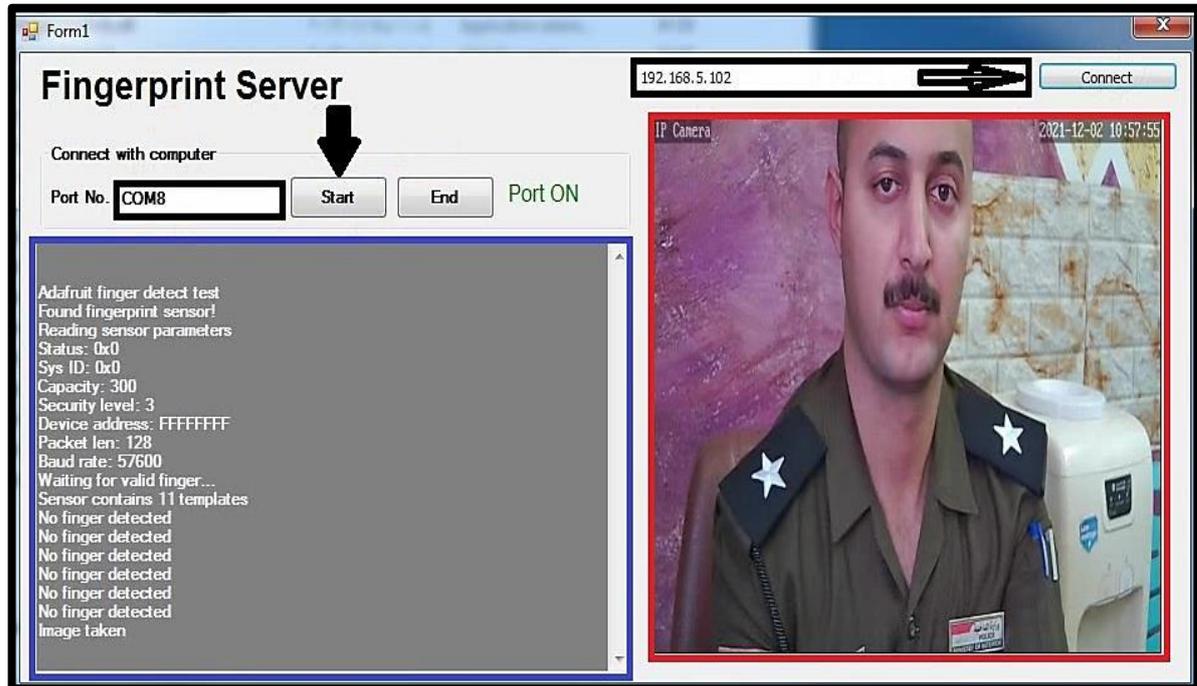


Fig 4.2 Local Fingerprint server application operated

When start running the local server application for the fire protection system for people and automatic lighting control, the graphic interface of the local server appears as shown in Fig 4.3, which shows the connection of the cable that connects the system to the COM5 of the computer for the direct. As there is no role for the Wi-Fi camera in this part, and there is no stored database representing this part, so the work of the local server application is limited to displaying the processors and transferring them directly to the cloud. The local server application window for this part indicates two observations when pressing the test connection with MySQL prompt, they are that the Online Connection Opened Successfully, and the Local Connection Opened Successfully.

