Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,

LONERE (M.S.)



# RFID Based Attendance System Using Cloud

**Submitted by**

**Neha Shashikant Tehare – 1921261372012**

**Sakshi Ganesh Bharari - 1921261372008**

**Devesh Sunil Parlikar - 2021261372008**

**Under The Guidance of**

**Prof. R. N. Patil**

**In Partial Fulfillment of the Award of**

**Bachelor of Engineering (Electronics & Tele-Communication Engineering)**

# Department of Electronics &Tele-Communication Engineering

**Marathwada Institute of Technology,**

**Aurangabad (Maharashtra)**

**[2022-23]**



CERTIFICATE

*This is to certify that the Project titled*

*RFID Based Attendance System Using Cloud*

Was prepared and presented by

##### **Neha Shashikant Tehare - 1921261372012**

##### **Sakshi Ganesh Bharari - 1921261372008**

##### **Devesh Sunil Parlikar - 2021261372008**

*Of the Seven Semester Electronics and Tele-Communication Engineering*

*in partial fulfillment of requirement for the award of*

*Degree of Bachelor of Engineering in Electronics &Tele-Communication Engineering under the Dr. Babasaheb Ambedkar Technological University, Lonere during the year 2021-22*

Place: Aurangabad

|  |  |
| --- | --- |
| Dr. V.M.Kulkarni Head ,  Department of Electronics  &  Tele-Communication Engineering | Prof. R. N. Patil Guide ,  Department of Electronics  &  Tele-Communication Engineering |
| Dr. S. P. Bhosle Director  Marathwada Institute of Technology  Aurangabad (M.S.) – 431 028 | |

*Date:*

**CONTENTS**

1. **INTRODUCTION 6**

1.1What is the concept of smart attendance system?6

1.2 History of RFID 7

1.3 Literature Survey 10

**2. WORKING OF RFID 13**

2.1Basic System Configuration 13

2.2 Types of RFID’s 15

2.3 Need of RFID based smart attendance 18

2.4 How RFID attendance works 20

**3. Requirements 22**

3.1Arduino Uno 22

3.2 LCD Display 26

3.3 RFID reader 29

3.4 Wi-Fi Module 31

3.5 RFID Tags 35

4. **Software Requirements 38**

4.1Cloud 38

4.2 Mobile Application 47

**5. PROGRAM, APPLICATIONS, LIMITATIONS, ADVANTAGES, FUTURE SCOPE, CONCLUSION S 50**

5.1 Program 50

5.2Application 61

5.3 Limitation 68

5.4Advantages 71

5.5 Future Scope 75

5.6 Conclusion 76

**REFERENCES** 77

**ACKNOWLEDGEMENT** 78

LIST OF FIGURES

Fig 2.1. Evolution of RFID 14

Fig 1.2. Amplitude of RFID 15

Fig 3.1. Arduino 22

Fig 3.2. Components of Arduino 23

Fig 3.3. Memory Structure of Arduino 25

Fig 3.4. Pin Description of LCD 16x2 26

Fig. 3.5. Esp32 Wifi Module 31

Fig 3.6 RFID 35

Fig 3.7 Working of RFID 36

Fig 4.1 Cloud 38

**CHAPTER 1**

**INTRODUCTION:**

**1.1 What is the concept of smart attendance system?**

Child safety, in today’s times, is one of the most essential and basic rights that we can give our children. However, with the extent of crime rate against children that is afflicting our country and our world, this basic right is being denied to them. Did you know that almost one lakh children go missing every year when they are travelling to or from school? Some of these children are kidnapped for ransom but most of them end up in illegal trades.

It has thus become a matter of critical importance that our children stay safe when fulfilling their right to education. And the burden of each student’s safety lies heavily upon the educational institutions they belong to, be they schools or colleges. Guaranteeing the safety of its students not only brings peace of mind to the school management and students’ parents, it also builds the institution’s goodwill in the market. When people know that a particular school is proactively concerned about the safety of its students, more parents are willing to enrol their children into that institution.

Attendance management has been a great challenge over the years in Nigerian academic institutions. Ranging from university to polytechnics, colleges of educations and secondary schools, quality attendance management has been a freak. Manual authentication of attendance of logbooks has become an arduous task and this is also time-consuming. The academic attendance policy has generated a lot of questions at various quarters. In this paper, we present a system which maintains the attendance records of students adequately and automatically. The device is an efficient module that comprises a fingerprint sensor to manage the attendance records of students at all levels in an academic institution. The module enrols the students at the beginning of each semester with adequate semester course registration. This enrolment is a one-time process and their fingerprints are stored in the fingerprint sensor. The module provides percentage attendance results at the end of each semester so as to ascertain qualification by each student to write the semester examination.

**1.2 History of RFID**

Radio Frequency Identification or RFID is a technology that has existed for decades. At a simple level, it is a technology that involves tags that emit radio signals and devices called readers that pick up the signal. It was not until the 1980’s that RFID applications began to appear in commercial applications, such as railroad freight car tagging, the tagging of cattle and rare dog breeds, key less entry systems and automatic highway toll collection. As there is improvement in the technology there has been reduction in the cost and size, and it has gained wide acceptance in warehouse management and manufacturing.

First application to identify planes in world II using radar.

60’s -Electronic article surveillance (EAS) used to identify whether an item has been paid or not using a 1 bit tag.

80’s first automated toll payment systems.

RFID has been used in mobile technology through which there had been a great advancement in this field. Korea is widely known that it has established one of the most robust mobile telecommunication networks. Korea has recognized the potential of RFID technology and has tried to converge with mobile phone.

**Convergence of three technologies:**

Radio frequency electronics: The research in the field of radio frequency electronics as applied to RFID was begun during World War 2 and continued through the 1970’s. The RF electronics and antenna systems employed by RFID interrogators and tags have been made possible because of radio frequency electronic research and development. Information technology: The research in the field of information technology started in the mid 1970’s and roughly continued through 1990’s. Interrogator and the host computer employ this technology. Networking of RFID systems and RFID interrogators has been made possible by research in this field. Material science: some of the breakthroughs in material science technology made the RFID tags cheaper to manufacture. By overcoming this cost barrier goes a long wayin making RFID technology commercially viable.

**Mile stones in RFID and speed of adoption**:

The development of RFID technology can be defined by the following time based summaries shown below:

**Pre- 1940s:**

Different scientists like faraday, Maxwell, hertz had yielded a complete set of laws of electromagnetic energy describing its nature. In the beginning of 1896 Watson, Baird and many others sought to apply these laws in radio communications and radars.

So including RFID work done in this era form the building blocks upon which many technologies have been built.

**1940s – World war 2:**

Many advancements and improvements have been taken place during World War 2. Scientists and engineers continued their research increasingly in these areas. In 1948 Harry stockman published a paper on reflected power which is the closest thing to the birth of RFID technology.

**1950s- Early exploration of RFID technology:**

Different technologies related to RFID were explored by researchers during 1950s. The US military began to implement early form of aircraft RFID technology called identification, Friend of Foe, or IFF.

**1960s- Development of RFID theory and early field trials:**

RF Harrington did a lot of research in the field of electromagnetic theory and it is applied to the RFID. Passive data transmission techniques utilizing radar beams and interrogator- responder identification system introduced by Vogel man and J.P vinding’s. In the late 1960s sensormatic and checkpoints were founded to develop electronic article surveillance (EAS) equipment for anti-theft and security applications. These are 1-bit systems that mean these only detect in the presence of RFID tags rather than identifying them. Later EAS is the first widespread use of RFID.

**1970s: Early adopter applications and an RFID explosion:**

There is a great deal of growth in RFID technology in 1970s based on the witnesses. All the academic institutions, companies and government laboratories are involved in RFID. In 1975 short range radio- telemetry for electronic identification using modulated backscatter was released. Big companies such as Raytheon, RCA started to develop electronic identification technology and by 1978 a passive microwave transponder is accomplished. Later the US federal administration convened a conference to explore the use of electronic identification technology in vehicles and transportation application too. By the end of the decade research in computers and information technology which is crucial to the development of RFID hosts, interrogators and networks has started as evidenced by the birth of PC and the ARPANET.

**1980’s- commercialization:**

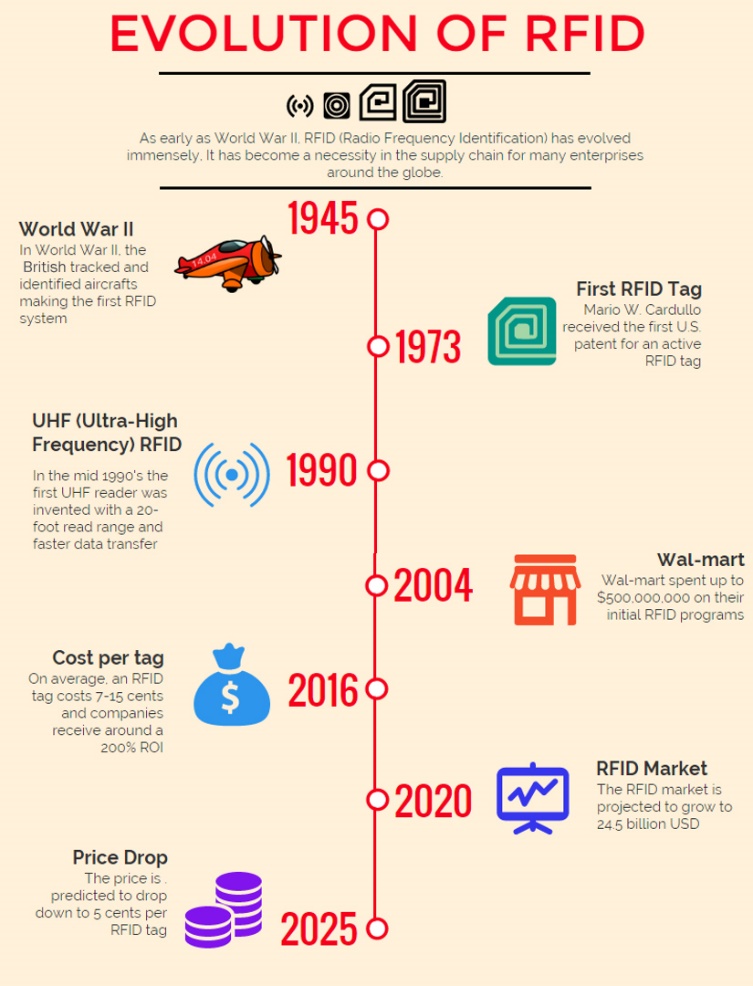
This year brought about the first widespread commercial RFID systems. Personnel access systems, key less entry are some of the examples. In Norway the world’s first toll application was implemented and later in Dallas. In 1980s the implemented RFID systems were proprietary systems. So there is little competition in the RFID industry and that results in high cost and impeded industry growth.

**1990s- RFID enters the main stream:**

In 1990 RFID finally started to enter the main stream of business and technology. In the middle of the year RFID toll systems operate at highway speeds. This means the drivers could pass through toll points un impeded by plazas or barriers. This results in the deployment of RFID toll systems in United States. TIRIS system was started by the Texas instruments which developed new RFID applications for dispensing fuel such as ski pass system and vehicle access systems. In the early 1990s the research in the information was well developed and evidenced by proliferation of PC’s and internet. The materials technology advances and many of them related to semiconductor chip makers such as IBM, INTEL, MOTOROLA and AMD put cost effective tags on the horizon. At the end of the year large scale smart label tests had started.

**2007 and Beyond:**

Item level tagging is implemented when there are no checkout scenario at large super markets. High value and high risk goods are the first to benefit from item level tagging. For example goods like pharmaceuticals and firearms. Smart shelves for select categories started to appear and smart appliances with embedded RFID technology come into the market place.



**1.2. Literature Survey**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No** | **Published Year** | **Paper Name** | **Author** | **Contents** |
| 1 | Oct 30, 2013 | RFID Based Attendance Management System | Shashank Shukla  Shailee Shah  Pooja Save | The Time-Attendance System GUI is developed using Visual Basic.Net. The Attendance Management System provides the functionalities of the overall system such as displaying live ID tags transactions, registering ID, deleting ID, recording attendance and other  minor functions. This interface was installed in the host computer. |
| 2 | July 13, 2015 | RFID Technology Based Attendance Management System | Sumita Nainan  Romin Parekh    Tanvi Shah | The Backend database  stores individual tag identifiers to uniquely identify the roles of each tag. The database stores record entries pertaining to individual tags and its role in the system application. |
| 3 | August 15, 2018 | A RFID Based Automatic Attendance System in Educational    Institutions of Nigeria | A.A. Olanipekun and O.K. Boyinbode | This work eradicates the deficiencies associated with the manual attendance system with an automated approach implemented through Radio frequency identification (RFID) technology. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 4 | January 19, 2015 | Attendance and Information System using RFID and Web-Based Application for Academic Sector | Hasanein D. Rjeib & Nabeel Salih Ali, Ali Al Farawn, Basheer Al-Sadawi, Haider Alsharqi | Based on the results, the proposed attendance and information system is time-effective and it reduces the documentation efforts as well as, it does not have any power consumption. Besides, students attendance RFID based systems that have been proposed are also analyzed and criticized respect to systems functionalities and main findings. Future directions for further researchers are focused and identified. |
| 5 | 30 February, 2020 | THE PROPOSED IMPLEMENTATION OF RFID BASED ATTENDANCE SYSTEM | Rizwan Qureshi | one interface which requires the Internet to access the proposed system and the mobile interface will use the Android platform for the testing scenarios. The user will access the system to generate customized reports to review the status of students for a particular course. It is anticipated that the proposed system will significantly improve students' monitoring mechanisms hence enabling both parents and teachers in making appropriate decisions. |
| 6 | 15 May 2020 | Radio Frequency Identification (RFID) Based Attendance & Assessment System with Wireless Database Records | Sarmad Hameed, Syed Muhammad Taha Saquibb, Moez ul Hassan, Faraz Junejo | This paper illustrates a physical system which incorporates an application of RFID and wireless data base record entries. Our proposed system not only eliminates the time consumed in manual attendance but also maintains the record of entries which can be used for statistical purposes like allocation of appropriate attendance score and further administrative tasks. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 7 | January 15 2021, | RFID Based Attendance System | Ajay Joshi  Aman Ahmad, Arpit Saxena, Poonam Juneja | The proposed system has been implemented through a prototype that has proved the effectiveness of the concept in easing the logistics of taking attendance as a result of the automation due to the use of the RFID technology. The design of the system is simple, cost effective and agile making it a good candidate for commercial and academic purposes. |
| 8 | January 27, 2022 | RFID-Based Students Attendance Management System | Arulogun O. T., Olatunbosun, A., Fakolujo O. A., and Olaniyi, O. M. | This study is capable of eliminating time wasted during manual collection of attendance and an opportunity for the educational administrators to capture face-to-face classroom statistics for allocationof appropriate attendance scores and for further managerialdecisions. |

