Fingerprint Based Attendance System using IoT

B.E. Dissertation

Submitted in partial fulfillment of the requirement of

University of Mumbai

For the Degree of

Bachelor of Engineering
(Electronics and Telecommunication Engineering)

by

Arfin Sayyed (13ET07)
Humera Khan (13ET04)
Khubaib Khan (14DET83)
Shumaila Ansari (13ET01)

Under the guidance of

Asst. Prof. Awab Fakih

Electronics and Telecomunication Engineering
Anjuman-I-Islam's Kalsekar Technical Campus,
Sector 16, New Panvel , Navi Mumbai
(Affiliated to University of Mumbai)
2016-2017

Anjuman-I-Islam's

Kalsekar Technical Campus

(Affiliated to the University of Mumbai)

Plot 2 and 3,Sector 16, Khandagaon, Near Thana Naka, New Panvel, Navi Mumbai 410206.

Certificate

This is to certify that, the dissertation titled

"Fingerprint Based Attendance System using IoT "

is a bonafide work done by

Arfin Sayyed (13ET07)
Humera Khan (13ET04)
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and is submitted in the partial fulfillment of the requirement for the degree of

Bachelor of Engineering
in
Electronics and Telecomunication Engineering
to the
University of Mumbai.

Guide	Project Coordinator
Head of Department	Principal

Certificate of Approval by Examiners

This is to certify that the dissertation entitled "**Fingerprint Based Attendance System using IoT**" is a bonafide work done by **Arfin Sayyed, Humera Khan, Khubaib Khan, Shumaila Ansari** under the guidance of **Asst. Prof. Awab Fakih**.

This dissertation has been approved for the award of **Bachelor's Degree in Electronics and Telecommunication Engineering**, University of Mumbai.

Examiners :

Signature

Signature

Acknowledgment

We are highly grateful to the **Asst. Prof. Mujib Tamboli**, H.O.D of Electronics and Telecommunication Department, Anjuman-I-Islams Kalsekar Technical Campus, New Panvel for providing this opportunity to carry out the project. We would like to express our gratitude to other faculty members of Electronics and Telecommunication Engineering Department for providing academic inputs, guidance and encouragement throughout this period.

We would like to express our deep sense of gratitude and thank to our project guide **Asst. Prof. Awab Fakih** , for the wise council and able guidance, it would have not been possible to carry out our project in this manner.

Finally, we express our indebtedness to all who have directly or indirectly contributed to the successful completion of our project.

Abstract

The human body has the privilege of having features that are unique and exclusive to each individual. This exclusivity* and unique characteristic has led to the field of biometrics and its application in ensuring security in various fields with various embedded controllers and embedded computers. Biometrics have gained popularity and has proved itself to be a reliable mode of ensuring privacy, maintaining security and identifying individuals. Biometrics is the study of identifying a person by their physical traits that are inherent and unique to only the person concerned. Biometric identification include fingerprint verification, palm geometry, face recognition, iris recognition, etc. Accuracy and reliability are the two most important parameters when it comes to biometric applications and that too with advanced embedded computers. Fingerprint verification is one of the oldest known biometric techniques known but still is the most widely used because of its simplicity and good levels of accuracy.

Thus, this project aims to reduce the hectic manual work by making an automated attendance management system in which the live transfer of data will take place through the internet - **INTERNET OF THINGS**.

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Introduction

1.1 Internet of Things

Figure 1.1: Overview of IoT

The Internet of things (stylised Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as ”connected devices” and ”smart devices”), buildings and other itemsembedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as ”the infrastructure of the information society.” The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure,[creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit., which also encompasses technologies such as smart grids, smart homes, intelligence transportation and smart cities. Each thing is uniquely identifiable through its embedded computing

system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to areas such as smart cities.

"Things," in the IoT sense, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist fire fighters in search and rescue operations. Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include home automation (also known as smart home devices) such as the control and automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens or refrigerators/freezers that use Wi-Fi for remote monitoring.

1.2 History

As of 2016, the vision of the Internet of things has evolved due to a convergence of multiple technologies, including ubiquitous wireless communication, real-time analytics, machine learning, commodity sensors, and embedded systems. This means that the traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things (IoT).

The concept of a network of smart devices was discussed as early as 1982, with a modified Coke machine at Carnegie Mellon University becoming the first Internet-connected appliance, able to report its inventory and whether newly loaded drinks were cold. Mark Weiser's seminal 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as U bi Comp and Per Com produced the contemporary vision of IoT. In 1994 Reza Raji described the concept in IEEE Spectrum as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories" Between 1993 and 1996 several companies proposed solutions like Microsoft's at Work or Novell's NEST. However, only in 1999 did the field start gathering momentum. Bill Joy envisioned Device to Device (D2D) communication as part of his "Six Webs" framework, presented at the World Economic Forum at Davos in 1999.