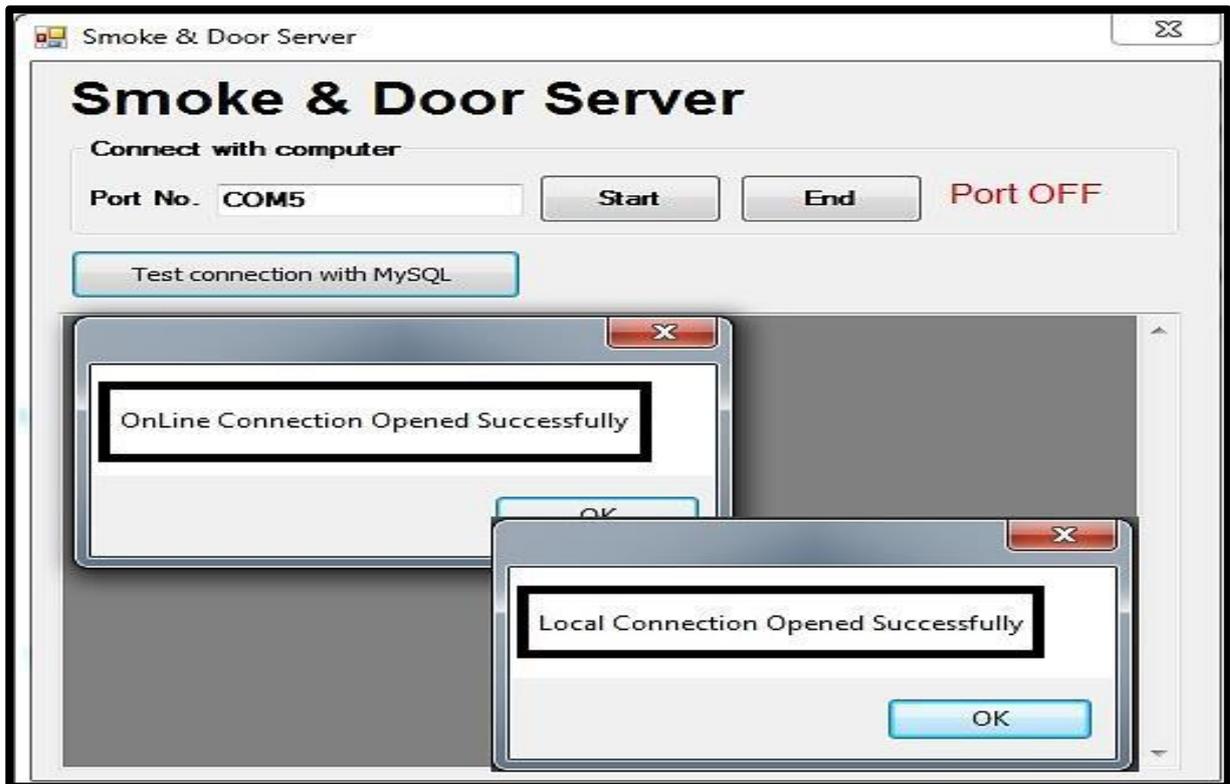


Fig 4.3 Local server application for the fire protection system for people and automatic lighting control

### 4.3 Display Final Cloud Results:

The supervisor's room or whoever is higher in authority than him contains a computer to display all the information recorded from the security organization's system. It also contains an internet network to update all directives from the system in real-time and archive them in the form of reports. The security software consists of the main graphical user interface.

It is the main interface through which all personal information of all employees working in the security organization and all system operations related to them are displayed, which is sent from the website of the organization's website to the cloud. Therefore, this technology is of great importance because it enables competent decision-makers to easily follow the status of the institution and its employees. There are two main parts of the main GUI, the first is to display the daily actions of the employees that are confirmed by sensors, and the second is to display the personal information of the employees.

The main graphic user interface displays the Ministry's logos with a picture of the implemented system in practice, which is referred to in Fig 3.17 Home of online server. When you click on the report option as indicated in Fig 4.4, three options are displayed, each one related to a part of the designed system parts, namely, the fingerprint report, the RFID report, and the smoke & door report.

When choosing the fingerprint report, it shows us all the reports of fingerprints that are scanned will send from the system and stored on the cloud for auditing and as shown in Fig 4.5. Reports indicate that the total number of fingerprints scanned on March 29 is 20 between known and unknown, and the total number of fingerprints scanned on March 30 is 10 between known and unknown. And the total number of fingerprints scanned on April 12 is 4, between known and unknown. And the total number of fingerprints scanned on April 13 is 6, between known and unknown.

When a check of the images taken with each of the fingerprints, it becomes clear to us that on March 29 at 10:37:49 the status was given to the employee (**Khalid Abdmohammed Kadam**) as being unknown in the system. The reason for this is the use of a fingerprint different from the fingerprint saved in the system previously.



Fig 4.4 Report options

Employee Name	Datetime	Type	Image
ahmed hamza shaheed	Tuesday, 29 March 2022 09:30:37	known	
Saif Saad Ibraheem	Tuesday, 29 March 2022 09:49:28	known	
ali hasan sahib	Tuesday, 29 March 2022 09:54:32	known	
	Tuesday, 29 March 2022 09:57:14	unknown	
ahmed fahim sahib	Tuesday, 29 March 2022 09:58:06	known	
	Tuesday, 29 March 2022 10:19:09	unknown	
	Tuesday, 29 March 2022 10:22:23	unknown	
nadom ismaeel naif	Tuesday, 29 March 2022 10:23:23	known	
nadom ismaeel naif	Tuesday, 29 March 2022 10:27:12	known	
Hosham Helo Mahdi	Tuesday, 29 March 2022 10:27:58	known	
Hosham Helo Mahdi	Tuesday, 29 March 2022 10:29:31	known	
Mohanad Rzaeg Swafee	Tuesday, 29 March 2022 10:30:45	known	
Mohanad Rzaeg Swafee	Tuesday, 29 March 2022 10:31:08	known	
khalid abdmohammed kadum	Tuesday, 29 March 2022 10:37:20	known	
khalid abdmohammed kadum	Tuesday, 29 March 2022 10:37:38	known	
	Tuesday, 29 March 2022 10:37:49	unknown	
adnan kahtan farhan	Tuesday, 29 March 2022 10:38:55	known	
adnan kahtan farhan	Tuesday, 29 March 2022 10:39:42	known	
	Tuesday, 29 March 2022 10:40:49	unknown	
	Tuesday, 29 March 2022 10:41:38	unknown	
	Wednesday, 30 March 2022 11:10:27	unknown	
	Wednesday, 30 March 2022 11:10:48	unknown	
ahmed jelab salem	Wednesday, 30 March 2022 11:14:04	known	
ahmed jelab salem	Wednesday, 30 March 2022 11:14:22	known	
furat ali chead	Wednesday, 30 March 2022 11:19:48	known	
furat ali chead	Wednesday, 30 March 2022 11:21:00	known	
Mohammed Ameer Abdalee	Wednesday, 30 March 2022 11:23:32	known	
Mohammed Ameer Abdalee	Wednesday, 30 March 2022 11:23:59	known	
walaa kadom saeed	Wednesday, 30 March 2022 11:27:44	known	
walaa kadom saeed	Wednesday, 30 March 2022 11:28:16	known	
	Tuesday, 12 April 2022 11:21:26	unknown	
	Tuesday, 12 April 2022 11:21:51	unknown	
	Tuesday, 12 April 2022 11:22:15	unknown	
Mohammed Alaa YOUSIF	Tuesday, 12 April 2022 11:23:04	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:37:43	known	
walaa kadom saeed	Wednesday, 13 April 2022 10:37:58	known	
	Wednesday, 13 April 2022 10:38:06	unknown	

Fig 4.5 Final fingerprint report

Table 4.1 shows the final results of scanning the fingerprints of the automatic entry system for authorized persons for four days and at different times.