**CHAPTER 2**

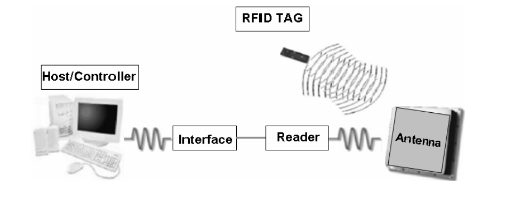
**WORKING OF RFID**

**2.1 Basic system configuration.**

The recent world, development of effective technologies for linking the object wireless information is being prompted in various fields. Radio frequency identification (RFID) is the latest technology for automatic identification which allows the transmission of a unique serial number wirelessly. The purpose of this paper is to review RFID systems and its various components infrastructure. The components and features are still under research and being integrated in existing systems to create a marketable and potential new system. To achieve higher performance; low cost, low power RFID tag with efficient anti-collision technique which provides a large throughput and flexible security mechanism is required. The review has shown different types of readers, antennas and tags which would becomes a bottleneck to reduce the RFID cost. Basically the haptic information provided by the system will be the combination of

The recent world, development of effective technologies for linking the object wireless information is being prompted in various fields. Radio frequency identification (RFID) is the latest technology for automatic identification which allows the transmission of a unique serial number wirelessly. The purpose of this paper is to review RFID systems and its various components infrastructure. The components and features are still under research and being integrated in existing systems to create a marketable and potential new system. To achieve higher performance; low cost, low power RFID tag with efficient anti-collision technique which provides a large throughput and flexible security mechanism is required. The review has shown different types of readers, antennas and tags which would becomes a bottleneck to reduce the RFID cost. The paper has shown details the entire components where RFID researchers will get benefit for the development of future technology. The challenges of RFID system design with the entire components (Reader, Tag and Antenna) and its advantages, disadvantages are briefly explained. Keywords: RFID, Reader, Tag, Antenna. 1. Introduction RFID (Radio Frequency Identification) is an automatic identification method. The great appeal of RFID technology allows storing and reading the data without requiring either contact or a line of sight Design and Application of Radio Frequency Identification Systems 439 between the tag and reader. RFID consists of three basic component such as transponder (tag), interrogator (reader) and antenna. In a typical communication sequence, RFID system performs a Figure 1: Configuration of RFID system number of functionalities between reader and tag. RFID reader emits a continuous RF carrier sine wave. When a tag enters the RF field of the reader, the tag receives energy from the field. Further, receiving sufficient energy, it begins to modulate the carrier signal to the data storage on the tag. The modulating carrier signal is resonated from the tag to the reader. The reader detects the modulating signal from the tag, and decodes signal in order to retrieve the data from the tag. However, the information relays to the host computer where more manipulation data will be stored and finally will be displayed to the user. RFID is basically based on wireless communication making use of radio waves, which is a part of the electromagnetic spectrum (Wenting et al., 2007). Moreover, RFID follows the standard frequency ranges, which are low frequency (120-135 KHz), high frequency (10-15 MHz), ultra high frequency (UHF) (850-950 MHz), and microwave frequency (2.45 GHz). Matt Ward and Rob van Kranenburg (2006) says RFID is a wireless communication device, it follows a number of standards. There are several standard bodies involved in the development and definition of RFID technologies including: International Organization of Standardization (ISO); EPCglobal Incorporation; European Telecommunications Standards Institute (ETSI); Federal Communications Commission (FCC). RFID systems have a number of limitations for integration, streaming and large volume of data. The accuracy of current RFID is improving, but there is still erroneous readings error, such as duplicate readings or missing readings. Fusheng Wang and Peiya Liu (2005) presented RFID data which are normally generated swiftly and automatically. It also accumulates the data for tracking and monitoring. The generated data volume can be enormous, but the problem which requires a scalable storage scheme. It is essential to assure the efficient queries and updates. A. Gupta and M. Srivastava (2004) presented RFID data which integrates with existing applications for product tracking and monitoring. This requires an RFID data management system that can be easily configured to be integrated into different applications, with minimum integration cost. Nowadays, fabrication techniques are also improving, so the reliability and the read range of the passive RFID system continues to improve the cost effective way. Figure 1 shows the basic configuration of RFID system.

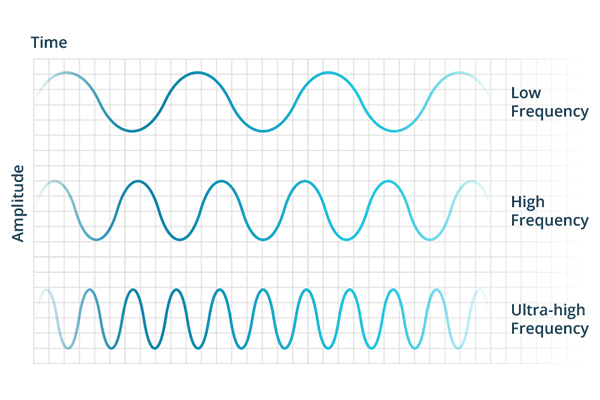
2.1 Fig RFID Flow



**2.2 Types of RFID**

RFID systems can be broken down by the frequency band within which they operate: low frequency, high frequency, and ultra-high frequency. There are also two broad categories of systems—passive and active RFID. In the sections below we will explore the frequencies and types of RFID systems.

RFID systems are often categorized by their operating frequency band. Frequency refers to the size of the radio waves used to communicate between system components. RFID systems throughout the world operate in low frequency (LF), high frequency (HF), and ultra-high frequency (UHF) bands. Radio waves behave differently at each of these frequencies and there are advantages and disadvantages associated with using each frequency band. For example, if an RFID system operates at a lower frequency, it has a slower data read rate, but increased capabilities for reading near or on metal or liquid surfaces. If a system operates at a higher frequency, it generally has faster data transfer rates and longer read ranges, but more sensitivity to radio wave interference caused by liquids and metals in the environment. However technology innovations in recent years have made it possible to use ultra-high frequency RFID systems around liquids and metals.



2.2 Fig Amplitude of RFID

**Low Frequency (LF) RFID**

The LF band covers frequencies from 30 KHz to 300 KHz. Typically LF RFID systems operate at 125 KHz, although there are some that operate at 134 KHz. This frequency band provides a short read range of 10 cm, and has slower read speed than the higher frequencies, but is not very sensitive to radio wave interference. LF RFID applications include access control and livestock tracking. Standards for LF animal-tracking systems are defined in ISO 14223, and ISO/IEC 18000-2. The LF spectrum is not considered a truly global application because of slight differences in frequency and power levels throughout the world.

**High-Frequency (HF) RFID**

The HF band ranges from 3 to 30 MHz. Most HF RFID systems operate at 13.56 MHz with read ranges between 10 cm and 1 m. HF systems experience moderate sensitivity to interference. HF RFID is commonly used for ticketing, payment, and data transfer applications.

There are several HF RFID standards in place, such as the ISO 15693 standard for tracking items, and the ECMA-340 and ISO/IEC 18092 standards for Near Field Communication (NFC), a short range technology that is commonly used for data exchange between devices. Other HF standards include the ISO/IEC 14443 A and ISO/IEC 14443 standards for MIFARE technology, which used in smart cards and proximity cards, and the JIS X 6319-4 for FeliCa, which is a smart card system commonly used in electronic money cards.

**Ultra-high frequency (UHF) RFID**

The UHF frequency band covers the range from 300 MHz to 3 GHz. RAIN RFID systems comply with the UHF Gen2 standard and use the 860 to 960 MHz band. While there is some variance in frequency from region to region, RAIN RFID systems in most countries operate between 900 and 915 MHz.

The read range of passive UHF systems can be as long as 12 m, and UHF RFID has a faster data transfer rate than LF or HF. UHF RFID is the most sensitive to interference, but many UHF product manufacturers have found ways of designing tags, antennas, and readers to keep performance high even in difficult environments. Passive UHF tags are easier and cheaper to manufacture than LF and HF tags.

**RAIN RFID** is used in a wide variety of applications, ranging from retail inventory management, to pharmaceutical anti-counterfeiting, to wireless device configuration. The majority of new RFID projects are using UHF (RAIN) as opposed to LF or HF, making RAIN the fastest growing segment of the RFID market. The UHF frequency band is regulated by a single global standard called the EPCGlobal Gen2 (ISO 18000-63) UHF standard. Impinj spearheaded development of the Gen2 standard, lobbied governments to allocate frequency spectrum and co-founded the RAIN RFID Alliance along with Google, Intel, and Smartrac in order to promote the universal adoption of RAIN technology solutions across many different vertical markets.

**Active RFID Systems**

In active RFID systems, tags have their own transmitter and power source. Usually, the power source is a battery. Active tags broadcast their own signal to transmit the information stored on their microchips. Active RFID systems typically operate in the ultra-high frequency (UHF) band and offer a range of up to 100 m. In general, active tags are used on large objects, such as rail cars, big reusable containers, and other assets that need to be tracked over long distances. There are two main types of active tags: transponders and beacons. Transponders are “woken up” when they receive a radio signal from a reader, and then power on and respond by transmitting a signal back. Because transponders do not actively radiate radio waves until they receive a reader signal, they conserve battery life.

Beacons are often used in real-time locating systems (RTLS), in order to track the precise location of an asset continuously. Unlike transponders, beacons are not powered on by the reader’s signal. Instead, they emit signals at pre-set intervals. Depending on the level of locating accuracy required, beacons can be set to emit signals every few seconds, or once a day. Each beacon’s signal is received by reader antennas that are positioned around the perimeter of the area being monitored, and communicates the tag’s ID information and position. The wireless ecosystem for customers is very large and growing daily, there are use cases where Active RFID and Passive RFID are deployed simultaneously for an additive approach to asset or sensor management.

**Passive RFID Systems**

In passive RFID systems the reader and reader antenna send a radio signal to the tag. The RFID tag then uses the transmitted signal to power on, and reflect energy back to the reader. Passive RFID systems can operate in the low frequency (LF), high frequency (HF) or ultra-high frequency (UHF) radio bands. As passive system ranges are limited by the power of the tag’s backscatter (the radio signal reflected from the tag back to the reader), they are typically less than 10 m. Because passive tags do not require a power source or transmitter, and only require a tag chip and antenna, they are cheaper, smaller, and easier to manufacture than active tags. Passive tags can be packaged in many different ways, depending on the specific RFID application requirements. For instance, they may be mounted on a substrate, or sandwiched between an adhesive layer and a paper label to create smart RFID labels. Passive tags may also be embedded in a variety of devices or packages to make the tag resistant to extreme temperatures or harsh chemicals.

RAIN is a passive RFID solution which is useful for many applications, and is commonly deployed to track goods in the supply chain, to inventory products in the retail industry, to authenticate products such as pharmaceuticals, and to embed RFID capability in a variety of devices.

**Battery-Assisted Passive (BAP) Systems**

A Battery-Assisted Passive RFID tag is a type of passive tag which incorporates a crucial active tag feature. While most passive RFID tags use the energy from the RFID reader’s signal to power on the tag’s chip and backscatter to the reader, BAP tags use an integrated power source (usually a battery) to power on the chip, so all of the captured energy from the reader can be used for backscatter. Unlike transponders, BAP tags do not have their own transmitters.

**Beyond tags: Looking at the entire RFID system:**

While tags are integral to the success of your RFID application, they don’t tell the whole story. There are four key components to an RFID system: The tags, readers, antennae and the RFID information processing system. And to ensure each of these four components work together in perfect harmony, you’ll need to enlist a label converter experienced in deploying RFID solutions at scale.

**2.3 Need of RFID based attendance**

All of us enjoy the benefits of RFID solutions every day even though many of us do not recognize its presence in various situations in our daily life. We see it in retail stores, libraries, hospitals, amusement parks, airports, schools and any place where tracking of item/people movements are implemented to serve the customers better. Even though RFID related solutions were part of libraries from a long time ago, there is a sudden growth in the RFID applications for student tracking as it enhances the overall security of students in schools and other places where constant supervision of adults is required. The RFID applications can produce enormous data that can be analyzed to derive insights for decision making.

**Limitations of manual attendance system:**

The process of tracking working times has always been a complicated task. Over the years, several solutions have been developed to record the presence of employees. The most popular of these traditional manual attendance tracking systems are the time card, the perforation clock, and the time sheets. Each of these options has its own disadvantages. In recent decades, companies have slowly begun to integrate software and modern clock terminals to better track the attendance of employees. Discover the drawbacks of using traditional systems and why you should consider upgrading to an automated time recording solution.

In the 20th century, the need to accurately record employees’ working hours became an integral part of the company’s management. Legislation has been enacted to protect employees and ensure that they receive adequate compensation. Companies have begun to use various methods to record employee time. While these methods allowed companies to record employee time, they also had shortcomings.

**The main disadvantages of these traditional systems are as follows;**

**There is a risk of human error**

When you rely on punched cards or time sheets, there is always a risk of human error. Employees may record their hours of work incorrectly in a time sheet or the information may be incorrectly entered into your payroll software. These errors often occur in the workplace when you use manual time tracking solutions. Your personnel department can spend a lot of time correcting these errors. Unrecorded errors can lead to incorrect employee payments and other payroll issues.

**Employees can commit time theft**

Manual time sheets and punched cards do not prevent time theft or punching by friends. With manual time recording, an employee can use another punch card to register for his or her shift. This is called buddy punching and is a common problem in large companies.

**Manual time entry is very time-consuming**

A lot of time is spent on attendance time sheets. Your employees may have to queue to enter or exit and your human resources department may spend time dealing with time on time ticket issues. This may include replacing the scorecard, correcting time entry errors and errors, and other problems that occur when using manual time recording systems.