The term "Internet of things" was coined by Peter T. Lewis in a 1985 speech given at a U.S. Federal Communications Commission (FCC) supported wireless session at the Congressional Black Caucus 15th Legislative Weekend Conference. In his speech he states that "The Internet of Things, or IoT, is the integration of people, processes and technology with connectable devices and sensors to enable remote monitoring, status, manipulation and evaluation of trends of such devices."

The concept of the Internet of things became popular in 1999, through the Auto-ID Centre atMIT and related market-analysis publications. Radio-frequency identification (RFID) was seen by Kevin Ashton (one of the founders of the original Auto-ID Centre) as a prerequisite for the Internet of things at that point. Ashton prefers the phrase "Internet for Things." If all objects and people in daily life were equipped with identifiers, computers could manage and inventory them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

1.3 Best Example of IoT

It was a very nerve racking experience. Youre literally driving under the earth. The smell is the smell of sulphur, the smell of dirt. Now they go down there and they blasting and digging, its a very difFicult job, its very dangerous, its hard work, its hard labour and the mountain doesnt give everything you want it to give

DUNDEE PRECIOUS METALS LEVERAGES THE INTERNET OF EVERYTHING AND TAKES THE LID OFF THE MINE

I've travelled a great deal around the globe in the last year and am amazed at the interesting things organizations are doing with technology to connect the unconnected. As we enter the next big phase of the Internet the Internet of Everything (IoE) no industry can afford to be left behind. Even the industries that existed long before the Internet was even a glimmer on the horizon, such as manufacturing and mining, can realize great value through IoE. Dundee Precious Metals (DPM) is one example. Theyre a manufacturing company that has capitalized on the connections between the people, process, data and things that IoE is enabling, transforming one of the worlds most traditional industries in the process.

When DPM set a goal to increase production of their flagship mining operation by 30 percent, their IT team needed to find a way to reach the target without increasing manpower or the number of vehicles.

With the help of the connections from IoE, now Dundee can share important information in real time, such as miners locations, equipment updates and data such as the number of buckets filled. This lets their teams troubleshoot as they go, instead of just at the end of a shift, keeping crews better on track to meet daily goals. Whats more, miners and mine managers had limited communication options since their Wi-Fi didnt function well underground. So they leveraged Ciscos unified wireless network to provide coverage along 50 kilometers of tunnels. This let drivers, supervisors and managers communicate efficiently above ground or below with calls and instant messaging. Radio Frequency Identification (RFID) tags placed on miners caps and vehicles keep everyone synced up with location tracking via a 3D map for improved worker safety. New collaboration capabilities extend to other DPM locations, making face-to-face collaboration possible between managers, geologists and metallurgists as they discuss production, development and project schedules. This all adds up to better understanding and decision-making across the board. So what have these changes meant for DPM?

- Production increased by 400 percent, far exceeding their original 30 percent goal.
- Miner safety has improved as they track miners movements and know where everyone is at all times.
- Asset utilization of vehicles has also improved via continually transmitted data identifying repair needs.
- Communication and energy costs have been lowered through more efficient use of resources.

  This is just the start of DPM leveraging IoEs capabilities. The company plans to replicate the same systems in all of its mines, as well as extend the Internet of Everything concept to health monitoring of employees, using connected environmental health sensors.

  The Internet of Everything is not just the technology of tomorrow. It is here today, and the networked connections it provides can impact all industries, even those industries with roots from long ago.

1.4 Application

1.4.1 Smart home

Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term Smart Home each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds$2.5bn. This list includes prominent startup names such as Nest or AlertMe as well as a number of multinational corporations like Philips, Haier, or Belkin.

1.4.2 Wearables

Wearables remains a hot topic too. As consumers await the release of Apples new smart watch in April 2015, there are plenty of other wearable innovations to be excited about:

like the Sony Smart B Trainer, the Myo gesture control, or LookSee bracelet. Of all the IoT startups, wearables maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars!

1.4.3 Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

1.4.4 Smart grids

Smart grids is a special one. A future smart grid promises to use information about the behaviours of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlights the concepts popularity. However, the lack of tweets (Just 100 per month) shows that people dont have much to say about it.

1.4.5 Industrial internet

The industrial internet is also one of the special Internet of Things applications. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently doesnt reach the masses like smart home or wearables do. The industrial internet however has a lot going for it. The industrial internet gets the biggest push of people on Twitter (1,700 tweets per month) compared to other non-consumer-oriented IoT concepts.

1.4.6 Connected car

The connected car is coming up slowly. Owing to the fact that the development cycles in the automotive industry typically take 2-4 years, we havent seen much buzz around

the connected car yet. But it seems we are getting there. Most large auto makers as well as some brave startups are working on connected car solutions. And if the BMWs and Fords of this world dont present the next generation internet connected car soon, other well-known giants will: Google, Microsoft, and Apple have all announced connected car platforms.

1.4.7 Connected Health (Digital health/Telehealth/Telemedicine)

Connected health remains the sleeping giant of the Internet of Things applications. The concept of a connected health care system and smart medical devices bears enormous potential (see our analysis of market segments), not just for companies also for the well-being of people in general. Yet, Connected Health has not reached the masses yet. Prominent use cases and large-scale startup successes are still to be seen. Might 2015 bring the breakthrough?