Table 4.1 The final results of scanning the fingerprints

Date	Day No.	Total Finger-Print Scanned	Known F-P	Unknown F-P	Error
03/29/2022	1	20	14	6	1
03/30/2022	2	10	8	2	0
04/12/2022	3	4	1	3	0
04/13/2022	4	6	4	2	0

Fig 4.6 also shows the flowchart of the achieved results of scanning fingerprints for the automatic entry system for authorized persons.

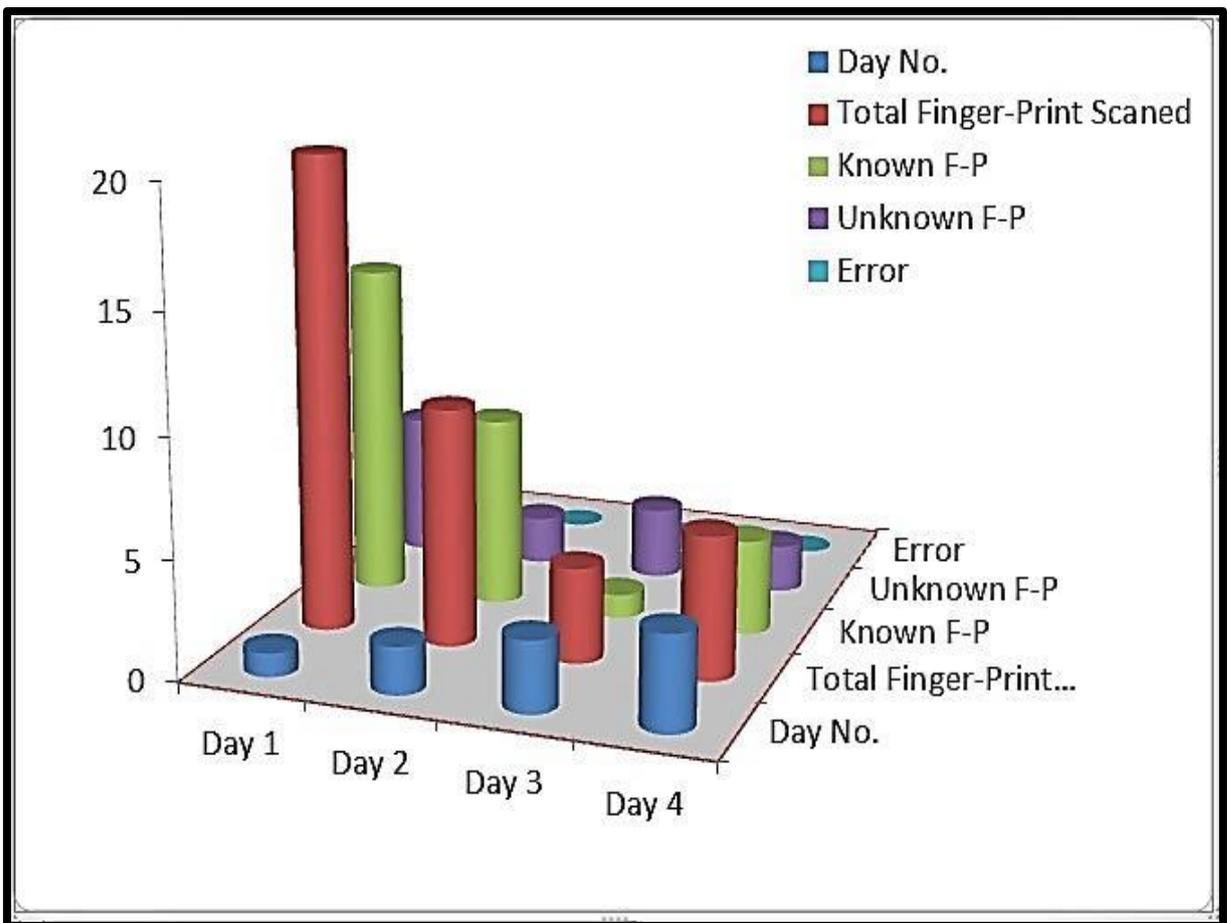


Fig 4.6 Flowchart of final fingerprint report

But when choosing RF Report, all reports for automatic cars entry appear as shown in Fig 4.7, where the reports show the days of tests for entering vehicles, which are on April 11, the one ID Tag reading is unknown, and on April 12, two ID Tag readings one of which is known and the other unknown. On April 13, the system recorded ten known and unknown ID tag readings.

Six of which are known and the other unknown. In addition, you can check the photos taken of the entry cases, the Wi-Fi camera begins to take pictures consecutively when the car approaches the entry area until it leaves it. After that the system closes the servomotor gate. Fig 4.8 shows the beginning of the process of taking pictures consecutively to enter the car until the servomotor gate is closed.

Table 4.2 shows the final results of reading the ID tags of the automatic entry system for authorized vehicles for three days and at different times.

Table 4.2 The final results of reading the ID tags

Date	Day No.	Total RFID Scaned Sencative	Known ID Card	Unknown ID Card	Error
04/11/2022	1	1	0	1	0
04/12/2022	2	2	1	1	0
04/13/2022	3	10	8	2	0

Fig 4.9 also shows the flowchart of the achieved results of reading the ID tags of the automatic entry system for authorized vehicles.