**Are ineffective and outdated**

Ultimately, the manual on clock piercing in systems is ineffective and outdated. They can have a significant impact on your company’s performance. Clock errors can be costly to your business. These problems are growing with a big company. You can minimize the inconvenience of using manual drilling clock solutions when you only have a dozen employees. But with a thousand or more employees, you could lose thousands of dollars in payroll errors and time theft every month.

**Keyboard and printing errors**

From collecting attendance data to collecting percentage data for each student, everything depends on manual data entry. A simple error in manual data entry can lead to an error in a student’s total attendance percentage. You can avoid this by checking all the details after each lesson. Also, try to enter the data daily and make sure they are not overloaded.

**No review of your eligibility requirements**

Create a student attendance policy based on your school’s priorities and principles. The Attendance Policy ensures that all school staff and managers are aware of good attendance practices. Try to review and follow your school’s attendance policies, which include verbal warnings, written warnings, optional and mandatory vacation markings, vacation approval policies, etc.

**Incorrect Entry of Times**

Teachers and staff get on and off and make their way through various time recording options, such as timers, touch screen kiosks, PCs, mobile phones, etc. Automatic time recording reduces administrative costs and improves efficiency. However, for this system to work properly, it needs to be integrated into your billing module. Biometric assistance is one of the safest methods of time recording. It avoids common time theft practices such as hitting a friend.

**Too much paperwork**

Managing this growing batch of data requires a system that ensures that information is archived, found, and retrieved quickly and efficiently. Paperwork can take up a lot of space if the presence is marked in the records. If your school has multiple offices, it will be even more difficult to access documents from each office in different locations. If you are still responding on paper based on the attendance system, you are more likely to choose attendance incorrectly.

**Obsolete Systems**

The use of obsolete systems carries the risk of system crashes, security issues and loss of valuable information: Have you thought about what could happen if your system does not process payroll correctly and becomes an employee complaint? A modern attendance management system reduces stress, saves time and improves accuracy. Given the few common errors you can make in attendance tracking, an all-in-one solution would be to implement automated school attendance management software that integrates intelligently with your payroll and leave management system. The result is error reduction, no stress, better management, and greater efficiency.

**How RFID Attendance System works?**

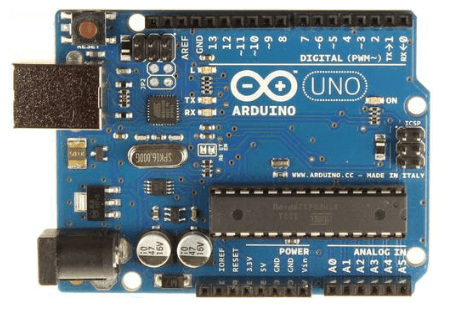
The RFID can be implemented in a school environment to derive the benefits for all stakeholders – students, parents, teachers, and management. Each student will be given an RFID tag to wear. This can be in the form of an ID card or a part of their daily uniform. Each RFID tag will be preprogrammed according to the unique user profile of the student. The antennas will be placed in strategical locations like school gate, classroom doors, library, canteen, etc. Multiple antennas can be placed around the same location to increase accuracy and work as a standby to avoid the single point of failure. The antennas will be connected to RFID readers and power source through a well-planned grid of power cables and communication cables. The RFID readers are then connected to a computer to store and process the information and database. This computer will be connected to the student information system like Fedena whereby different alerts are sent to the stakeholders. Ex: SMS alerts to parents when the student enters the main gate, Mobile app notifications when the student enters or leaves a certain area.

**CHAPTER 3**

**3.1 Arduino**

Arduino UNO

The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits. The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.



3.1 Fig Arduino uno

The components of Arduino UNO board are shown below:

3.2 Fig Components of Arduino

ATmega328 Microcontroller- It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.

ICSP pin - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

Power LED Indicator- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.

Digital I/O pins- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.

TX and RX LED's- The successful flow of data is represented by the lighting of these LED's.

AREF- The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.

Reset button- It is used to add a Reset button to the connection.

USB- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.

Crystal Oscillator- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.

Voltage Regulator- The voltage regulator converts the input voltage to 5V.

GND- Ground pins. The ground pin acts as a pin with zero voltage.

Vin- It is the input voltage.

Analog Pins- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

**Why is Arduino recommended over other boards for beginners?**

The USB port in the Arduino board is used to connect the board to the computer using the USB cable. The cable acts as a serial port and as the power supply to interface the board. Such dual functioning makes it unique to recommend and easy to use for beginners.

**What is the main difference between Arduino UNO and Arduino Nano?**

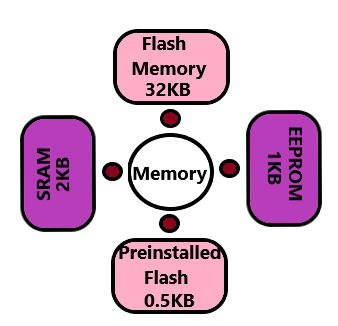
The Arduino Nano has a compact size and mini USB cable than the Arduino UNO.

**What is the main difference between Arduino UNO and Arduino Mega?**

The Arduino UNO is a standard board recommended to beginners, while Arduino Mega is used for complex projects due to its greater memory space.

Memory

The memory structure is shown in the below image:



3.3 Fig Memory structure of arduino

**Technical Specifications of Arduino UNO**

The technical specifications of the Arduino UNO are listed below:

There are 20 Input/output pins present on the Arduino UNO board. These 20 pis include 6 PWM pins, 6 analog pins, and 8 digital I/O pins. The PWM pins are Pulse Width Modulation capable pins. The crystal oscillator present in Arduino UNO comes with a frequency of 16MHz. It also has a Arduino integrated Wi-Fi module. Such Arduino UNO board is based on the Integrated Wi-Fi ESP8266 Module and ATmega328P microcontroller. The input voltage of the UNO board varies from 7V to 20V. Arduino UNO automatically draws power from the external power supply. It can also draw power from the USB.

**How to get started with Arduino UNO?**

We can program the Arduino UNO using the Arduino IDE. The Arduino IDE is the Integral Development program, which is common to all the boards. We can also use Arduino Web Editor, which allows us to upload sketches and write the code from our web browser (Google Chrome recommended) to any Arduino Board. It is an online platform. The USB connection is essential to connect the computer with the board. After the connection, the PWR pins will light in green. It is a green power LED.

**The steps to get started with Arduino UNO are listed below:**

Install the drivers of the board.

As soon we connect the board to the computer, Windows from XP to 10 will automatically install the board drivers.

But, if you have expanded or downloaded the zip package, follow the below steps:

Click on Start -> Control Panel -> System and Security.

Click on System -> Device Manager -> Ports (COM &LPT) -> Arduino UNO (COMxx). If the COM &LPT is absent, look Other Devices -> Unknown Device.

Right-click to Arduino UNO (COmxx) -> Update Driver Software -> Browse my computer for driver software.

Select the file "inf" to navigate else, select "ArduinoUNO.inf" .

Installation Finished.

Open the code or sketch written in the Arduino software.

Select the type of board.

Click on 'Tools' and select Board

Select the port. Click on the Tools -> Port (select the port). The port likely will be COM3 or higher. For example, COM6, etc. The COM1 and COM2 ports will not appear, because these two ports are reserved for the hardware serial ports.

Now, upload and run the written code or sketch.

To upload and run, click on the button present on the top panel of the Arduino display

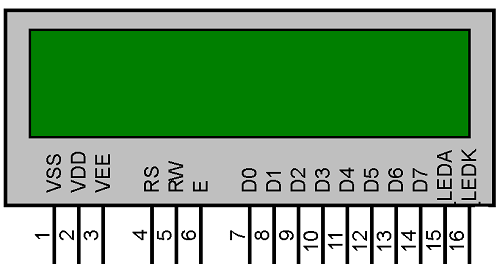
Within the few seconds after the compile and run of code or sketch, the RX and TX light present on the Arduino board will flash.

The 'Done Uploading' message will appear after the code is successfully uploaded. The message will be visible in the status bar.

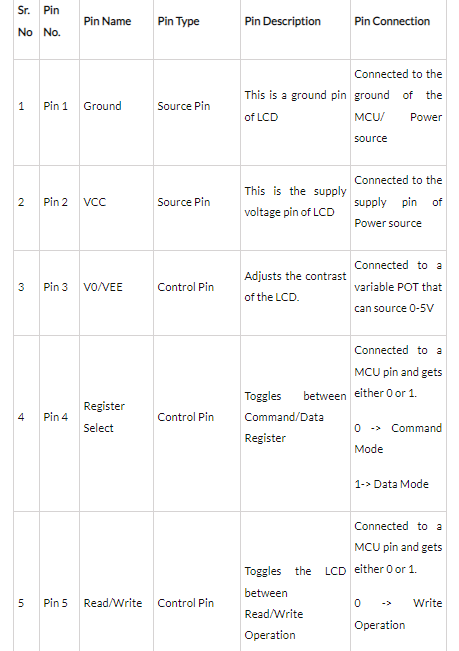
**3.2 LCD Display**

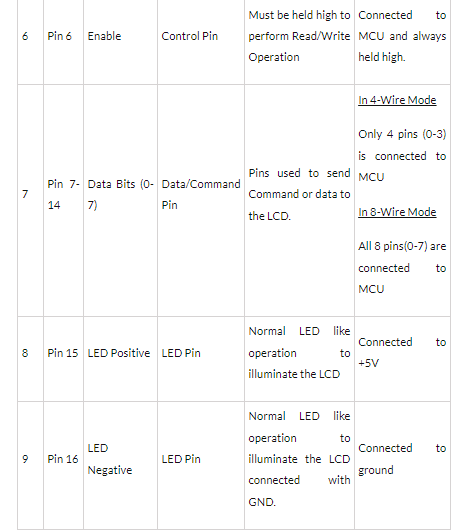
**16×2 LCD** is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16\*2 LCD, hence we are using it here.

All the above mentioned LCD display will have 16 Pins and the programming approach is also the same and hence the choice is left to you. Below is the **Pinout and Pin Description of 16x2 LCD Module**:



3.4 Fig Pin Description of lcd 16x2

****



Pin Description of LCD Display

So Now, we know that each character has (5\*8=40) 40 Pixels and for 32 Characters we will have (32\*40) 1280 Pixels. Further, the LCD should also be instructed about the Position of the Pixels. It will be a hectic task to handle everything with the help of MCU, hence an Interface IC like HD44780 is used, which is mounted on LCD Module itself. The function of this IC is to get the Commands and Data from the MCU and process them to display meaningful information onto our LCD Screen.

Let’s discuss the different type of mode and options available in our LCD that has to be controlled by our Control Pins.

**4-bit and 8-bit Mode of LCD:**

The LCD can work in two different modes, namely the 4-bit mode and the 8-bit mode. In 4 bit mode we send the data nibble by nibble, first upper nibble and then lower nibble. For those of you who don’t know what a nibble is: a nibble is a group of four bits, so the lower four bits (D0-D3) of a byte form the lower nibble while the upper four bits (D4-D7) of a byte form the higher nibble. This enables us to send 8 bit data.

Whereas in 8 bit mode we can send the 8-bit data directly in one stroke since we use all the 8 data lines.

Now you must have guessed it, Yes 8-bit mode is faster and flawless than 4-bit mode. But the major drawback is that it needs 8 data lines connected to the microcontroller. This will make us run out of I/O pins on our MCU, so 4-bit mode is widely used. No control pins are used to set these modes. It's just the way of programming that change.

Read and Write Mode of LCD: As said, the LCD itself consists of an Interface IC. The MCU can either read or write to this interface IC. Most of the times we will be just writing to the IC, since reading will make it more complex and such scenarios are very rare. Information like position of cursor, status completion interrupts etc. can be read if required, but it is out of the scope of this tutorial.

**3.3 RFID Reader**

Usage

A visual indication of the state of the RFID Card Reader is given with the on-board LED. When the module is successfully powered-up and is in an idle state, the LED will be GREEN. When the module is in an active state searching for or communicating with a valid tag, the LED will be RED. The RFID Card Reader Serial version is activated via the /ENABLE pin on the module’s 4-pin header. When the RFID Card Reader is powered and /ENABLE is pulled LOW, the module will enter the active state. When /ENABLE is pulled HIGH or left unconnected, the module will enter the idle state. The RFID Card Reader USB version is activated via the DTR line of the USB Virtual COM port. When the

DTR line is set HIGH, the module will enter the active state. When the DTR line is set LOW, the module will enter the idle state. The face of the RFID tag should be held parallel to the front or back face of the antenna (where the majority of RF energy is emitted). If the tag is held sideways (for example, perpendicular to the antenna), you’ll either get no reading or a poor reading distance. Only one transponder tag should be held up to the antenna at any time. The use of multiple tags at one time will cause tag collisions and the reader may not detect any of them. The tags available in the Parallax store have a read distance of approximately 4 inches. Actual distance may vary slightly depending on the size of the transponder tag and environmental conditions of the application.

**Communication Protocol**

All communication is 8 data bits, no parity, 1 stop bit, and least significant bit first (8N1) at 2400 bps. The RFID Card Reader Serial version transmits data as 5 V TTL-level, non-inverted asynchronous serial. The RFID Card Reader USB version transmits the data through the USB Virtual COM Port driver. This allows easy access to the serial data stream from any software application, programming language, or interface that can communicate with a COM port. When the RFID Card Reader is active and a valid RFID transponder tag is placed within range of the activated reader, the tag’s unique ID will be transmitted as a 12-byte printable ASCII string serially to the host.

The start byte and stop byte are used to easily identify that a correct string has been received from the reader (they correspond to line feed and carriage return characters, respectively). The middle ten bytes are the actual tag's unique ID. For example, for a tag with a valid ID of 0F0184F07A, the following bytes would be sent: 0x0A, 0x30, 0x46, 0x30, 0x31, 0x38, 0x34, 0x46, 0x30, 0x37, 0x41, 0x0D.