1.4.8 Smart retail

Proximity-based advertising as a subset of smart retail is starting to take off. But the popularity ranking shows that it is still a niche segment. One LinkedIn post per month is nothing compared to 430 for smart home.

1.5 Future of IoT

Internet of Things is a technology of the future that becomes a reality in the present. Let's try to answer the question about where things are moving - for users, businesses, as well as the developers.

It is obvious that the Internet of Things will revolutionize the ordinary life of people, transform the global IT landscape, and affect the roadmap and development strategy for many types of businesses. Therefore, theres a lot to be said about the IoT and its practically impossible to exhaust the topic considering its numerous aspects. I will try to focus on a few segments, understanding that my thoughts below are just a tip of an enormous iceberg.

IoT segments development is interconnected. Users and society in the general interest to one or another technology or product will, in turn, generate interest in developers and investors. For example, the interest in smart home systems will lead to the emergence of many developments of this type (but will require data protection technologies for proper work).

At the same time, new opportunities and tools create new needs among users and businesses. For example, the ability to transmit data to your home electronics while youre still on your way home may lead to the desire to not simply turn the coffee pot on, but also to order food based on the data received from the fitness band activity. In turn, the developers should be ready to provide technological background for all these solutions, needs, and demands.

1.6 IoT Devices Management and Analysis

IoT-devices will produce massive amounts of data that will require new analysis methods. In the beginning, its possible to use the existing data analysis tools, but over time, the market will require new methods and instruments. The emergence of numerous IoT-gadgets will force to revaluate the management issues as well - working capacity check, firmware updates, error analysis. The easiest and the most obvious way - sending a maintenance man to the site to fix the problem - will no longer work because it will be unreasonably expensive, especially if the gadgets will become cheaper and more affordable. Therefore, the market will need instruments for data analysis and remote IoT-device controls within minimum time and with minimum effort.

Chapter 2

Biometrics

Figure 2.1: Biometric

Many different aspects of human physiology, chemistry or behaviour can be used for biometric authentication. The selection of a particular biometric for use in a specific application involves a weighting of several factors. Jain et al. (1999) identified seven such factors to be used when assessing the suitability of any trait for use in biometric authentication. Universality means that every person using a system should possess the trait. Uniqueness means the trait should be sufficiently different for individuals in the relevant population such that they can be distinguished from one another. Permanence

relates to the manner in which a trait varies over time. More specifically, a trait with 'good' permanence will be reasonably invariant over time with respect to the specific matching algorithm. Measurability (collectability) relates to the ease of acquisition or measurement of the trait. In addition, acquired data should be in a form that permits subsequent processing and extraction of the relevant feature sets. Performance relates to the accuracy, speed, and robustness of technology used (see performance section for more details). Acceptability relates to how well individuals in the relevant population accept the technology such that they are willing to have their biometric trait captured and assessed. Circumvention relates to the ease with which a trait might be imitated using an artifact or substitute.

2.1 Biometric Functionality

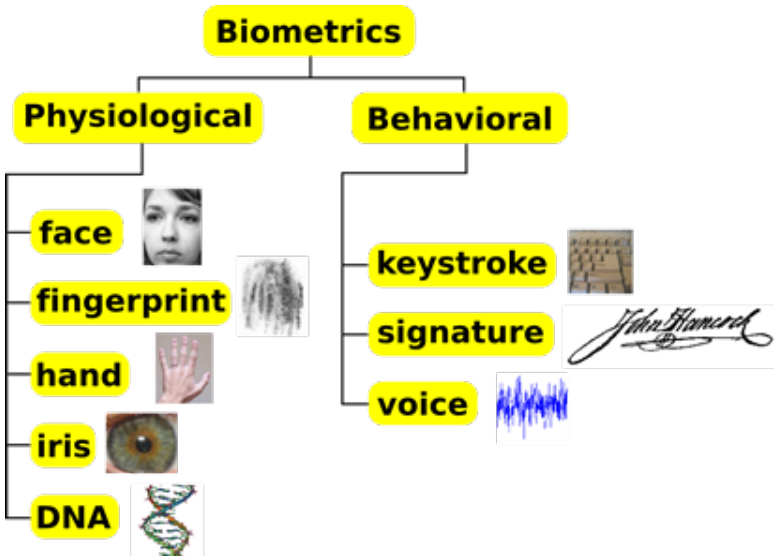

Figure 2.2: Biometric Functionality

Many different aspects of human physiology, chemistry or behaviour can be used for biometric authentication. The selection of a particular biometric for use in a specific application involves a weighting of several factors. Jain et al (1998).

Identified seven such factors to be used when assessing the suitability of any trait for use in biometric authentication.