The screenshot shows a web browser window with the URL `security-camp.a2hosted.com/security/reports/rf`. The page title is "Security" and it includes a navigation menu with "Home", "Employees", and "Reports". A user is logged in as "admin". The main content is a table of RFID reports.

Employee Name	Datetime	Car Number	Car Type	Car Color	Type	Image
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:53:47	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:59:49	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:59:50	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:59:52	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:59:54	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 10:59:56	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:05	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:07	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:08	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:10	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:11	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:13	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:15	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:17	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:18	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:20	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:21	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:23	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:24	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:26	A123	NISSAN	RED	known	
Mohammed Alaa YOUSIF	Wednesday, 13 April 2022 11:06:28	A123	NISSAN	RED	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:03:08	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:03:10	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:03:11	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:03:14	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:04:31	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:04:34	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:04:37	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:04:40	B456	BMW	BREEN	known	
Firas Nadum Sahib	Wednesday, 13 April 2022 11:04:43	B456	BMW	BREEN	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:36:47	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:36:48	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:36:50	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:36:52	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:53:32	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:53:34	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:53:36	C147	KIA	BLUE	known	
aqeel karem farhod	Wednesday, 13 April 2022 10:53:37	C147	KIA	BLUE	known	
	Wednesday, 13 April 2022 10:37:10				unknown	
	Wednesday, 13 April 2022 10:54:00				unknown	
	Wednesday, 13 April 2022 11:03:35				unknown	
aqeel karem farhod	Tuesday, 12 April 2022 11:24:45	C147	KIA	BLUE	known	
	Tuesday, 12 April 2022 11:24:58				unknown	
	Monday, 11 April 2022 13:26:59				unknown	