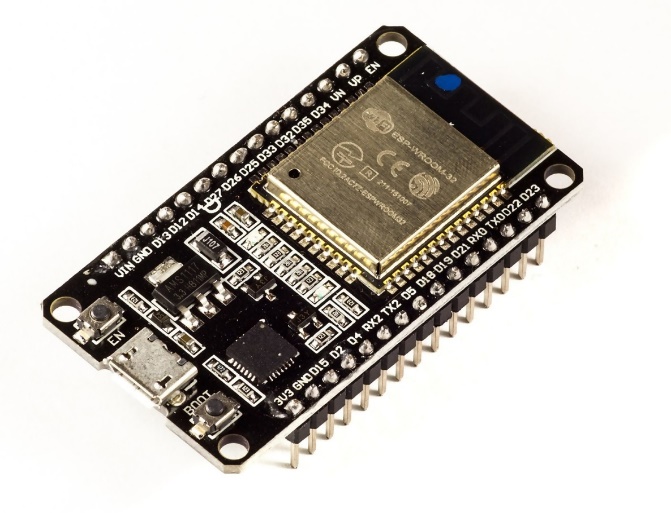
**RFID Technology Overview**

Radio Frequency Identification (RFID) is a generic term for non-contacting technologies that use radio waves to automatically identify people or objects. There are several methods of identification, but the most common is to store a unique serial number that identifies a person or object on a microchip that is attached to an antenna. The combined antenna and microchip are called an "RFID transponder" or "RFID tag" and work in combination with an "RFID reader" (sometimes called an "RFID interrogator"). An RFID system consists of a reader and one or more tags. The reader's antenna is used to transmit radio frequency (RF) energy. Depending on the tag type, the energy is "harvested" by the tag's antenna and used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader. The reader receives the modulated waves and converts them into digital data.

There are two major types of tag technologies. "Passive tags" are tags that do not contain their own power source or transmitter. When radio waves from the reader reach the chip’s antenna, the energy is converted by the antenna into electricity that can power up the microchip in the tag (typically via inductive coupling). The tag is then able to send back any information stored on the tag by modulating the reader’s electromagnetic waves. "Active tags" have their own power source and transmitter. The power source, usually a battery, is used to run the microchip's circuitry and to broadcast a signal to a reader. Due to the fact that passive tags do not have their own transmitter and must reflect their signal to the reader, the reading distance is much shorter than with active tags. However, active tags are typically larger, more expensive, and require occasional service.

Frequency refers to the size of the radio waves used to communicate between the RFID system components. Just as you tune your radio to different frequencies in order to hear different radio stations, RFID tags and readers must be tuned to the same frequency in order to communicate effectively. RFID systems typically use one of the following frequency ranges: low frequency (or LF, around 125 kHz), high frequency (or HF, around 13.56 MHz), ultra-high frequency (or UHF, around 868 and 928 MHz), or microwave (around 2.45 and 5.8 GHz).The read range of a tag ultimately depends on many factors: the frequency of RFID system operation, the power of the reader, and interference from other RF devices. Balancing a number of engineering trade-offs (antenna size v. reading distance v. power v. manufacturing cost), the Parallax RFID Card Reader's antenna was designed specifically for use with low-frequency (125 kHz) passive tags with a read distance of around 4 inches

**3.4 Wi – Fi Module**



3.5 Fig esp 32

The ESP32 is a very versatile System On a Chip (SoC) that can be used as a general purpose microcontroller with quite an extensive set of peripherals including WiFi and Bluetooth wireless capabilities. It is manufactured by Shanghai-based Espressif Systems, and costs less than $5. Although the ESP32 is a SoC, most users will not start by using just the ESP32 chip itself. While it is possible to design a product using the ESP32 SoC, this is not a common approach. Instead, most ESP32-based designs use pre-made modules that consist of an actual ESP-32 SoC, external flash memory, and a crystal and pre-tuned PCB antenna or an IPEX antenna connector. The whole assembly is then placed under a shielded can. This module is made by Express if itself, and this link shows several versions.

One big advantage to using this module instead of designing from scratch is that Express if has already pre-loaded the low-level device drivers, the wireless protocol stacks for Wi-Fi b, g, n, Bluetooth and BLE, and FreeRTOS as the base OS.

In addition, a bootloader has also been loaded to allow for relatively easy downloading of user applications. Another module commonly referred to as an ESP32 is what is more appropriately called an ESP32 Development Module. This is basically an ESP32 module mounted on a board with additional support circuitry such as a voltage regulator and a serial to USB IC. It allows direct connection to a desktop PC that can then be used to compile, download, and run programs directly on this module. Figure 3 shows two such development modules from different manufacturers. Note that one has more of the pins of the ESP module available than the other one, and is slightly more expensive. Otherwise, they are very similar. They each allow a direct connection to a desktop development system through a USB cable.

Now that you’ve learned about both commonly available ESP32 modules, which one should you use? The recommended approach is to use the Development Board for Proof of Concept designs since it is fully self-contained. Then, switch to the more compact ESP32 module when the application is more fully developed, and the entire hardware design is ready to be integrated. The application code can be downloaded to the ESP32 Module using an adapter board (Figure 4). It essentially provides all the functionality of the ESP32 Development Module. But the target is the ESP32 Module without the actual programming interface that is part of the Development Board.

**Key Specifications and Features:**

Processors:

Main processor: Tensilica Xtensa 32-bit LX6 microprocessor

Cores: All versions of the ESP32 series are dual-core except for ESP32-S0WD, which is single-core.

Clock frequency: up to 240 MHz

Performance: up to 600 DMIPS

Ultra low power co-processor: allows you to do ADC conversions, computation, and level thresholds while in deep sleep.

Wireless connectivity:

Wi-Fi: 802.11 b/g/n/e/i (802.11n @ 2.4 GHz up to 150 Mbit/s)

Bluetooth: v4.2 BR/EDR and Bluetooth Low Energy (BLE)

Memory:

ROM: 448 KB – For booting and core functions

SRAM: 520 KB – For data and instruction

RTC fast SRAM: 8 KB – For data storage and main CPU during RTC Boot from the deep-sleep mode

RTC slow SRAM: 8 KB – For co-processor accessing during deep-sleep mode

eFuse: 1 KBit – Of which 256 bits are used for the system (MAC address and chip configuration) and the remaining 768 bits are reserved for customer applications, including Flash-Encryption and Chip-ID

Embedded flash:

0 MB (ESP32-D0WDQ6, ESP32-D0WD, and ESP32-S0WD chips)

2 MB (ESP32-D2WD chip)

4 MB (ESP32-PICO-D4 SiP module)

Flash memory is connected internally via IO16, IO17, SD\_CMD, SD\_CLK, SD\_DATA\_0 and SD\_DATA\_1 on ESP32-D2WD and ESP32-PICO-D4.

External flash & SRAM: ESP32 supports up to four 16 MB external QSPI flashes and SRAMs with hardware encryption based on AES to protect developers’ programs and data. ESP32 can access the external QSPI flash and SRAM through high-speed caches.

Up to 16 MB of external flash are memory-mapped onto the CPU code space, supporting 8-bit, 16-bit and 32-bit access. Code execution from flash is supported.

Up to 8 MB of external flash/SRAM memory are mapped onto the CPU data space, supporting 8-bit, 16-bit and 32-bit access. Data-read is supported on the flash and SRAM. Data-write is supported on the SRAM.

Note that ESP32 chips with embedded flash do not support the address mapping between external flash and peripherals. Peripheral input/output: The ESP32 offers a rich peripheral interface with DMA that includes:

Capacitive touch

ADCs (analog-to-digital converter)

DACs (digital-to-analog converter)

I²C (Inter-Integrated Circuit)

UART (universal asynchronous receiver/transmitter)

CAN 2.0 (Controller Area Network)

SPI (Serial Peripheral Interface)

I²S (Integrated Inter-IC Sound)

RMII (Reduced Media-Independent Interface)

PWM (pulse width modulation), and more.

Security:

IEEE 802.11 standard security features all supported, including WFA, WPA/WPA2 and WAPI

Secure boot

Flash encryption

1024-bit OTP, up to 768-bit for customers

Cryptographic hardware acceleration: AES, SHA-2, RSA, elliptic curve cryptography (ECC), random number generator (RNG)

**Developing applications for the ESP32**

The usual way to develop any embedded system is to first choose the proper microcontroller, or microcontroller module, that fits the desired hardware requirements and, just as importantly, has the proper software development support. A prototype hardware platform to test the application code is developed. Then, the application software development process can begin. Assuming that the ESP32 has been chosen as the microcontroller module, the next step is to actually set up an environment where application code can be developed and tested. Developing an application for an embedded system is an iterative process that usually requires a setup on a cross-development platform whereby the code can be written, complied, linked, and loaded into the processor. After hardware testing, the whole process is repeated until you achieve the final performance requirements.

The entire process is usually carried out in an Integrated Development Environment (IDE) that, at a minimum, should provide the following: A text editor to write the application code; a compiler/linker/locater; and a loader to download the compiled binary code to the proper physical address segments in the target processor. The IDE also typically includes some kind of feature that automates the whole cycle.

**3.5 RFID tags**

RFID stands for Radio Frequency Identification. It is a technology allowing devices to automatically identify information stored in a tag through radio waves. An RFID tag consists of an antenna and a microchip in order to transmit and receive.

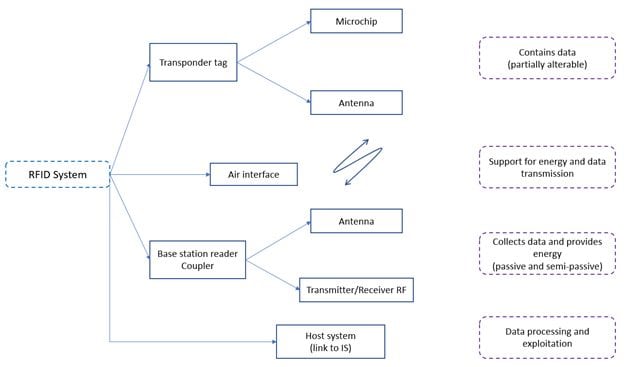


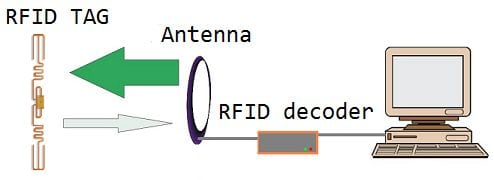
Fig 3.6 RFID

**How does it work?**

The operating principle of RFID systems is based on the remote exchange of electromagnetic waves. Specifically, the reader transmits a signal at a given frequency to one or more radio tags located in its reading field and they also transmit a signal back. The electromagnetic field feeds the label and activates the chip.

To transmit the information recorded in the chip, the chip creates an amplitude or phase modulation on the carrier frequency. Once this information is received by the reader, it transforms it into binary code. The operation remains symmetrical in the opposite direction.

The scenario of a radio frequency identification is therefore as follows:



3.7 Fig Working of RFID

The reader transmits energy by radio to activate the tag.

It queries the tags nearby.

It listens to the answers and eliminates duplicates or collisions between answers.

Finally, it transmits the results obtained to the concerned applications.

**Features of RFID :**

* An RFID tag consists of two-part which is an microcircuit and an antenna.
* This tag is covered by protective material which acts as a shield against the outer environment effect.
* This tag may active or passive in which we mainly and widely used passive RFID.

**Application of RFID :**

* It utilized in tracking shipping containers, trucks and railroad, cars.
* It uses in Asset tracking.
* It utilized in credit-card shaped for access application.
* It uses in Personnel tracking.
* Controlling access to restricted areas.
* It uses ID badging.
* Supply chain management.
* Counterfeit prevention (e.g., in the pharmaceutical industry).

**Advantages of RFID :**

* It provides data access and real-time information without taking to much time.
* RFID tags follow the instruction and store a large amount of information.
* The RFID system is non-line of sight nature of the technology.
* It improves the Efficiency, traceability of production.
* In RFID hundred of tags read in a short time.

**Disadvantages of RFID:**

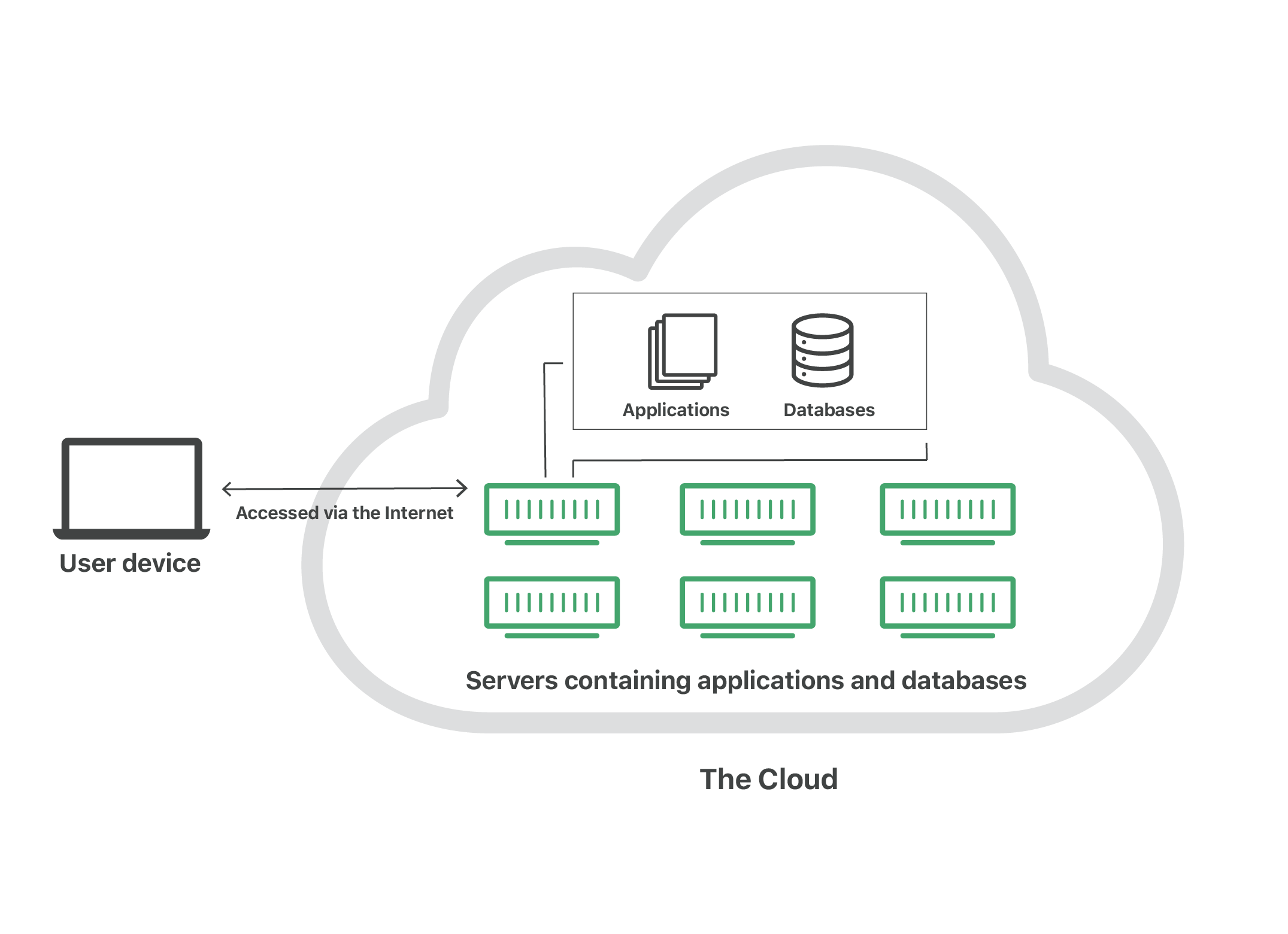
* It takes longer to program RFID Devices.
* RFID intercepted easily even it is Encrypted.
* In an RFID system, there are two or three layers of ordinary household foil to dam the radio wave.
* There is privacy concern about RFID devices anybody can access information about anything.
* Active RFID can costlier due to battery.