- Universality means that every person using a system should possess the trait.
- Uniqueness means the trait should be sufficiently different for individuals in the relevant population such that they can be distinguished from one another.
- Permanence relates to the manner in which a trait varies over time. More specifically, a trait with 'good' permanence will be reasonably invariant over time with respect to the specific matching algorithm.
- Measurability (collectability) relates to the ease of acquisition or measurement of the trait. In addition, acquired data should be in a form that permits subsequent processing and extraction of the relevant feature sets.
- Performance relates to the accuracy, speed, and robustness of technology used (see performance section for more details).
- Acceptability relates to how well individuals in the relevant population accept the technology such that they are willing to have their biometric trait captured and assessed.

  Proper biometric use is very application dependent. Certain biometrics will be better than others based on the required levels of convenience and security. No single biometric will meet all the requirements of every possible application.

2.2 Fingerprint Identification Method

A fingerprint in its narrow sense is an impression left by the friction ridges of a human finger. The recovery of fingerprints from a crime scene is an important method of forensic science. Fingerprints are easily deposited on suitable surfaces (such as glass or metal or polished stone) by the natural secretions of sweat from the eccrine glands that are present in epidermal ridges. These are sometimes referred to as "Chanced Impressions". In a wider use of the term, fingerprints are the traces of an impression from the friction ridges of any part of a human or other primate hand. A print from the sole of the foot can also leave an impression of friction ridges. Deliberate impressions of fingerprints may be formed by ink or other substances transferred from the peaks of friction ridges on the skin to a relatively smooth surface such as a fingerprint card. Fingerprint records normally contain impressions from the pad on the last joint of fingers and thumbs, although

fingerprint cards also typically record portions of lower joint areas of the fingers. Human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity. They may be employed by police or other authorities to identify individuals who wish to conceal their identity, or to identify people who are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster. Fingerprint analysis, in use since the early 20th century, has led to many crimes being solved. This means that many criminals consider gloves essential. In 2015, the identification of sex by use of a fingerprint test has been reported. The analysis of fingerprints for matching purposes generally requires the comparison of several features of the print pattern. These include patterns, which are aggregate characteristics of ridges, and minutia points, which are unique features found within the patterns. It is also necessary to know the structure and properties of human skin in order to successfully employ some of the imaging technologies.

2.3 Fingerprint Processing

Figure 2.3: Fingerprint Processing

Fingerprint processing has three primary functions: enrollment, searching and verification. Among these functions, enrollment which captures fingerprint image from the sensor plays an important role. A reason is that the way people put their fingerprints on a

mirror to scan can affect to the result in the searching and verifying process. Regarding to verification function, there are several techniques to match fingerprints such as correlation-based matching, minutiae-based matching, ridge feature-based matching and minutiae-based algorithm. However, the most popular algorithm was minutiae based matching algorithm due to its efficiency and accuracy.

2.4 Minutiae features

The major minutia features of fingerprint ridges are ridge ending, bifurcation, and short ridge (or dot). The ridge ending is the point at which a ridge terminates. Bifurcations are points at which a single ridge splits into two ridges. Short ridges (or dots) are ridges which are significantly shorter than the average ridge length on the fingerprint. Minutiae and patterns are very important in the analysis of fingerprints since no two fingers have been shown to be identical.

Chapter 3

Literature Review Table

Our automated attendance management system was previously done using various technologies like Zigbee, RFID and GSM model. Following is the brief description based on the thorough study of 2 IEEE and 1 IRJET paper.

Method	Advantages	Limitations	References
ZigBee	1.Very low power consumption 2.Secure data transfer 3.Reliable data transfer	1.Sort range & low data speed 2.Bit slower than any other technology 3.It is costly	*Maddu Kamaraju, Penta Anil Kumar* **"Wireless Fingerprint Attendance System"**, IEEE Spectrum ,2015
RFID	1.Multiple tag read/write 2.Portable data base 3.Long read range	1.It is less reliable 2.Poor read data can occur if the reader & receiver is not properly aligned 3.More than one tag can response at the same time	McKeehan D.A (2002) : Attendance management programme (article).
GSM	1.Great speed 2.Simultaneous voice & data	1.It has security issues such as theft at services 2.Less Reliable	*Pallavi Verma, Namit Gupta* : **"Fingerprint based Student Attendance system using GSM"**, Volume 2 Issue 10, IEEE Spectrum Oct 2013

Figure 3.1: Literature Table

Chapter 4

Objective

When any brilliant idea strikes our mind it comes along with some objective, and the objective of anything we do in this life id to reduce or eliminate the pain point.