Fig 4.7 Final RFID report

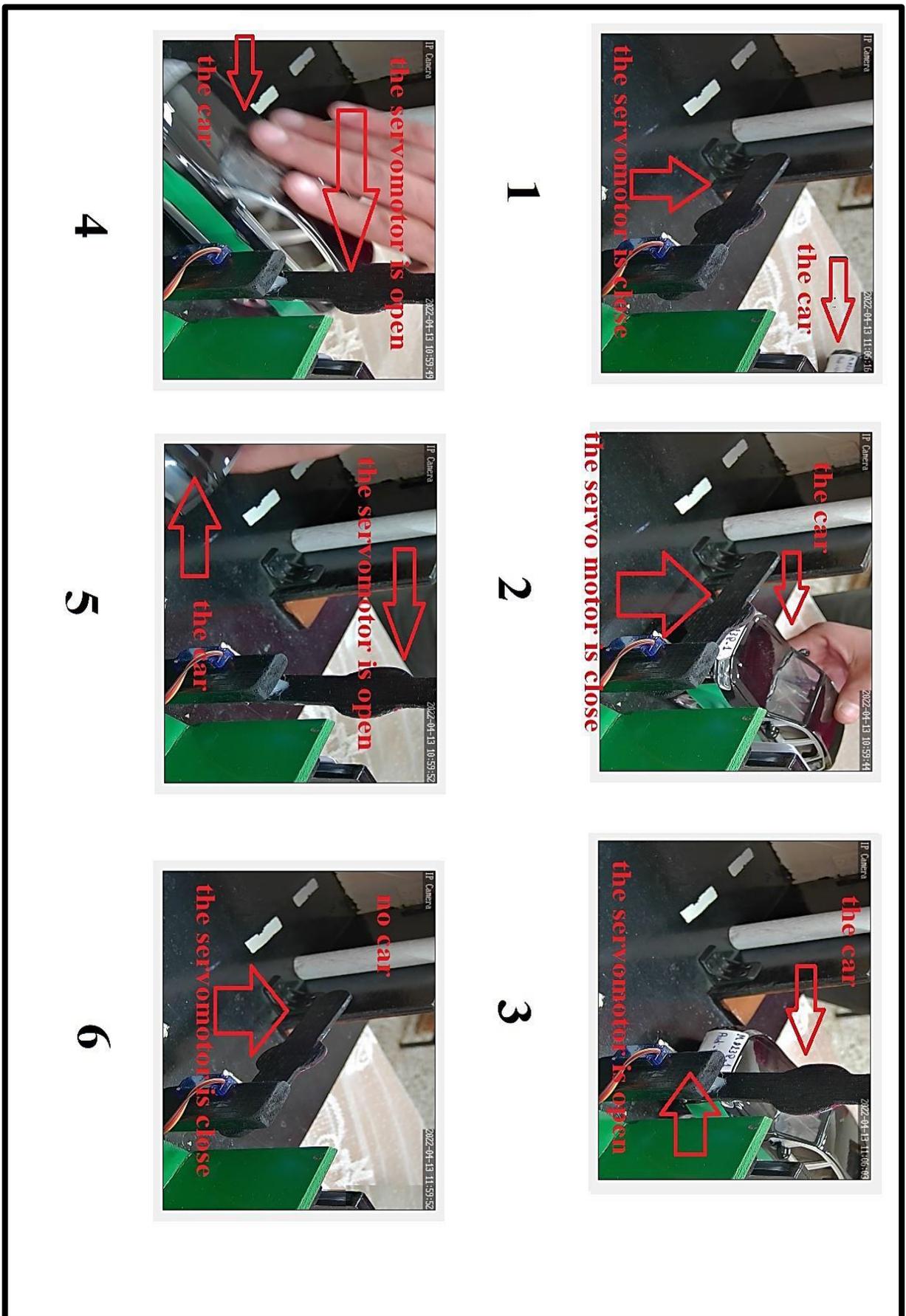


Fig 4.8 Stages of taking a sequence of photos for entering a vehicle

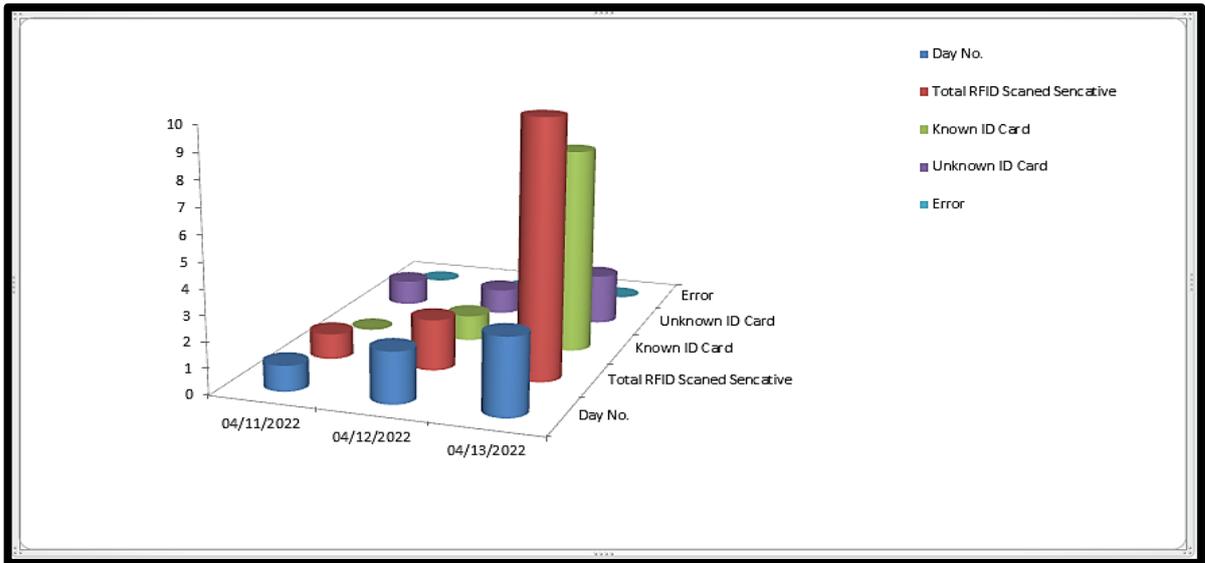


Fig 4.9 Flowchart of final RFID report

when choosing Smoke&Door Report, all reports for fire protection systems for people and automatic lighting control appear as shown in Fig 4.10, so that the report shows all the data sent from the system and stored on the cloud. The phrase “door closed” confirms that the lighting of the room is turned on in the presence of employees in it. If the lights are not turned on, the system does not raise any reports. As for the fire, it means that the smoke sensor is working and the presence of emissions of gases or smoke associated with the occurrence of a specific fire, where the fire alarm inside the establishment works to warn the supervisor of that.

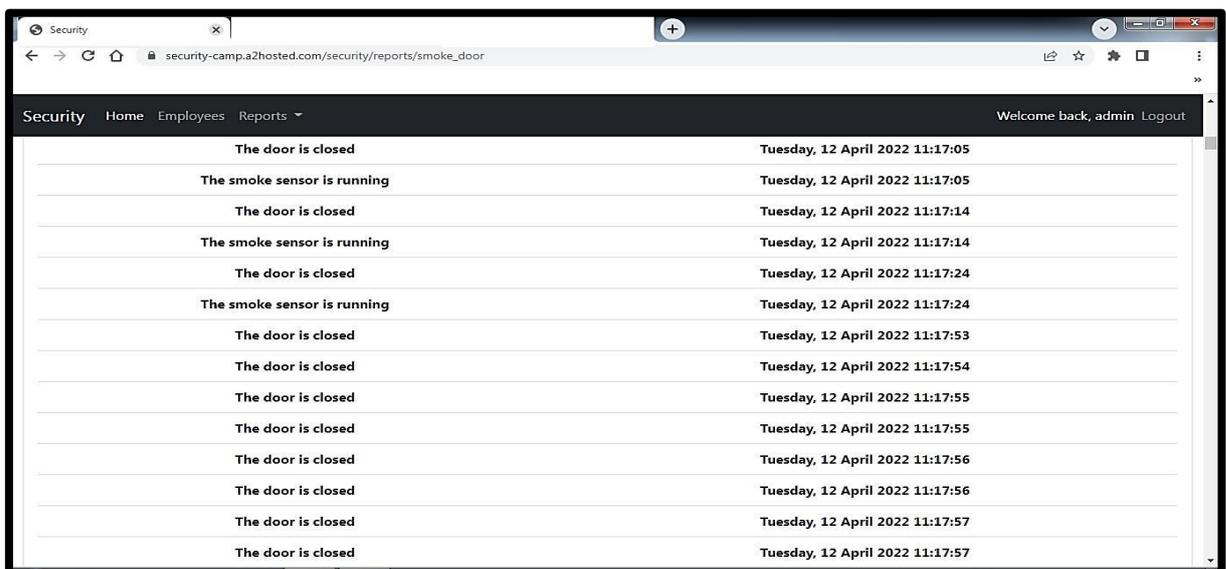


Fig 4.10 Final Smoke&Door report

#### 4.4 Discussion:

The discussion of the result is described as follows:

1. Real-time monitoring of the work of a security institution in another geographical location is very important.
2. Securing the security establishment and its employees is extremely important in order to ensure the privacy of the institution and its employees.
3. Hosting the security data of state institutions for the responsible person and his advisors facilitate discussion of the risks and overcoming them more quickly.
4. The main reason for using (PHP, Perl, CSS, HTML,C++, #C) programming languages is to simplify data entry and facilitate processing operations, whether on the site of the security institution inside the supervisor's room or in the place where reports are presented in front of the higher decision-making bodies.
5. Direct control of outposts and remote security points and follow-up of their work and the risks that they may encounter increases the security of the security establishment.
6. Table 4.3 shows the comparison between our proposed system and the systems in some the literature review. Several improvements related to security and the environment have been added.