**CHAPTER 4**

**SOFTWARE REQUIRMENTS**

**4.1 Cloud**

"The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies do not have to manage physical servers themselves or run software applications on their own machines.

4.1 Fig Cloud

The cloud enables users to access the same files and applications from almost any device, because the computing and storage takes place on servers in a data center, instead of locally on the user device. This is why a user can log in to their Instagram account on a new phone after their old phone breaks and still find their old account in place, with all their photos, videos, and conversation history. It works the same way with cloud email providers like Gmail or Microsoft Office 365, and with cloud storage providers like Dropbox or Google Drive. For businesses, switching to cloud computing removes some IT costs and overhead: for instance, they no longer need to update and maintain their own servers, as the cloud vendor they are using will do that. This especially makes an impact for small businesses that may not have been able to afford their own internal infrastructure but can outsource their infrastructure needs affordably via the cloud. The cloud can also make it easier for companies to operate internationally, because employees and customers can access the same files and applications from any location.

**Introduction to cloud computing**

The impact of cloud computing on industry and end users would be difficult to overstate: many aspects of everyday life have been transformed by the omnipresence of software that runs on cloud networks. By leveraging cloud computing, startups and businesses are able to optimize costs and increase their offerings without purchasing and managing the hardware and software themselves. Independent developers are empowered to launch globally-available apps and online services. Researchers can share and analyze data at scales once reserved only for highly-funded projects. And internet users can quickly access software and storage to create, share, and store digital media in quantities that extend far beyond the computing capacity of their personal devices.

Despite the growing presence of cloud computing, its details remain obscure to many. What exactly is the cloud, how does one use it, and what are its benefits for businesses, developers, researchers, government, healthcare practitioners, and students? In this conceptual article, we’ll provide a general overview of cloud computing, its history, delivery models, offerings, and risks.

In this article, you will gain an understanding of how the cloud can help support business, research, education, and community infrastructure and how to get started using the cloud for your own projects.

**What is Cloud Computing?**

Cloud computing is the delivery of computing resources as a service, meaning that the resources are owned and managed by the cloud provider rather than the end user. Those resources may include anything from browser-based software applications (such as Tik Tok or Netflix), third party data storage for photos and other digital media (such as iCloud or Dropbox), or third-party servers used to support the computing infrastructure of a business, research, or personal project.

Before the broad proliferation of cloud computing, businesses and general computer users typically had to buy and maintain the software and hardware that they wished to use. With the growing availability of cloud-based applications, storage, services, and machines, businesses and consumers now have access to a wealth of on-demand computing resources as internet-accessed services. Shifting from on-premise software and hardware to networked remote and distributed resources means cloud users no longer have to invest the labor, capital, or expertise required for buying and maintaining these computing resources themselves. This unprecedented access to computing resources has given rise to a new wave of cloud-based businesses, changed IT practices across industries, and transformed many everyday computer-assisted practices. With the cloud, individuals can now work with colleagues over video meetings and other collaborative platforms, access entertainment and educational content on demand, communicate with household appliances, hail a cab with a mobile device, and rent a vacation room in someone’s house.

**Defining Cloud Computing**

The National Institute of Standards and Technology (NIST), a non-regulatory agency of the United States Department of Commerce with a mission to advance innovation, defines cloud computing as:a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

NIST lists the following as the five essential characteristics of cloud computing: On-demand self-service: Cloud resources can be accessed or provisioned without human interaction. With this model, consumers can gain immediate access to cloud services upon signup. Organizations can also create mechanisms for allowing employees, customers, or partners to access internal cloud services on demand according to predetermined logics without needing to go through IT services.

Broad network access: Users can access cloud services and resources through any device and in any networked location provided that they have permission. Resource pooling: Cloud provider resources are shared by multiple tenants while keeping the data of individual clients hidden from other clients. Rapid elasticity: Unlike on-premise hardware and software, cloud computing resources can be rapidly increased, decreased, or otherwise modified based on the cloud user’s changing needs. Measured service: Usage of cloud resources is metered so that businesses and other cloud users need only pay for the resources they use in any given billing cycle. These characteristics offer a wide variety of transformative opportunities for businesses and individuals alike, which we’ll discuss later in the section Benefits of Cloud Computing. To gain some additional context, let’s briefly review the emergence of cloud computing.

**History of Cloud Computing**

Many aspects of cloud computing can be traced as far back as the 1950s, when universities and companies rented out computation time on mainframe computers. At the time, renting was one of the only ways to access computing resources as computing technology was too large and expensive to be owned or managed by individuals. By the 1960s, computer scientists like John McCarthy of Stanford University and J.C.R Licklider of The U.S. Department of Defense Advanced Research Projects Agency (ARPA) began proposing ideas that anticipated some of the major features of cloud computing today, such as the conceptualization of computing as a public utility and the possibility of a network of computers that would allow people to access data and programs from anywhere in the world.

Cloud computing, however, didn’t become a mainstream reality and a popular term until the first decade of the 21st century. This decade saw the launch of cloud services like Amazon’s Elastic Compute (EC2) and Simple Storage Service (S3) in 2006, Heroku in 2007, Google Cloud Platform in 2008, Alibaba Cloud in 2009, Windows Azure (now Microsoft Azure) in 2010, IBM’s SmartCloud in 2011, and DigitalOcean in 2011. These services allowed existing businesses to optimize costs by migrating their in-house IT infrastructure to cloud-based resources and provided independent developers and small developer teams resources for creating and deploying apps. Cloud-based applications, known as Software as a Service (SasS) — which we’ll discuss in greater detail in the Cloud Delivery Models section — also became popular during this time period. Unlike on-premise software, or software that users need to physically install and maintain on their machines, SaaS increased the availability of applications by allowing users to access them from a variety of devices on demand. Some of these cloud-based applications — such as Google’s productivity apps (Gmail, Drive, and Docs) and Microsoft 365 (a cloud-based version of the Microsoft Office Suite) — were offered by the same companies that launched cloud infrastructure services, while other pre-existing software products, such as Adobe Creative Cloud, were launched as cloud-based applications using the services of cloud providers. New SaaS products and businesses also emerged based on the novel opportunities of these cloud providers, such as Netflix’s streaming services in 2007, the music platform Spotify in 2008, the file-hosting service Dropbox in 2009, the video conferencing service Zoom in 2012, and the communication tool Slack in 2013. Today, cloud-based IT infrastructure and cloud-based applications have become a popular choice for both businesses and individual users and their market share is expected to grow.

**Cloud Delivery Models**

Cloud resources are provided in a variety of different delivery models that offer customers different levels of support and flexibility.

**Infrastructure as a Service (IaaS)**

IaaS is the on-demand delivery of computing infrastructure, including operating systems, networking, storage, and other infrastructural components. Acting much like a virtual equivalent to physical servers, IaaS relieves cloud users of the need to buy and maintain physical servers while also providing the flexibility to scale and pay for resources as needed. IaaS is a popular option for businesses that wish to leverage the advantages of the cloud and have system administrators who can oversee the installation, configuration, and management of operating systems, development tools, and other underlying infrastructure that they wish to use. However, IaaS is also used by developers, researchers, and others who wish to customize the underlying infrastructure of their computing environment. Given its flexibility, IaaS can support everything from a company’s computing infrastructure to web hosting to big data analysis.

**Platform as a Service (PaaS)**

PaaS provides a computing platform where the underlying infrastructure (such as the operating system and other software) is installed, configured, and maintained by the provider, allowing users to focus their efforts on developing and deploying apps in a tested and standardized environment. PaaS is commonly used by software developers and developer teams as it cuts down on the complexity of setting up and maintaining computer infrastructure, while also supporting collaboration among distributed teams. PaaS can be a good choice for developers who don’t have the need to customize their underlying infrastructure, or those who want to focus their attention on development rather than DevOps and system administration.

**Software as a Service (SaaS)**

SaaS providers are cloud-based applications that users access on demand from the internet without needing to install or maintain the software. Examples include GitHub, Google Docs, Slack, and Adobe Creative Cloud. SaaS applications are popular among businesses and general users given that they’re often easy to adopt, accessible from any device, and have free, premium, and enterprise versions of their applications. Like PaaS, SaaS abstracts away the underlying infrastructure of the software application so that users are only exposed to the interface they interact with.

**Cloud Environments**

Cloud services are available as public or private resources, each of which serves different needs.

**Public Cloud**

The public cloud refers to cloud services (such as virtual machines, storage, or applications) offered publicly by a commercial provider to businesses and individuals. Public cloud resources are hosted on the commercial provider’s hardware, which users access through the internet. They are not always suitable for organizations in highly-regulated industries, such as healthcare or finance, as public cloud environments may not comply with industry regulations regarding customer data.

**Private Cloud**

The private cloud refers to cloud services that are owned and managed by the organization that uses them and available only to the organization’s employees and customers. Private clouds allow organizations to exert greater control over their computing environment and their stored data, which can be necessary for organizations in highly-regulated industries. Private clouds are sometimes seen as more secure than public clouds as they are accessed through private networks and enable the organization to directly oversee their cloud security. Public cloud providers sometimes provide their services as applications that can be installed on private clouds, allowing organizations to keep their infrastructure and data on premise while taking advantage of the public cloud’s latest innovations.

**Hybrid Cloud and Multicloud**

Many organizations use a hybrid cloud environment which combines public and private cloud resources to support the organization’s computing needs while maintaining compliance with industry regulation. Multicloud environments are also common, which entail the use of more than one public cloud provider (for example, combining Amazon Web Services and DigitalOcean).

**Benefits of Cloud Computing**

Cloud computing offers a variety of benefits to individuals, businesses, developers, and other organizations. These benefits vary according to the cloud users goals and activities.

**For Business and Industry**

Prior to the proliferation of cloud computing, most businesses and organizations needed to purchase and maintain the software and hardware that supported their computing activities. As cloud computing resources became available, many businesses began using them to store data, provide enterprise software, and deploy online products and services. Some of these cloud-based adoptions and innovations are industry-specific. In healthcare, many providers use cloud services that are specifically designed to store and share patient data or communicate with patients. In academia, educators and researchers use cloud-based teaching and research apps. But there are also a large number of general cloud-based tools that have been adopted across industries, such as apps for productivity, messaging, expense management, video conferencing, project management, newsletters, surveys, customer relations management, identity management, and scheduling. The rapid growth of cloud-based business apps and infrastructure shows that the cloud isn’t just changing business IT strategy: it’s a booming business in its own right.

Cloud-based technologies offer businesses several key advantages. First, they can help optimize IT costs. As businesses shift towards renting computing resources, they no longer have to invest as much in purchasing and maintaining on-premise IT infrastructure. Cloud computing is also enormously flexible, allowing businesses to rapidly scale (and only pay for) the computing resources they actually use. Cost, however, is not the only consideration that drives cloud adoption in business. Cloud-based technologies can help make internal IT processes more efficient as they can be accessed on demand by employees without needing to go through IT approval processes. Cloud-based apps can improve collaboration across a business as they allow for real-time communication and data sharing.

**For Independent Developers**

Computing resources that were once only affordable to large companies and organizations are now available on demand through an internet connection and at a fraction of their previous cost. In effect, independent developers can rapidly deploy and experiment with cloud-based apps. Cloud-based apps for sharing code (such as GitHub) have also made it easier for developers to build upon and collaborate on open source software projects. Additionally, cloud-based educational platforms and interactive coding tutorials have expanded access to developer education, enabling individuals without formal technical training to learn to code in their own time.

Altogether, these cloud-based computing and educational resources have helped lower the barriers to learning developer skills and deploying cloud-based apps. Formal training, company support, and massive amounts of startup capital are no longer necessary for individuals to experiment with creating and deploying apps, allowing for more individuals to participate in cloud development, compete with established industry players, and create and share apps as side projects.

**For Researchers**

As machine learning methods become increasingly important in scientific research, cloud computing has become essential to many scientific fields, including astronomy, physics, genomics, and artificial intelligence. The massive amount of data collected and analyzed in machine learning and other data-intensive research projects often require computing resources that scale beyond the capacity of hardware owned by an individual researcher or provisioned by the university. Cloud computing allows researchers to access (and only pay for) computing resources as their workloads require and allows for real-time collaboration with research partners across the globe. Without commercial cloud providers, a majority of academic machine learning research would be limited to individuals with access to university-provisioned, high-powered computing resources.