Following are the objectives of our project :

- Improve visibility to track and manage student attendance & absenteeism across multiple campuses
- Real-time status tracking of leave requests
- Automatic calculation of leave and reward points accrued
- Easy attendance recording using RFID & Biometric based attendance system
- Track the attendance of teachers and staff, assign work and manage allocation
- Keep the parents informed about the students performance via Email & SMS alerts
- Auto-generate various types of reports of class or student attendance
- Increased security and confidentiality with role-based permissions to users

Chapter 5

Proposed System

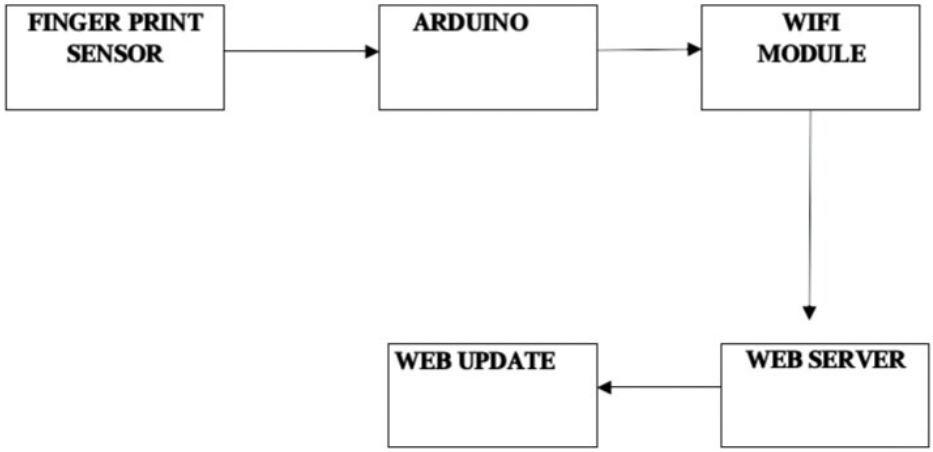

Figure 5.1: Proposed System

5.1 Fingerprint Sensor

While biometrics and fingerprint identification has been existing for well over 100 years in some basic form, it is the growth of maker community that made modules like R305 and SM630 so popular. R305 and S630 are common modules used for fingerprint scanners, with the aid of a powerful DSP in its core. Basically both of these modules work the same way, we can commu-

nicate with them using a packet of hex codes in a specific format. However, the commands for operation can vary from module to module, for which we should have its datasheet. Well, for now we have the R305 here, just tested it with the products demo software from SFG.

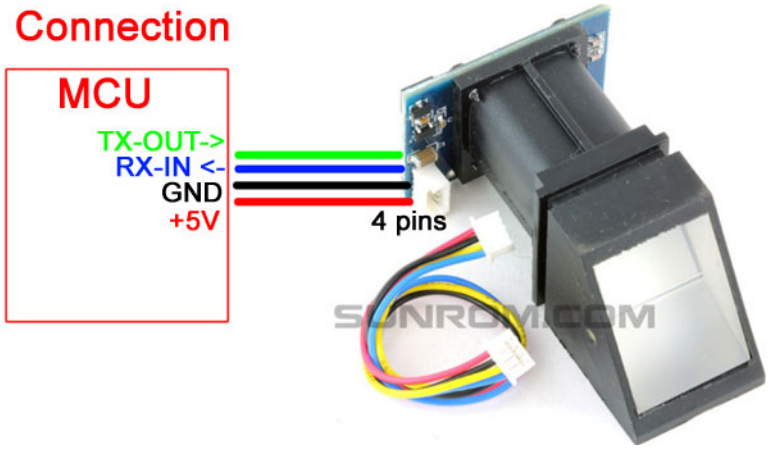

Figure 5.2: Fingerprint Sensor

Though these have no good English documentation, SFG has done a real good work with the demo software (except the bad UI) This is a finger print sensor module with TTL UART interface for direct connections to microcontroller UART or to PC through MAX232 / USB-Serial adapter.

5.1.1 Features

- Integrated image collecting and algorithm chip together, ALL-in-One
- Fingerprint reader can conduct secondary development, can be embedded into a variety of end products
- Low power consumption, low cost, small size, excellent performance
- Professional optical technology, precise module manufacturing techniques
- Good image processing capabilities, can successfully capture image up to resolution 500 dpi

5.1.2 Specifications

- Fingerprint sensor type: Optical
- Sensor Life: 100 million times
- Static indicators: 15KVBacklight: bright green
- Interface: USB1.1/UART(TTL logical level)
- RS232 communication baud rate: 4800BPS 115200BPS changeable
- Dimension: 55*32*21.5mm
- Image Capture Surface 1518(mm)
- Verification Speed: 0.3 sec
- Scanning Speed: 0.5 sec
- Character file size: 256 bytes
- Template size: 512 bytes
- Storage capacity: 250
- Security level: 5 (1,2,3,4,5(highest))
- False Acceptance Rate (FAR) :0.0001%
- False Rejection Rate (FRR): 0.1%
- Resolution 500 DPI
- Voltage :3.6-6.0 VDC
- Working current: Typical 90 mA, Peak 150mA
- Matching Method: 1: N

  Fingerprint scanners are awesome. Why use a key when you have one right at the tip of your finger? Unfortunately, theyre usually unreliable or difficult to implement. Well not

anymore! Weve found this great fingerprint module from ADH-Tech that communicates over TTL Serial so you can easily embed it into your next project.