Table 4.3 Comparison between proposed system and some related works

Ref	Input Device	delay	Controller Device	Accura cy	IoT & Cloud	Output Device
[22]	IR, PIR Sensors	Very Slow 30 Sec	ESpresso Lite V2.0 control unit	LOW	IoT & Cloud	Mobil via Wi-Fi Home security
[27]	Temp sensors Energy meter	Slow 5 Sec	Raspberry Pi 4 microcontroller ESP 8266 Wi-Fi module	Medium	IoT only	Mobil via Wi-Fi Home security Remote control of all electrical units
[PROPOSED WORK]	Biometric Fingerprint, IR, Smoke, RFID, Sensors	Fast Real-Time	Arduino Uno R3 UNO R3+ Wi-Fi microprocessor unit	High	IoT & Cloud	mobile phone, Web site via Wi-Fi electric lock Servo-Motor Wi-Fi cam

## Chapter Five

### Conclusions and Future Works

#### 5.1 Conclusions:

Through the results recorded by the practically implemented system, the conclusions can be summarized as follows:

- ❖ The practically implemented system is extremely useful because it progressively reduces the use of human resources and naturally increases the efficient operation of advanced technical resources at the most appropriate prices and adequately provides a better peaceful, simpler, and more protected environment for human society.
- ❖ The practically implemented system provides active users and those in effective charge of the automated system with direct access to accurate data and reports through the use of a mobile phone, tablet, or personal computer from anywhere typically utilizing the Internet via 4G, 5G networks, or Wi-Fi, so it will correctly be an environment high-quality easy to reliably use in the cloud.
- ❖ Ease of use of the practically implemented system with sufficient flexibility to communicate between devices and sensors with low power consumption and low rates of storage memory consumption increases the reliability of the system used, and ease of developing the practically implemented system by adding devices and sensors and programming them in a way that suits the function for which it was designed, making it a high-quality and accurate development environment.
- ❖ The network speed of your Internet connection is an important factor in transferring reports and data between the local server and the cloud for this system.
- ❖ The use of the system data graphical user interface makes the system highly efficient for display the results and information exchange.

### 5.2 Future Works:

During the review of the previous works and from the results obtained, some future works can be suggested as follows:

- ❖ Using encryptions and decryption techniques for developing the security of the proposed system. While uploading images from the local server to the online server
- ❖ Using FPGA instead of MCU to increase the sensing speed and processing of the signal.
- ❖ Corneal sensors, and voice or face recognition technology is another development of security technologies. It will be used as an additional reliable means to increase the security of entering cars in the event of losing the identification card, or as an alternative method when the entry using the fingerprint fails.
- ❖ Using high-level programming languages such as (Python) that support the concept of object-oriented programming, designing software that takes advantage of all the advantages of the Internet, and creating programs with a high-level Graphical User Interface (GUI).
- ❖ Connecting the energy control system to all power outlet switches and air conditioning devices in the security establishment.

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A.2. Check the Preliminary results of RFID sensor with data-bass :

Fig A.2 is shows check the preliminary results of RFID sensor with data-bass

id	name	phone_number	email	address	job	image	fp id	rf id	created by	car no	car type	car color
1	Mohammed Aha YOUSUF	07711920985	mohammedaha848484@yahoo.com	Iraq-Babil- Almohtarbeen	Employee	tempEmp1641970433.bmp	1	49 33 A2 8D	0	A123	NISSAN	RED
2	Mohammed Ameer Abdalae	07727396143	eqw61@yahoo.com	Iraq- Karbala- Alwafsa	Employee	tempEmp1641970734.bmp	2		0			
3	Mohamad Rzaeg Swalee	07801190085	mohamed82@yahoo.com	Iraq-Babil- Mosaiab	Employee	tempEmp1641971382.bmp	3		0			
4	Hosham Helo Mandi	07813453723	hoshamhe084@gmail.com	Iraq-Babil- Mosab	Employee	tempEmp1641971682.bmp	4		0			
5	nadom ismaeel naif	07709026688	nadom_1987@yahoo.com	Iraq-babil- 60street	Employee	tempEmp1642670934.bmp	5		0			
6	saif shraqui fadik	07813257971	saifshraqui@gmail.com	Iraq-babil-	Employee	tempEmp1642534469.bmp	6		0			
7	haider saih mohae	07827809083	haider64@gmail.com	Iraq-babil-	Employee	tempEmp1642534684.bmp	7		0			
8	abdalah ayad karaem	078278191720	abdalahayad@gmail.com	Iraq-babil- 80street	Employee	tempEmp1642535796.bmp	8		0			
9	Firas Nadum Sahib	07903636600	frasnadum61@gmail.com	Iraq-Babil- Abokaraq	Employee	tempEmp1641971991.bmp	9	16 40 B8 F0	0	B456	BMW	BREEN
10	ali hasan sahib	07809683007	ali_1987@yahoo.com	Iraq-babil- abogaraq	Employee	tempEmp1642668055.bmp	10		0			
11	Saif Saad husham	07831016890	ss1542439@gmail.com	Iraq-Babil- Alshaminias	Employee	tempEmp1641972152.bmp	11		0			
26	adnan kathan farhan	07813004891	adnanfarhan@gmail.com	Iraq-babil- alwardiaa	Employee	tempEmp1642673430.bmp	26		0			
27	ahmed fahim sahib	07801373548	ahmed_fahim1984@yahoo.com	Iraq-babil- 60street	Employee	tempEmp1642673839.bmp	27		0			
28	furat ali chead	0782526291	furat1975@yahoo.com	Iraq-babil- hayalaskan	Employee	tempEmp1643110407.bmp	28	87 E6 DF 52	0	D963	AUDI	BLACK
29	saif adil fakher	07816852534	saif1989@yahoo.com	Iraq-babil-hay' alaskan	Employee	tempEmp1643109761.bmp	29		0			
30	maged neema shimna	07801515417	maged1972@yahoo.com	Iraq-babil- hayalameer	Employee	tempEmp1643110827.bmp	30		0			