**For Educators and Students**

Cloud computing has also provided students with tools for supplementing their education and opportunities to put their technical skills into practice as they learn. Cloud-based apps for sharing, teaching, and collaborating on code and data (such as GitHub and Jupyter Notebooks) enable students to learn technical skills in a hands-on manner by studying, deploying, and contributing to open source software and research projects relevant to their field or professional aspirations. And just like independent developers, students are able to use cloud computing resources to share their code and apps with the public and reap the satisfaction of understanding the real-world application of their skills.

Students, researchers, and educators can also take advantage of cloud computing resources to support personalized academic infrastructure and practice greater control over their computing environments. Some academics prefer this approach as it lets them pick which applications they use, customize the functionality and design of these tools, and limit or prohibit the collection of data. There are also a growing number of cloud-based applications developed specifically for academic purposes that supplement or provide alternatives to traditional academic IT offerings. Voyant Tools offers students and researchers a code-free method for providing textual analysis on documents of their choosing and The HathiTrust provides access to its digital collection of millions of volumes. Reclaim Hosting, Commons in a Box, the Modern Language Humanities Commons, and Manifold offer educational, publishing, and networking tools designed specifically for academic communities.

**For Community Infrastructure**

Some individuals and communities choose to install and manage their own cloud-based software to serve community needs and values, customize functionality, protect user data, and have more control over their computing environment. Open source software, such as social media tools like Mastodon, video conferencing software like Jitsi, collaborative text editors like Etherpad, and web chat tools like Rocket Chat, provide alternatives to SaaS platforms that often limit user’s control, privacy, and oversight over their computing environment. While often requiring more administrative work than SaaS applications or social media platforms, some communities prefer these options given ethical concerns about the use of personal data and company practices with popular platforms and SaaS applications.

**Risks, Costs, and Ethics in Cloud Computing**

Though the cloud offers many benefits, it also comes with its own set of risks, costs, and ethical questions that should be considered. Some of these issues are relevant to all cloud users, while others are more applicable to businesses and organizations that use the cloud to store customers’ data:

**Considerations for all cloud users:**

Security: Cloud resources can have additional security vulnerabilities (compared to traditional on-premise data centers) given their use of APIs, cloud-based credentials, and on-demand services that make it easier for attackers to obtain unauthorized access. Find out what measures the cloud service provider takes to secure customer data from theft and other attacks and what practices or additional services customers can implement to safeguard their data.

Data loss: Just as with physically-owned or managed devices, cloud services can permanently lose stored data due to physical disasters, bugs, unintended syncing, user-generated errors, or other unforeseen issues. When implementing cloud services, find out what backup services the provider offers and be aware that these may not be automatically or freely provided. You may also choose to run backups yourself.

Data persistence: There are times when cloud users may want to ensure the deletion of personal data they’ve given to cloud service providers. However, the processes for deleting data on cloud resources and verifying that deletion can be time-consuming, complicated, or even impossible. Before you give cloud providers access to your data, find out what their policies are for deleting it in case you want to remove the data later.

Costs: Though the cloud can provide computing services at a fraction of the cost of owning them, expenses for cloud services can quickly ramp up with usage. When signing up for a cloud service, check the billing details to learn how services are metered and whether you can set caps or notifications when usage goes beyond your desired limits. It is also worth researching how billing details are communicated, as the billing methods of some providers are not always easy to understand.

Vendor lock-in: Users of proprietary cloud services may be at more risk for vendor lock in, or the condition in which it becomes difficult or impossible to change providers once computing operations are structured to fit a closed, proprietary system. Using open source cloud solutions can help alleviate this risk as its open standards make it easier to migrate computing operations from one provider to another. However, cloud users should be aware that any migration will take work, planning, and expertise.

Company use of data: Cloud service providers may use data to understand customer use of their product, sell or personalize ads, train machine learning algorithms, or even sell customer data to outside entities. If you have concerns about how your or your organization’s data is used, make sure to find out the service provider’s policies regarding their use of it.

Company ethic: Given the vast power some cloud service providers have over world affairs, cloud users may want to consider the ethics of the company that their business is supporting. Reviewing company practices with regard to topics such as data collection, advertising, hate speech, politics, misinformation, the environment, and labor may help a cloud user choose a provider that best reflects their personal values.

Loss of user control and visibility: The use of third-party computing resources makes it difficult or impossible for cloud users to have full visibility and control over their computing environments, which can create a variety of technical and trust concerns. Some of these technical concerns can be helped through the use of monitoring and analytics tools which allow cloud users to stay updated on their infrastructure’s performance, allowing users to respond quickly when problems arise. Trust concerns — such as those related to a company’s use of personal data — can be addressed by reviewing the company’s customer data policies and public forms of analysis about its data practices.

**Additional Business Considerations:**

Regulation: Some industries — such as healthcare, finance, and education — have strict regulations regarding the storage and use of customer data and may prohibit the storage of customer data in public clouds. Cloud users in these industries often need to adopt a hybrid cloud approach and other customized IT solutions in order to comply with regulations regarding customer data. In addition to industry regulations, organizations also need to comply with data protection and privacy laws of the location where their service is accessed. For example, cloud providers serving customers in the European Union must comply with the General Data Protection Regulation (GDPR).

Complexity: Migrating an organization’s computing resources to the cloud can be an extremely complex endeavor, requiring in-depth planning, governance structures, and continuous oversight to avoid incompatibilities, data loss, and cost optimization. Though the cloud can help organizations cut costs on computing infrastructure, they will still need IT experts to direct and manage infrastructure.

**4.2 Mobile Applications**

Mobile application development is the process of designing and building software for use on mobile devices. A mobile application can be pre-installed or downloaded from an app store or mobile web browser. The application must have a network connection to a remote server or computer, which is facilitated by an application programming interface (API).

**Mobile Application Platforms**

Most mobile applications are developed for two main smartphone platforms—the Android operating system and Apple’s iOS. While Apple creates its iOS exclusively for its own iPhones and other mobile devices, Google develops the Android system so that it can be used on devices other than their own. Each of these platforms requires different software development kits (SDKs) and each uses different development tools. It is common for developers to develop mobile applications to be compatible with both Android and iOS.

**Types of Mobile Applications**

There are four types of mobile applications that are typically developed, each of which comes with advantages and disadvantages. They are:

**Native Mobile Applications**

Native mobile applications are developed strictly to be run on the operating system of the target device, whether that is Android or iOS. This means they are developed using the programming language and frameworks that are provided by Google or Apple. These applications offer the best runtime performance, plus they provide direct access to the APIs of the device. However, they cost more to build and maintain and there is more than one code-base for each platform, making it more complex and requiring a highly specialized skillset to develop.

**Cross-platform Native Mobile Applications**

These are mobile applications that are initially developed using multiple programming languages and frameworks but are then assembled specifically to be used on a specific operating system. With a single code base that can be used for multiple platforms, this is a more versatile option. The applications are easy to build and maintain, but there are limitations to their performance because of the need for bridging and the use of libraries for native device features.

**Hybrid Mobile Applications**

These are mobile applications that are developed using standard web programming languages, such as HTML5 and JavaScript. Once created, they are bundled into app installation packages. They can then operate on a web container that makes it possible for the app to run on a browser and on native devices via an API. The code base for these mobile applications is shared between the app and the web. This means mobile applications can be built using a web development skillset. However, these applications come with lower performance when compared to native applications. There is also limited support when it comes to native device features.

**Progressive Web Applications**

Progressive Web Applications (PWAs) are web applications that are fully available via a web browser. This means they are not available via an app store and there is no app installation required. The experience is just like using a true application, but with the benefits of operating via a browser, such as running background processes and linking to the home screen of the device. This type of mobile application provides the most flexibility because the same application can be used on a mobile device and on the web. Plus, there is no installation required. Instead, the app is available via a URL. Again, this type of application offers limited support when it comes to native device features and the capabilities of the app are browser dependent.

Mobile applications rely on two core components—the mobile application itself, known as the “front-end,” which is integrated with the cloud-based “backend.” The backend supports the mobile front-end, supplying it with the data required to run and comply with user requests. Communication between the backend and the front end takes place via APIs.

In most cases, a mobile application programmer is a person with the skillset and knowledge to develop the front-end application that resides on the user’s device. The development of the front end can be done by a single person or a team of people. The application development lifecycle is comprised of the following steps:

* Development
* Testing
* Release
* Monitoring
* Analysis

These steps are repeated as necessary until the application is running smoothly.

In many cases, the backend services are provided by a third party. Only when the mobile application backend is highly specific to the application domain and there are intellectual property concerns will mobile application programmers build their own backend. When it comes to the backend development lifecycle, it is similar to that of the front-end, as follows:

* Development
* Testing
* Release
* Monitoring
* Analysis

There is also a new method of application development known as low-code app development.This is a method of developing applications that make it easy for people with little coding experience to build an app using a highly visual drag-and-drop interface. The benefit of this ethod of application development is that non-IT people can easily develop apps with very little knowledge of coding, taking the pressure off IT teams and helping minimize IT backlog.

**Mobile Application Development Services**

Mobile applications require many different services that can be supplied by a third party, making the development process easier. These include:

* Management of user sign-up/sign-in
* Social media login
* User engagement/analytics
* Push notifications
* Real device testing
* Cloud storage
* Offline and real-time data
* Cloud functions
* Application logic
* Conversational bots
* Speech recognition
* Video and image recognition

**CHAPTER 5**

**PROGRAM, APPLICATIONS, LIMITATIONS, FUTURE VISION & CONCLUSIONS**

**5.1. PROGRAM:-**

#include <Wire.h>

#include <LiquidCrystal\_I2C.h>

LiquidCrystal\_I2C lcd(0x3F, 16, 2);

#include <ESP8266WiFi.h>

#include <WiFiClientSecure.h>

#include <SPI.h>

#include <MFRC522.h>

#define SS\_PIN D4

#define RST\_PIN D3

int l1 = 0;

int l2 = 0;

int l3 = 0;

int l4 = 0;

MFRC522 mfrc522(SS\_PIN, RST\_PIN);

const char\* host = "script.google.com";

const int httpsPort = 443;

WiFiClientSecure client;

const char\* fingerprint = "46 B2 C3 44 9C 59 09 8B 01 B6 F8 BD 4C FB 00 74 91 2F EF F6";

void setup() {

Serial.begin(9600);

pinMode(14,OUTPUT);

WiFi.begin(ssid,password);

int h = 0;

while (WiFi.status() != WL\_CONNECTED) {

h++;

lcd.setCursor(h,0);

lcd.print('.');

delay(500);

}

Wire.begin();

lcd.begin(); // initializing the LCD

lcd.backlight(); // Enable or Turn On the backlight

lcd.clear();

lcd.print("Connecting....");

delay(1000);

SPI.begin();

mfrc522.PCD\_Init();

}

void loop() {

lcd.clear();

lcd.print("Scan Card Here");

delay(1000);

if ( ! mfrc522.PICC\_IsNewCardPresent())

{

return;

}

if ( ! mfrc522.PICC\_ReadCardSerial())

{

return;

}

String content = "";

for (byte i = 0; i < mfrc522.uid.size; i++)

{

content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));

content.concat(String(mfrc522.uid.uidByte[i], HEX));

}

content.toUpperCase();

if (content.substring(1) == "76 BA 63 AF")

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Devesh Parlikar");

lcd.setCursor(0,1);

lcd.print("ID--76\_BA\_63\_AF");

sendData("Devesh\_Parlikar","29","76\_BA\_63\_AF","2206568809","2305665300","PADAMPURA\_FLAT\_NO-26","2020","COMPUTER\_SCIENCE");

l1++;

delay(3000);

if(l1 == 1)

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Devesh Parlikar");

lcd.setCursor(3,1);

lcd.print("---IN---");

sendData1("Devesh\_Parlikar","29","76\_BA\_63\_AF","IN");

delay(2000);

}

if(l1 == 2)

{

l1 = 0;

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Devesh Parlikar");

lcd.setCursor(3,1);

lcd.print("---OUT---");

sendData1("Devesh\_Parlikar","29","76\_BA\_63\_AF","OUT");

delay(2000);

}

}

else if (content.substring(1) == "A0 5B CD 1B")

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Neha Tehare");

lcd.setCursor(0,1);

lcd.print("ID--A0\_5B\_CD\_1B");

sendData("Neha\_Tehare","35","A0\_5B\_CD\_1B","2066654832","3000508691","N2-CIDCO","2020","ELECTRONICS\_TELE-COMM");

l2++;

delay(3000);

if(l2 == 1)

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Neha\_Tehare");

lcd.setCursor(3,1);

lcd.print("---IN---");

sendData1("Neha\_Tehare","35","A0\_5B\_CD\_1B","IN");

delay(2000);

}

if(l2 == 2)

{

l2 = 0;

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Neha\_Tehare");

lcd.setCursor(3,1);

lcd.print("---OUT---");

sendData1("Neha\_Tehare","35","A0\_5B\_CD\_1B","OUT");

delay(2000);

}

}

else if (content.substring(1) == "A0 1D 05 1B")

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Sakshi Bharari");

lcd.setCursor(0,1);

lcd.print("ID--A0\_1D\_05\_1B");

sendData("Sakshi\_Bharari","50","A0\_1D\_05\_1B","5002365541","2305665300","N2-CIDCO","2019","ELECTRONICS\_TELE-COMM");

l3++;

delay(3000);

if(l3 == 1)

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Sakshi\_Bharari");

lcd.setCursor(3,1);

lcd.print("---IN---");

sendData1("Sakshi\_Bharari","50","A0\_1D\_05\_1B","IN");

delay(2000);

}

if(l3 == 2)

{

l3 = 0;

lcd.clear();

lcd.setCursor(0,0);

lcd.print("Sakshi\_Bharari");

lcd.setCursor(3,1);

lcd.print("---OUT---");

sendData1("Sakshi\_Bharari","50","A0\_1D\_05\_1B","OUT");

delay(2000);

}

}

else if (content.substring(1) == "B7 EA 0B 03")

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("NUEKO KAMDO");

lcd.setCursor(0,1);

lcd.print("ID--B7\_EA\_0B\_03");

sendData("NUEKO\_KAMDO","49","B7\_EA\_0B\_03","4880099068","1248643581","N7-CIDCO","2021","COMPUTER\_SCIENCE");

l4++;

delay(3000);

if(l4 == 1)