The module itself does all of the heavy lifting behind reading and identifying the fingerprints with an on-board optical sensor and 32-bit CPU. All you need to do is send it simple commands. To get started, just register each fingerprint that you want to store by sending the corresponding command and pressing your finger against the reader three times. The fingerprint scanner can store different fingerprints and the database of prints can even be downloaded from the unit and distributed to other modules. As well as the fingerprint template, the analyzed version of the print, you can also retrieve the image of a fingerprint and even pull raw images from the optical sensor!

This is the updated version of the GT-511 which has an increased memory capacity. The module can store up to 200 different fingerprints (thats 10x more than the old version!) and is now capable of 360 recognition.

The module is small and easy to mount using two mounting tabs on the side of the sensor. The on-board JST-SH connector has four signals: Vcc, GND, Tx, Rx. A compatible JST-SH pigtail can be found in the related items below. Demo software for PC is available in the documents below, simply connect the module to your computer using an FTDI Breakout and start the software to read fingerprint!

The fingerprint sensor is combination of R305 FP+PIC MCU board that can read different fingerprints and store in its own flash memory. The sensor can perform three functions namely Add (Enroll), Empty Database or Search Database and return the ID of stored fingerprint.

Any of three functions can be called simply by making the pin low of the sensor or pressing onboard three switches. The response is either error or ok which is indicated by onboard LED. The response is also returned as single serial data byte. The return byte is a valid ID or error code. The response byte is a single byte at 9600 bps thus making whole sensor very easy to use. We have provided indicating LEDs and function switch already so its ready to use when you receive it. Just give power and start using the sensor using onboard switches. Then you can move on making external application using these functions.

5.2 Arduino

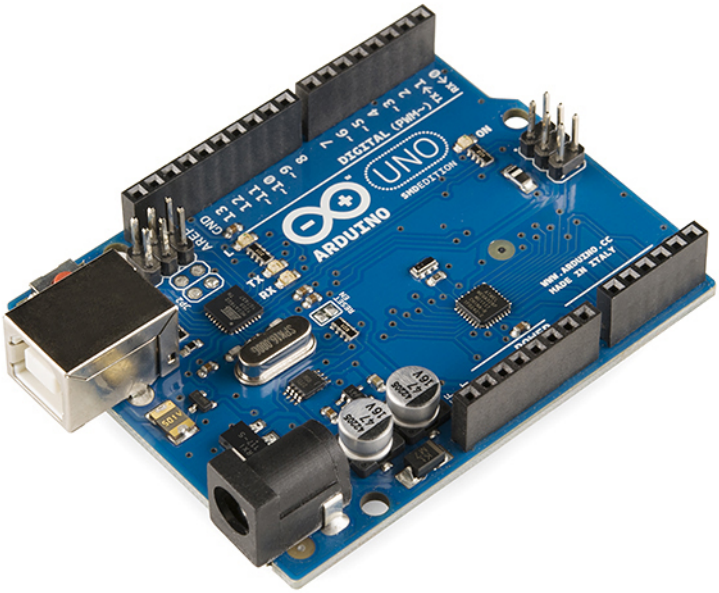

Figure 5.3: Arduino

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.

The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

5.3 Interfacing of Fingerprint sensor with Arduino

This optical fingerprint reader devices uses high powered DSP chip AS601 form Synochip, that does the image rendering, calculation, feature finding and searching. It provides TTL serial out hence we can connect to any microcontroller or system. The DSP processor has on board FLASH memory which can store 120 finger prints. Thanks to the Adafruit here we have Fingerprint library so that connect this sensor to Arduino as well.