Fig A.2 Check the Preliminary results of RFID sensor with data-bass

### A.3. Preliminary Results of Local Fingerprint Server:

Fig A.3 is shows preliminary results of local fingerprint server

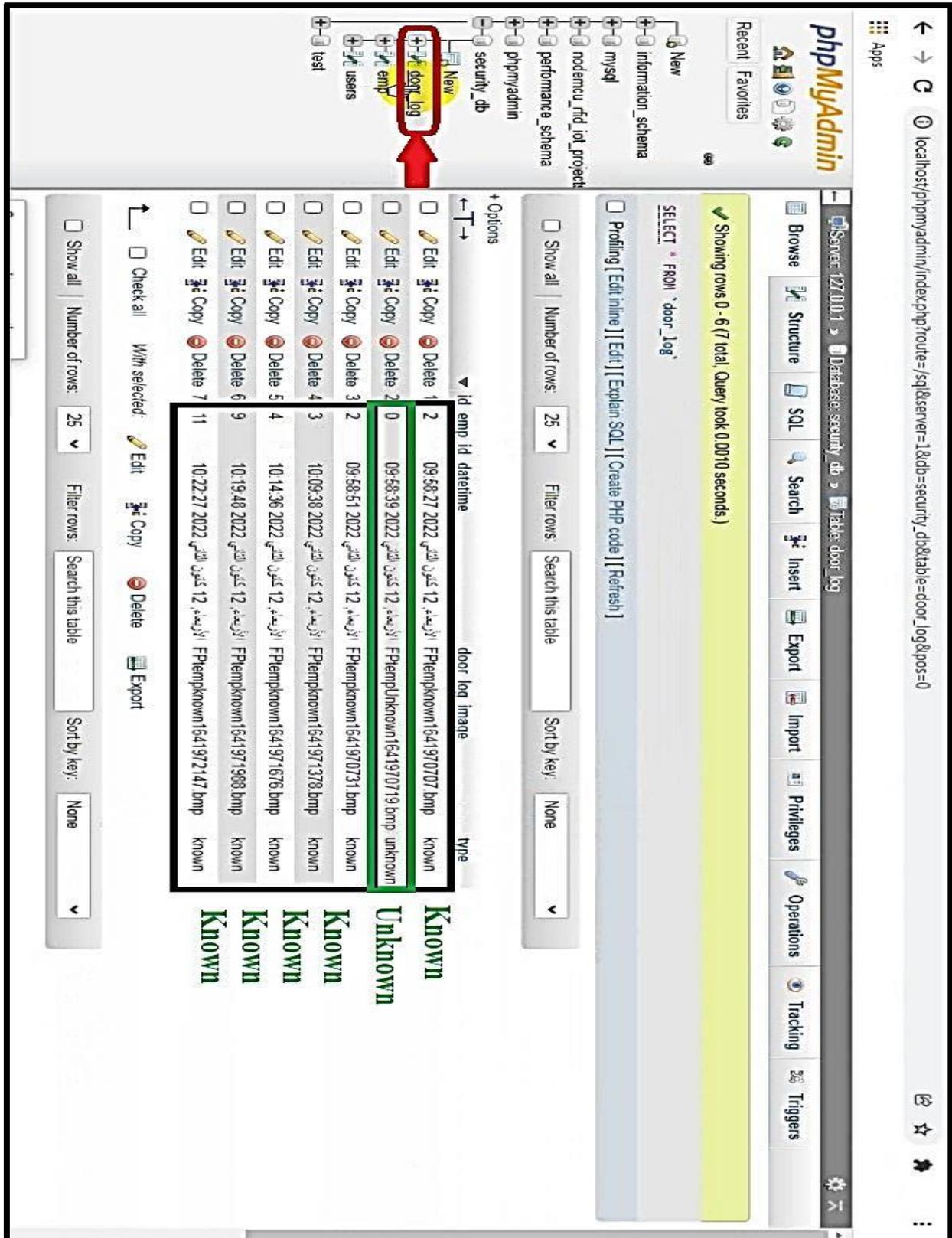


Fig A.3 Preliminary Results of Local Fingerprint Server

A.4. Check the Preliminary Results of Fingerprint Sensor with Databases:

Fig A.4 is shows check the preliminary results of fingerprint sensor with databases

id	name	phone_number	email	address	job	image	fp_id	rf_id	created_by	cat_no	car_type	car_color
1	Mohammed Aaaa YOUSSEF	07711920985	mohammedaaa8484@yahoo.com	Iraq-Babil Almohteben	Employee tempEmp	1641970433.bmp	1	A2 8D	0	A123	NISSAN	RED
2	Mohammed Ameer Abdalee	07727396443	eqw81@yahoo.com	Iraq- Karbala- Alwafaa	Employee tempEmp	1641970734.bmp	2		0			
3	Mohamad Rzaeq Swalee	07801190086	mohamed82@yahoo.com	Iraq-Babil Mosaib	Employee tempEmp	1641971382.bmp	3		0			
4	Hosham Helo Mahdi	07813453723	hoshamhelo84@gmail.com	Iraq-Babil Mosaib	Employee tempEmp	1641971682.bmp	4		0			
5	namon ismaeel naif	07709026888	namon_1991@yahoo.com	Iraq-babil 60street	Employee tempEmp	1642670934.bmp	5		0			
6	saif shauqi fadk	07813257971	saifahauqi@gmail.com	Iraq-babil	Employee tempEmp	1642534469.bmp	6		0			
7	haider saih mohbe	07827809083	haider84@gmail.com	Iraq-babil	Employee tempEmp	1642534684.bmp	7		0			
8	abdalah ayad kareem	07827819720	abdalahayad@gmail.com	Iraq-babil 80street	Employee tempEmp	1642535796.bmp	8		0			
9	Firas Nadum Saib	07903636600	frasnadum81@gmail.com	Iraq-Babil Abokaraq	Employee tempEmp	1641971991.bmp	9	16 40 B8 F0	0	B456	BMW	BREEN
10	ali hasan sahb	07809683007	ali_1987@yahoo.com	Iraq-babil abogaraq	Employee tempEmp	1642688085.bmp	10		0			
11	Saif Saad Ibrahim	07831016890	ss1542439@gmail.com	Iraq-Babil Alhashimaa	Employee tempEmp	164197162.bmp	11		0			
12	sinan saad aubais	07809888374	sinansaad@gmail.com	Iraq-babil wardagang	Employee tempEmp	1642688772.bmp	12		0			

Fig A.4 is shows Check the Preliminary Results of Fingerprint Sensor with Databases



جمهورية العراق

وزارة التعليم العالي والبحث العلمي

جامعة بابل

كلية الهندسة / قسم الهندسة الكهربائية

# تصميم وتنفيذ نظام امن وحماية بالاعتماد على الحوسبة السحابية

رسالة

مقدمة الى قسم الهندسة الكهربائية - كلية الهندسة - جامعة بابل  
كجزء من متطلبات نيل درجة الماجستير في الهندسة / الهندسة الكهربائية /  
اتصالات

من قبل

محمد علاء يوسف علي الحسيني

اشراف

الاستاذ الدكتور

إيهاب عبد الرزاق حسين الحيالي

## الخلاصة

من الجيد أن يصبح العالم سحابة معلومات تتيح لتقنيات المعلومات والبرمجيات مساحة واسعة لتسهيل متطلبات الحياة البشرية من حيث الأمن. يشمل النظام الدخول التلقائي للأشخاص ، ونظام الدخول التلقائي للمركبات ، ونظام إنذار الحريق ، ونظام التحكم في الطاقة. من خلال هذا العمل ، تم تصميم وتنفيذ نظام أمان منخفض التكلفة وسهل الاستخدام لاستشعار عمليات الدخول الآلية للأشخاص من خلال مستشعر بصمات الأصابع البيومترية ، وعمليات الدخول الآلية للمركبة من خلال مستشعرات تحديد الترددات الراديوية والأشعة تحت الحمراء (RFID و IR). ويتم التحكم في الطاقة الآلية من خلال مستشعر الأشعة تحت الحمراء (IR) ونظام إنذار الحريق لحماية الناس من خطر الغاز الناتج عن الحريق من خلال مستشعر الدخان. يتم عرض هذه البيانات في الوقت الحقيقي من خلال واجهة المستخدم الرسومية المميزة (GUI) أمام المشرف وكذلك أمام اعين الأشخاص المخولين لاتخاذ قرارات حاسمة فيما يتعلق بالمؤسسة. يتم نقل هذه التقارير من خلال استخدام الاتصال عبر الإنترنت. ويتم تقديمها للجهات العليا المختصة من خلال تصميم واجهة أمامية للدخول إلى النظام وواجهة خلفية لعرض التقارير ، ويمكن إجراء هذه العمليات باستخدام الصفحة الرئيسية الخاصة بالنظام. تم تصميم تطبيق الانترنت باستخدام اللغات (PHP ، CSS ، HTML) وتخصيص مساحة استضافة على موقع (A2 Hosting) سمي الموقع بهذا الاسم نسبة الى المدينة (Ann Arbor) التي تم تأسيس الشركة فيها في ولاية ميتشجان بالولايات المتحدة الأمريكية. وتم تصميم (End User Application) الذي يمثل الخادم المحلي ذو الواجهة الرسومية (GUI) لعرض البيانات باستخدام لغات (PHP و C-Sharp) واستخدام برنامج (XAMP)، حيث يجعل هذا البرنامج عملية إدخال البيانات وعرضها ومعالجتها أسهل على المشرف. تم اختبار النظام في حالات متعددة وعلى أشخاص مختلفين وبطاقات تعريف مختلفة ، وأثبتت فعاليته بشكل ملحوظ. كما تم اختبار أجهزة الإنذار وإثبتت فعاليتها أثناء وقوع الخطر ، سواء في حالة محاولة الدخول غير المصرح به أو في حالة انبعاث غاز أو دخان نتيجة حريق ما.