{

lcd.clear();

lcd.setCursor(0,0);

lcd.print("NUEKO\_KAMDO");

lcd.setCursor(3,1);

lcd.print("---IN---");

sendData1("NUEKO\_KAMDO","49","B7\_EA\_0B\_03","IN");

delay(2000);

}

if(l4 == 2)

{

l4 = 0;

lcd.clear();

lcd.setCursor(0,0);

lcd.print("NUEKO\_KAMDO");

lcd.setCursor(3,1);

lcd.print("---OUT---");

sendData1("NUEKO\_KAMDO","49","B7\_EA\_0B\_03","OUT");

delay(2000);

}

}

}

void sendData(String a, String b, String c,String d, String e, String f,String g, String h)

{

client.setInsecure();

Serial.print("connecting to ");

Serial.println(host);

if (!client.connect(host, httpsPort)) {

Serial.println("connection failed");

return;

}

if (client.verify(fingerprint, host)) {

Serial.println("certificate matches");

} else {

Serial.println("certificate doesn't match");

}

String string\_a = a;

String string\_b = b;

String string\_c = c;

String string\_d = d;

String string\_e = e;

String string\_f = f;

String string\_g = g;

String string\_h = h;

String url = "/macros/s/" + GAS\_ID + "/exec?value1=" + string\_a + "&value2=" + string\_b + "&value3=" + string\_c + "&value4=" + string\_d + "&value5=" + string\_e + "&value6=" + string\_f + "&value7=" + string\_g + "&value8=" + string\_h;

Serial.print("requesting URL: ");

Serial.println(url);

client.print(String("GET ") + url + " HTTP/1.1\r\n" +

"Host: " + host + "\r\n" +

"User-Agent: BuildFailureDetectorESP8266\r\n" +

"Connection: close\r\n\r\n");

Serial.println("request sent");

while (client.connected()) {

String line = client.readStringUntil('\n');

if (line == "\r") {

Serial.println("headers received");

break;

}

}

String line = client.readStringUntil('\n');

if (line.startsWith("{\"state\":\"success\"")) {

Serial.println("esp32/Arduino CI successfull!");

} else {

Serial.println("esp32/Arduino CI has failed");

}

Serial.println("reply was:");

Serial.println("==========");

Serial.println(line);

Serial.println("==========");

Serial.println("closing connection");

}

void sendData1(String a, String b, String c,String d)

{

client.setInsecure();

Serial.print("connecting to ");

Serial.println(host);

if (!client.connect(host, httpsPort)) {

Serial.println("connection failed");

return;

}

if (client.verify(fingerprint, host)) {

Serial.println("certificate matches");

} else {

Serial.println("certificate doesn't match");

}

String string\_a = a;

String string\_b = b;

String string\_c = c;

String string\_d = d;

String url = "/macros/s/" + GAS\_ID1 + "/exec?value1=" + string\_a + "&value2=" + string\_b + "&value3=" + string\_c + "&value4=" + string\_d;

Serial.print("requesting URL: ");

Serial.println(url);

client.print(String("GET ") + url + " HTTP/1.1\r\n" +

"Host: " + host + "\r\n" +

"User-Agent: BuildFailureDetectorESP8266\r\n" +

"Connection: close\r\n\r\n");

Serial.println("request sent");

while (client.connected()) {

String line = client.readStringUntil('\n');

if (line == "\r") {

Serial.println("headers received");

break;

}

}

String line = client.readStringUntil('\n');

if (line.startsWith("{\"state\":\"success\"")) {

Serial.println("esp32/Arduino CI successfull!");

} else {

Serial.println("esp32/Arduino CI has failed");

}

Serial.println("reply was:");

Serial.println("==========");

Serial.println(line);

Serial.println("==========");

Serial.println("closing connection");

}

**5.2 APPLICATIONS:-**

First of all, RFID allows for tracing every single item in a batch with an identification number per object. At the second place, RFID makes possible to read all the ID numbers in a box or pallet at the same time. At the third place, RFID offers the storage of more information per item which is updated in real-time. At last but not least, thanks to RFID you can read the RFID labels without manual direct sight-line. As a result, RFID systems are faster, more reliable, and they are the most costeffective solution.

Here are the main RFID applications you can find in your daily life

* Traceability in the supply chain
* Logistics and inventories in the retail industry
* Security control and jewelry
* Cosmetics and medicines
* Control of disposals and tools in hospitals
* Libraries
* Files and archives
* Aviation baggage control
* Sports timing
* Human traceability and access control in facilities
* Doors lock
* Traceability of animals

**RFID solutions for logistics**

The RFID solutions for logistics gather a wide range of RFID solutions. You can find them in almost every business process. For example, from tracking returnable transport units in the supply chain to retail inventories management. The automatic control of logistics is one of the major challenges nowadays and RFID technology is an essential tool for that. You can find more information about RFID logistics and how it improves companies competitiveness linked here.

**Automatic management with RFID technology**

Automatic management with RFID technology has the capacity to significantly improve global logistics chains. And it also increases the overall efficiency of the identification processes. Major retailers and their suppliers are already tagging pallets, cases and other returnable transport items (RTIs) like plastic crates used for fresh foods. On the other hand, logistics also is the control of retailers inventories. That’s why logistics is so wide and complex.

**Benefits of RFID solutions for logistics**

As we already have said, the definition of logistics gets together a lot of business processes. Below you can find the main benefits of automatic control of logistics with RFID technology.

**For Manufacturers**

* Better customer service
* Process optimization
* Faster billing Optimization of shipping papers

**For Distributors**

* Higher shipping accuracy
* Faster and more reliable deliveries
* Better traceability Greater cost savings

**For Retailers**

* Faster processes
* Less out of stocks

**RFID solutions for apparel**

There are several adequate smart labels that suit RFID systems designed for apparel. Here we are going to see the main RFID solutions for apparel. Trace-ID delivers these RFID tags as a standard format or customized. Do you know that RFID tagging increases sales? Here you know about the benefits of RFID solutions for apparel sales.

**Smart hangtags for apparel**

In this format, the RFID inlay is inside the label and become invisible to the customer. Generally, these labels are made with paper. But also they are possible with other materials. Above all, the comparative advantages of this type of smart labels are two. In the first place, they can be fully printed with creative colour designs, as customer wishes. In the second place, the RFID inlay remains discreetly invisible inside.

**RFID STICKERS**

As we already have explained in RFID tags page, the standard formats of RFID tags are “dry inlays”, “wets” and “white-wets”. As a rule, wets and white-wets are adhesive to be attached to boxes, papers, labels, bags, etc. But as a difference, the white-wets are printable because they have a front material that protects the chip. Wets are always transparent and they can’t be printed. On the other hand, depending on the position of PET material in wets, the chip is protected or not. Wets and white-wets are standard formats, so its size is very adjusted to the antenna’s size and is always the same size depending on the inlay’s model. Finally, in wets and white-wets the inlay’s position is always centred.

**Customized stickers as RFID solutions for apparel**

In opposite, when the sticker is a customized RFID tag, the size and the inlay’s position could be chosen by the customer. Besides, customized RFID labels are always printable.

**RFID polyester labels**

In the same way as the smart hangtags, in polyester labels, the RFID inlay remains invisible to the customer because it’s inserted between two polyester layers. Polyester labels can be sewn on clothes —but not directly, the better way to do that is to sew the smart label to a satin tab which is softer in order to be cut later, because the polyester label is quite tough. Another advantage of this kind of labels is that they can be printed as well. RFID polyester labels are the RFID solution for textile as well. The size and position of the inlay are personalized.

**DUAL TAG AND TH-WING**

If you are interested in RFID solutions for apparel, don’t miss these two videos about RFID Dual tag R3741L and TH-Wing. Both are specially designed for apparel retailing.

**RFID solution for food**

The RFID solution for food is one of our star products. Specifically RFID tags for hams and sausages. This food traceability product complies with the EU food safety directives.

**RFID smart label for the ham industry**

The RFID tag for the ham industry is the result of our close collaboration with our customers and partners. For its design, we have also taken into account the relevant food regulations. In addition to food storage factors that can affect the performance of the RFID system. For all this, we have accumulated valuable experience in understanding this type of product. Specifically, it is a ductile and at the same time durable RFID tag. Thanks to its design, the label can be hung and does not need to stick to the product. The RFID inlay is always kept isolated inside the tag. In this way, it is protected from the environment, while it is never in direct contact with the food product.

**Regulations that an RFID solution for food must meet**

Trace-ID is an RFID consumables manufacturer settled in Spain, Europe. That’s why the regulations we meet are mainly from UE organisations. Regarding smart labels for food we are compliant with:

* First, the EC 1935/2004 of the European Parliament on materials and articles intended to come into contact with food.
* Second, the EC2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.
* Third. the EC 10/2011 on plastic materials and articles intended to be in contact with food.

**RFID solution for jewelry**

The RFID solution for jewelry is specially designed to suit jewels that need to be traced and safe of theft, losses and counterfeiting. We are aware that jewels are valuable items. But they are difficult to tag because of its size.

**RFID tag for jewels**

Trace-ID is precisely a specialist in this kind of RFID consumables. Years of experience selling this product guarantee us. During all this time of expertise, we have developed an RFID solution for small items like rings, necklaces, earrings and even watches. Our RFID tag for jewelry and bijoux is discreet and soft. We know that our customers need RFID tags for jewels very discreet. At the same time, they need that it secures the product’s safety. Finally, thanks to the tag’s shape it’s easy to link to items.

**RFID hardware to complete the RFID solution for jewelry**

Depending on the features of the client’s RFID deployment, we can deliver the best devices that fit the most. Trace-ID can supply hardware from CSL and Times-7 and others that you find in our RFID hardware page. Our team will do its best to offer the best consumables and hardware for your RFID system for jewelry, bijoux and watches. Just ask us for your solution

**RFID solution for sports timing**

Trace and temporize a race’s participants with a disposable RFID solution for sports timing that can be attached to the runner’s bib, clothes or shoe. The RFID label for sports timing by Trace-ID, Chronotrace, have been tested for years with successful results. The loyalty of our customers when buying this RFID tag on foam for sports timing is the best proof of that.

**Chronotrace**

Chronotrace is an RFID solution created for all types of sports competitions where the follow-up and timing of the participants must be detailed and fast. Thanks to its format, the label can be placed near the torso without this altering its performance because of the high water content of the human body. This RFID tag is built on foam to protect the RFID inlay. In addition, it’s adhesive so you can attach it where you need.

**Trusted RFID solution to trace people in events**

This RFID label for sports timing can be attached to the runner’s garments. On the other hand, the tags are disposable. So, you can distribute them to the participants. Afterwards trace and temporize the runner’s races. And finally, you don’t need to collect them back. Because all data are recollected in the RFID system. In addition, if you also need RFID hardware, don’t hesitate to ask us for it. We will be happy to help you to choose the best option from our hardware suppliers. If you are still doubting, you must know that the most important marathons in the world use RFID technology to trace their runners. As an example, Los Angeles Marathon.

**RFID improves speed, reliability, and safety**

There are two facts that make RFID management and coordination the fastest. On the one hand, each item tagged with an RFID tag can be individually and uniquely followed. RFID allows for identifying every item as a separate object inside the stock, transit, arrival or departure records. On the other hand, the reading of this identification number is not done one by one. Thanks to RFID technology, the reading of all the identification numbers is automatic in batch and in real-time. This is how RFID tags work, all tagged items pass through the radiofrequency field of an antenna, which communicates with an RFID reader that contributes all the data to the registration system automatically, at the same time and in real-time. That’s why RFID technology ensures the reliability and safety of data at the same time that makes the processes faster.

There are great success cases about that. Basically, the retail industry gets three great benefits of implementing RFID systems. At the first place, they reduce the number of products lost or theft. It means less economic loss. At the second place, they avoid the stockout because they have information about the stock in real-time. So they have more economic gain because they are aware of having existences to satisfying demands. Finally, their personnel are freed of manual repetitive tasks like counting and feed the inventories. As a result, there are less human errors.

Valuable and small products like jewels are frequently lost and theft, but RFID implementation increases their security. First of all, each article in the store is tagged with an RFID label feeding the inventory system with the details of each article. At the same time, there are RFID readers at exit points of the store. If any article in the inventory is moving out of the premises, the application triggers an alarm. Generally, RFID implementation not only avoids this kind of disappearances but also acts as an anti-fake agent. If the jewel or watch is RFID tagged in the brand origin facility. Then the counterfeiter has more difficulties to replicate the product because of this RFID tag. That’s because the RFID tag has a unique number and this number is assigned in origin to an only product. It’s very difficult to fake this correspondence in inventories and delivery notes. The RFID system can facilitate automatic, speeedier, accurate and multiple object identification, accounting, stock-taking, all of which improves the efficiency of the workforce.

**Control of disposals and tools in hospitals RFID**

technology in hospitals is present in many forms, from tracking surgical tools to tracking persons –patients, visitors and staff. There are several important reasons to use RFID technology in the healthcare industry for reducing medical errors. As examples, to lost essential surgery tools, or to avoid to forget surgery gauzes within patients. As well as reducing economic costs and to increase the security at healthcare buildings. The most common RFID applications in hospitals are inventory tracking, control access, staff and patients tracking, to track tools and assets, tracking disposable consumables, tracking large/expensive equipment, laundry tracking, etc. . In addition, this inventory’s updating can be with many books at the same time because RFID readers don’t need a direct line-of-sight of any barcode one by one.

**Files and archives**

The RFID tagging allows for controlling and locating important documents which need to be physical papers and no digital documents. In some cases, the number of documents can be huge, this is the reason some archives need an RFID system to trace all the documents.

**Aviation baggage control rfid**

systems enable more accurate tracking of baggage through an airport, and more efficient loading and unloading of planes. Airport RFID systems help reduce lost luggage, and also improve on-time departures resulting in lower costs and greater passenger satisfaction. With no line-of-sight requirement and the ability of RFID tags to be read while moving, in any orientation, from up to 1.5 meters away, RFID provides significant benefits over bar codes. RFID-based systems are more reliable, achieving average read rates of more than 97% compared to barcodes at about 85% on average. Since 2018,  “IATA’s Resolution 753 now in effect, airlines have started to implement baggage tracking. IATA recommends the use of the RFID technology, which is much more effective than the barcode technology mostly in use currently.” This regulation makes aviation baggage control one of the most important applications among the RFID applications.