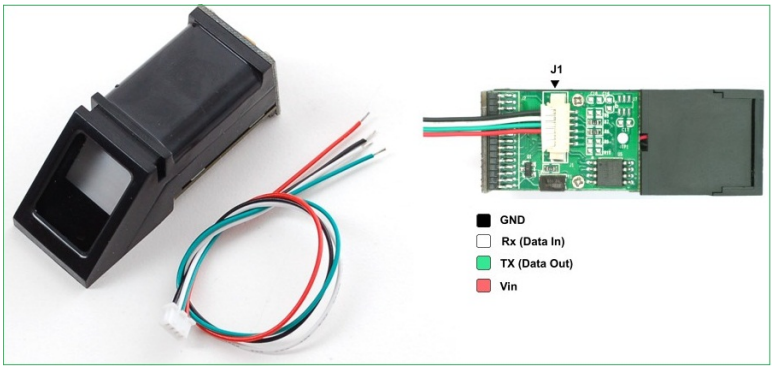

Figure 5.4: Interfacing of Fingerprint sensor with Arduino

Fingerprint sensor Arduino Hookup

The fingerprint identification process has two steps that is

1. Enrolling Fingerprint.

2. Matching Fingerprint.

5.4 Wifi Module

The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

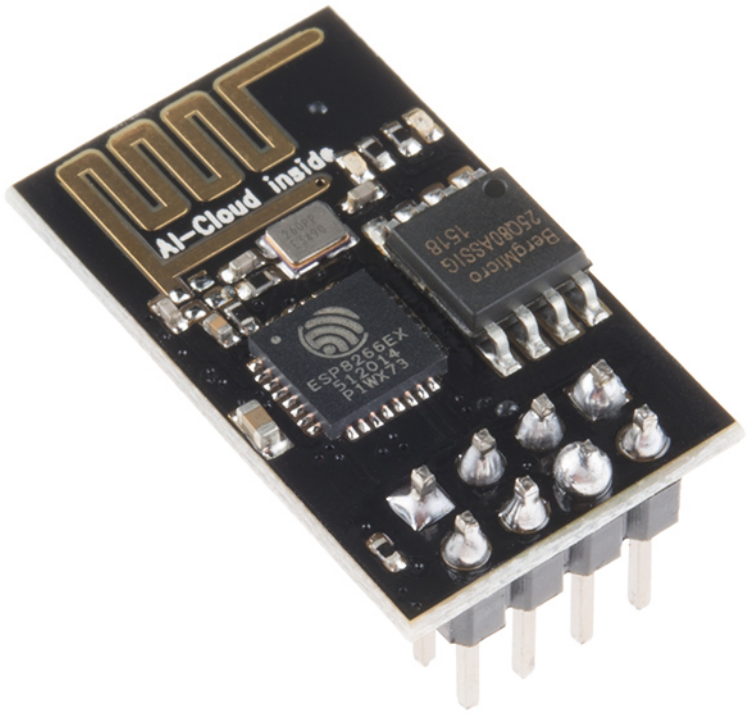

Figure 5.5: Wifi Module

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and thats just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high

degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

5.5 Web Server

Figure 5.6: Wifi Module

A web server is a computer system that processes requests via HTTP, the basic network protocolused to distribute information on the World Wide Web. The term can refer to the entire system, or specifically to the software that accepts and supervises the HTTP requests

The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content

5.5.1 Working process of web server

A user agent, commonly a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so. The resource is typically a real file on the server's secondary storage, but this is not necessarily the case and depends on how the web server is implemented. While the primary function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. This feature is used for submitting web forms, including uploading of files.

Many generic web servers also support server-side scripting using Active Server Pages (ASP), PHP, or other scripting languages. This means that the behaviour of the web server can be scripted in separate files, while the actual server software remains unchanged. Usually, this function is used to generate HTML documents dynamically (”on-the-fly”) as opposed to returning static documents. The former is primarily used for retrieving and/or modifying information from databases. The latter is typically much faster and more easily cached but cannot deliver dynamic content.

Web servers are not only used for serving the World Wide Web. They can also be found embedded in devices such as printers, routers, webcams and serving only a local network. The web server may then be used as a part of a system for monitoring or administering the device in question. This usually means that no additional software has to be installed on the client computer, since only a web browser is required which now is included with most operating systems.

5.5.2 Path Translation

Web servers are able to map the path component of a Uniform Resource Locator (URL) into:

- A local file system resource (for static requests)
- An internal or external program name (for dynamic requests)

For a static request the URL path specified by the client is relative to the web server's root directory.

Consider the following URL as it would be requested by a client:

http://www.example.com/path/file.html

The client's user agent will translate it into a connection to www.example.com with the following HTTP 1.1 request:

GET /path/file.html HTTP/1.1 Host: www.example.com

The web server on www.example.com will append the given path to the path of its root directory. On an Apache server, this is commonly /home/www (On Unix machines, usually /var/www). The result is the local file system resource:

/home/www/path/file.html

5.5.3 Load Limits

A web server (program) has defined load limits, because it can handle only a limited number of concurrent client connections (usually between 2 and 80,000, by default between 500 and 1,000) per IP address (and TCP port) and it can serve only a certain maximum number of requests per second (RPS, also known as queries per second or QPS) depending on:

- Its own settings,
- The HTTP request type,
- Whether the content is static or dynamic,
- Whether the content is cached, and
- The hardware and software limitations of the OS of the computer on which the web server runs.
- When a web server is near to or over its limit, it becomes unresponsive.

5.6 Website

A website is a collection of related web pages, including multimedia content, typically identified with a common domain name, and published on at least one web server. A

website may be accessible via a public Internet Protocol (IP) network, such as the Internet, or a private local area network (LAN), by referencing a uniform resource locator (URL) that identifies the site.

Websites have many functions and can be used in various fashions; a website can be a personal website, a commercial website for a company, a government website or a non-profit organization website. Websites can be the work of an individual, a business or other organization, and are typically dedicated to a particular topic or purpose, ranging from entertainment and social networking to providing news and education. All publicly accessible websites collectively constitute the World Wide Web, while private websites, such as a company's website for its employees, are typically a part of an intranet.

Web pages, which are the building blocks of websites, are documents, typically composed in plain text interspersed with formatting instructions of Hypertext Markup Language (HTML, XHTML). They may incorporate elements from other websites with suitable markup anchors. Web pages are accessed and transported with the Hypertext Transfer Protocol (HTTP), which may optionally employ encryption (HTTP Secure, HTTPS) to provide security and privacy for the user. The user's application, often a web browser, renders the page content according to its HTML markup instructions onto a display terminal.

5.6.1 History

The World Wide Web (WWW) was created in 1990 by the British CERN physicist Tim Berners-Lee. On 30 April 1993, CERN announced that the World Wide Web would be free to use for anyone. Before the introduction of HTML and HTTP, other protocols such as File Transfer Protocol and the gopher protocol were used to retrieve individual files from a server. These protocols offer a simple directory structure which the user navigates and chooses files to download. Documents were most often presented as plain text files without formatting, or were encoded in word processor formats.

5.6.2 Overview

Websites have many functions and can be used in various fashions; a website can be a personal website, a commercial website, a government website or a non-profit organization website. Websites can be the work of an individual, a business or other organization, and are typically dedicated to a particular topic or purpose. Any website can contain a hyperlink to any other website, so the distinction between individual sites, as perceived by the user, can be blurred.

Websites are written in, or converted to, HTML (Hyper Text Markup Language) and are accessed using a software interface classified as a user agent.Web pages can be viewed or otherwise accessed from a range of computer-based and Internet-enabled devices of various sizes, including desktop computers, laptops, PDAs and cell phones.

A website is hosted on a computer system known as a web server, also called an HTTP server. These terms can also refer to the software that runs on these systems which retrieves and delivers the web pages in response to requests from the website's users.

Apache is the most commonly used web server software.

5.7 Web Application

In computing, a web application or web app is a clientserver software application in which the client (or user interface) runs in a web browser. Common web applications include webmail, online retail sales, online auctions, wikis, instant messaging services and many other functions.In earlier computing models like clientserver, the processing load for the application was shared between code on the server and code installed on each client locally.

In other words, an application had its own pre-compiled client program which served as its user interface and had to be separately installed on each user's personal computer. An upgrade to the server-side code of the application would typically also require an upgrade to the client-side code installed on each user workstation, adding to the support cost and decreasing productivity.

In addition, both the client and server components of the application were usually tightly

bound to a particular computer architecture and operating system and porting them to others was often prohibitively expensive for all but the largest applications. (Today, of course, native apps for mobile devices are also hobbled by some or all of the foregoing issues.)

5.8 Interface

Through Java, JavaScript, DHTML, Flash, Silverlight and other technologies, application-specific methods such as drawing on the screen, playing audio, and access to the keyboard and mouse are all possible. Many services have worked to combine all of these into a more familiar interface that adopts the appearance of an operating system. General purpose techniques such as drag and drop are also supported by these technologies. Web developers often use client-side scripting to add functionality, especially to create an interactive experience that does not require page reloading. Recently, technologies have been developed to coordinate client-side scripting with server-side technologies such as ASP.NET, J2EE, Perl/Plack and PHP.

5.9 Web Update

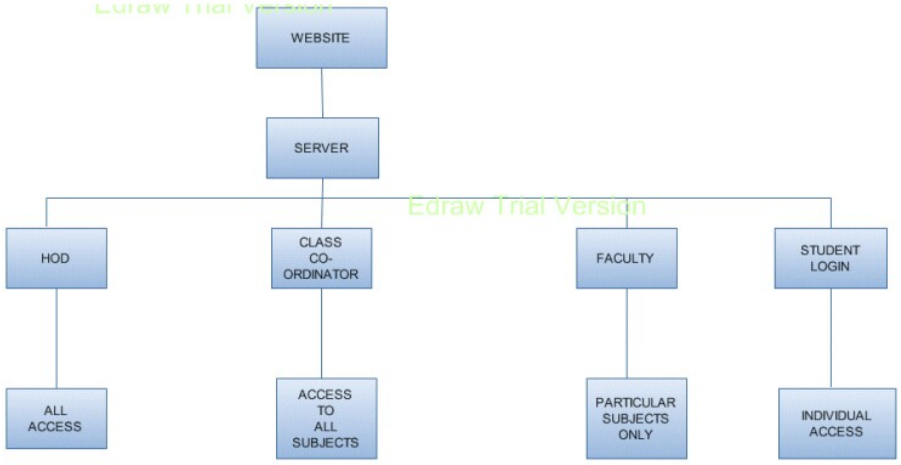

Figure 5.7: Web Update

Chapter 6

Conclusion

In this project, we proposed a system that automates the whole process of taking attendance and maintaining its record in an academic institute. Managing people is a difficult task for most of the organisations, and maintaining the attendance record is an important factor. By our automated system, we managed to achieve the desired objectives stated earlier.

Thus the conclusion is that Fingerprint based Attendance Management System will not only enhance our knowledge but this automated system could be adopted by every college to compute the attendance rate& to evaluate the effectiveness of our education system.

Achievement

On 29th September 2016, we participated in National Level Paper Presentation held at Universal College of Engineering, Vasai. And by the support of our H.O.D Prof. Mujib Tamboli and our Guide Asst. Prof. Awab Fakih, we emerged as Winners in the category of Undergraduate Electronics and all Applied Branches.

Position : **1st in our category**

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