**Human traceability and access control in facilities**

Companies can manage the information regarding the personnel’s presence and movement inside the facilities thanks to employees’ RFID cards. They can enable or not the entering permission of some people in specific rooms. The RFID cards can have much information linked in the employee’s profile.

**Doors lock**

In a very similar way than in a company’s facilities, hotels can manage the customers’ information through the RFID cards. This kind of RFID cards serves to lock doors and enable lights. As well as to know when customers are in their rooms or if they have used some services in the hotel.

**Traceability of animals**

Animal farming and pets are two examples where animals are tagged with RFID chips. This chips, and sometimes smart labels, have plenty of information about the animal, and in addition, this information can be updated rewriting the RFID chip. This feature is very important regarding to have all the animal’s health information and the information of their custody line.

**5.3. Limitations of RFID:-**

What are the disadvantages of RFID over a rival technology such as barcoding?

* RFID systems are often more expensive than barcode systems
* RFID technology is harder to understand
* Can be (debatably) less reliable
* RFID tags are usually larger than barcode labels
* Tags are application specific. No one tag fits all
* Possibility of unauthorized reading of passports and credit cards
* More than one tag can respond at the same time

**Disadvantages of RFID in more detail**

RFID systems are often more expensive than barcode systems

Expense is one of the more significant disadvantages of RFID, but there are ways to manage this. Passive tags are relatively inexpensive and, with some types, you can peel them off and stick them on various items, either manually or with an automated application system. Each has its own unique serial number. However they don’t have some of the advantages of active tags.

Active tags are more expensive because they are more complex. They comprise a microchip, a radio transceiver, an antenna and have a battery.

The read range of a passive tag is similar to that of a barcode. However the active tags are smart and more powerful, and can transmit and receive over a greater distance. While they cost more, you may still save overall, depending on the application.

When pricing an RFID system, consider costs over the system lifetime, not just the price on the day you buy it. You need to do a full lifetime costing to determine the viability of using RFID. The labour saving may be significant, so don’t be put off by up-front initial costs. You may recoup these in a very short time. Do a cost-to-benefit analysis and consider the big picture.

You can lower the initial costs. To get started, you can buy an RFID kit and carry out a trial. If this goes well, you could then build up your operation in small achievable steps, especially if cost is important.

Use active tags that are reusable. Depending on the type, you may be able to remove, relocate and reprogram them. This is a practical way of overcoming one of the major disadvantages of RFID... the high cost of active tags.

RFID technology is harder to understand

If this form of wireless technology seems a bit intimidating at first, don’t worry. It breaks down into three easy-to-understand components...

* tag (contains the ID, or serial number)
* reader (reads the information from the tag)
* computer (gets the information from the reader and stores it)

And you don’t need to know much about these systems to be able to benefit from them. Look for a system with an easy-to-understand user interface.

Can be (debatably) less reliable The RF gives RFID its strength… but is also its weakness, and potentially also one of the disadvantages of RFID.

RFID can only work if there’s enough RF signal strength. RF carries the information between reader and tag. And that’s about it. So what can go wrong? If you don’t understand it, quite a lot.

**However, you can minimize RF dead spots.** You can minimize these by using more than one reader and circularly-polarized or multiple-axis antennas.May be difficult to troubleshoot if you have problems with the RF link

Another of the disadvantages of RFID is that you can’t see RF (it’s invisible) and the tags may be hidden. So if you can’t read a tag you’re less likely to know why, than with a bar code ID system… you can’t be sure if the tag is even there? So what can you do? Test the reader by using a known-good test tag. This lets you verify that the rest of the system is working. If it is, move the reader around and closer to the target tags.

**Affected by metal**

Some of this depends on how you install your system. Metal objects will affect an RF field, so don’t expect 100% reliability if you’re working near metal objects. Metal is common and in a warehouse it may be hard to avoid. So just lower your expectations and work around it.

**How?**

RF is like light, except you can’t see it. Both RF and light are electromagnetic energy. Like light, with RF you can get patterns of RF light and shade around structures, you just can’t see it… but an antenna can detect it. A receiving antenna is like a pair of electronic eyes. A transmitting antenna is like a light bulb… they both radiate electromagnetic energy. But... you can move RF tags from the RF shade into the RF light. So movement between tag and reader can actually help, because you can move the tag from an RF dead spot into a position where the signal is strong – and it only takes an instant to read a tag. The same applies if the tag stays still and the reader moves.

So if the first read attempt fails, there may be many more opportunities. After all the tag only has to be read once to establish that its actually there. You can minimize this problem by using an RFID system that uses lower frequency RF. The patterns of light and shade increase with frequency.

Tags may be vulnerable to Electro-Static Discharge (ESD) damage This may affect tags attached to insulating materials such as plastics. The problem is usually caused by friction and can occur when items rub against each other and build up an electro-static charge. This may occur during manufacture, processing, transport and handling.

There’s a sinister side to ESD. The damage isn’t always immediate… or obvious, and ESD may be one of the least-understood disadvantages of RFID. ESD can degrade an RFID (or any other electronic) device and make it operate erratically. It may fail completely, a minute, an hour, a day or a month later. There’s no way of knowing.

Proactive ESD protection is a worthwhile strategy. Often there’s enough moisture in the air to provide a leakage path that will slowly discharge any electro-static charge that starts to build up. But on a dry day...!

You could fit two tags to minimize the risk if it’s critical. There are various ways to minimize these risks, including making sure that charges can’t build up in the first place, or if they do, they are discharged in a controlled way that doesn’t stress the microchip. If necessary, you can measure and monitor electric fields from charge build up with a suitable instrument.

RFID tags are usually larger than barcode labels. The size of an RFID tag is mainly determined by the size of its antenna. Ideally you want a tag to be as small as possible. But this is limited by the size of the antenna. The size of the antenna depends on the frequency of the RF. Usually, if you use a higher frequency, the antenna can be smaller.

On an active tag, the processor chip is small compared with the antenna. The chip is the small blob and the larger printed copper conductor surrounding it is the antenna. Usually, the higher the frequency, the smaller is the antenna. So if you need the tag to be smaller, you may be able to use a higher frequency. But note that higher frequencies may introduce other limitations, and you need to consider these as well.

Tags are application specific. No one tag fits all. There are applications that need maximum security and others that don’t need any security at all. RFID tags used in high security applications, such as bank cards, must comply with standards that demand the maximum level of security.

Possibility of unauthorized reading of RFID passports and credit cards. This is one of the more worrying disadvantages of RFID. It’s now common to embed RFID chips in passports. This, and credit card RFID technology, leads to the possibility of another of the disadvantages of RFID. That of unauthorized reading of an RFID passport or credit card.

While this is possible, there are a number of things that make it difficult. Some active smart tags can encrypt the information so that only the intended reader can understand it. Encryption standards are starting to emerge. One is the NIST Advanced Encryption Standard (AES). This standard is becoming popular for encoding and decoding ciphers.

Before an RFID passport or embedded credit card RFID tag can be read, there has to be sufficient RF coupling between tag and reader to carry the information between them. So someone would have to get quite close to carry out such an unauthorized read. The good news is that it’s reasonably easy to block RF. All you need, to provide RFID protection is a metallic layer over the tag to make an RFID shield or RFID blocker.

More than one tag can respond at the same time Of all the disadvantages of RFID, this is the one you may not even notice unless your system has a very slow data rate. Like cars travelling in opposite directions along a road, RFID data traffic has its own set of rules (protocols) and standards to help avoid collisions… important where tags may be read simultaneously. Usually, it all happens so quickly that if a read isn’t successful the first time, the reader simply tries again. If it only gets one good reply, the reader at least knows that the tag, and the item it’s attached to, is there. It couldn’t reply if it wasn’t.

**5.4. Advantages of RFID:-**

**What are the RFID benefits over a rival technology such as barcoding?**

* RFID has more uses
* No special positioning needed
* Fast - Read or write to many labels or tags at the same time
* Easy to install
* Identify items even when they’re moving
* If you use active tags (rather than passive) there are further RFID benefits
* Store useful information on active tags
* Active tags can send information to a reader anytime
* Active tags can be configured for a specific application
* You can select what items you want the reader to read

**Operational RFID benefits**

* You don’t need to be there - unattended operation
* Lower initial set-up costs and risk by building in stages
* You can get your own application developed
* Easy to integrate into an enterprise supply chain management system

**RFID benefits in more detail**

The advantages of rfid listed explain why RFID is useful for a wide range of applications where other technologies just don’t work or can be made to work better. RFID usually has fewer limitations and more advantages than other technologies, but a decision to implement RFID may depend on setup costs and the scale of the application. And RFID can be used together with a bar code as a backup. Then those who don’t have RFID capability, but can read barcodes, can still identify items.

No special positioning needed: No need for the RFID reader to have a clear view of the tag. RFID tags and readers don’t have to be within Line Of Sight (LOS) of one another, unlike a barcode label that must be visible to its reader, or it can’t be read.

You can read RFID labels or tags in any orientation. It doesn’t matter if they’re pointing up, down or sideways. The RF signal that carries the ID information can usually still get through, even when the tags are hidden, covered, in a heap and out-of-sight of the reader... but they must be within radio range.

Another of the RFID benefits is there’s no optics to line up and clean. RFID uses RF energy that, unlike visible light used for reading barcodes, can penetrate many non-metallic solid objects and isn’t greatly affected by misalignment. So...

Tags can be embedded inside items during manufacture. Then the tag is better protected than a barcode label, and the item will likely retain its identity over its lifetime. It’s easy to embed a tag into an item during manufacture, especially if the process is automated. Embedding RFID tags into plastic for items such as RFID wristbands and RFID keys for access control creates a very robust product.

Reader and tag don’t have to be close. Some long range RFID tags can be read tens of metres away, whereas a bar code has to be within a few millimetres of the reader.

Fast - Read or write to many RFID labels or tags at the same time You can read multiple tags fast and this lets you track large quantities of tagged items in real time.

Wireless RFID inventory tracking is one of the most significant of the RFID benefits. With RFID tracking, large numbers of many different types of items can be tracked from manufacturer, through the supply chain to the customer… RFID logistics in action, and the more complex the operation is, the greater the benefits.

Add a Global Positioning System (GPS) and wireless telemetry and you’ll always know where your items are.

With RFID in libraries, you can scan piles of books in one quick operation, rather than having to individually scan the barcode on each book. You save time, process customers faster and reduce the risk of repetitive strain injury caused by the unnecessary handling of books.

Easy to install: RFID readers aren’t as fussy as barcode readers to install.

As there is no optics to line up, RFID readers may be installed in ceilings or other out-of-the-way places, provided there are no conductive materials, such as metal structures, that could shield or weaken the RF signal between RFID tag and reader.

You can now buy mats that have RFID reader aerials built into them. You can monitor a sports event by placing these at strategic stages along a racetrack, during an event such as a marathon. If RFID tags are attached to the racer’s shoes and the information is read as the tag passes over the special mat. The data is then sent to a computer that records and processes it into near real time race information, giving a competitor’s placing and time. You could then make this information available on the web.

Industrial RFID readers could be placed next to an assembly line to monitor and control a production process.

Identify objects even when they’re moving: A radio frequency wireless link works when things are moving.

One of the great advantages of rfid is that the the reader can read tags even when either or both is moving... provided they stay within their specified range where the RF signal remains strong enough to carry the information.

Portable RFID readers may be used in forklifts or trucks. This helps ensure that the correct items are efficiently loaded, unloaded and accounted for. The portable RFID reader may send the information to a computer running RFID middleware, an RFID software application program. You would likely locate the server in a warehouse. The server could then coordinate and process all the information on what may become an RFID network.

Record the IDs of a truckload of tagged items passing through a gate. This establishes time, place, item type and quantities. If some of the items are offloaded, then you may carry out another recording when the truck goes back out through the gate, allowing you to check before and after. This information should then agree with the information read on board the forklift. Any discrepancies might automatically generate an alarm.

If you use active tags (rather than passive) there are even more RFID benefits...

Store useful information on RFID active tags. You can read and write to active tags. The primary use of the reader is (obviously) to read tags, but those readers that are part of an active system may also have a secondary role… to write to active tags.

Want to change the information? On a barcode, you’d need to replace the labels... a time-consuming task if there are a lot. With RFID? No problem. You can write the new information to selected tags in seconds.

**So why might you want to write to an RFID tag?**

Identify subgroups. You may want to configure a tag to link an item to a particular sub group of items, such as all TVs with a 42 inch LCD screen, in a large consignment of a group of TVs with different types of screens.

Quality Assurance: Or you might want to update test status to show that certain items have passed a particular test, before moving to the next stage of a production process.

Damage Control: Or mark items that were on a pallet that was dropped, and the items may need to be sidelined and checked for damage.

Assembly Instructions: You can program active RFID tags with assembly instructions so that tagged components could tell automated assembly machines what to do with them. A tagged item could carry its own specific handling instructions.

Automation: This makes it easy to automate a system, since you always know what items are located where, at any point in the process.

Managing Assets: For asset management RFID tags might have change of ownership, date and location information written to them.

Patient ID: In a hospital, a patient’s RFID wristband may be programmed with essential information relating to the patient’s condition and medical history. Instant access to this type of quality information is just one of the many RFID benefits available among the opportunities available in RFID health care.

It’s easy to update the information stored on a smart RFID tag. Active RFID tags can send information to a reader anytime. While it’s the reader that always initiates the reading of a passive RFID tag, RFID active tags are smarter, and some may be able to actually initiate a read... without first being asked.

So how does a tag initiate this? The initiation may be triggered by it’s own internal clock, or perhaps by an external sensor, such as a motion sensor. You can select what items you want the reader to read

Want to only read a specific group of tags? Another of the RFID benefits is that you read only the tags that you want to. Readers can be configured to wake up a specific tag, or group of tags, or all tags within range of a reader… you choose.

Unattended operation - you don’t need to be there, Once set up, there’s usually little need for human intervention. In fact this would probably just slow things down!

RFID is ideal for use in some types of automated system.

Lower initial set-up costs and risk by building in stages

Unsure about whether you need an RFID system? You could start by carrying out a low cost small-scale trial. One way to do this is by purchasing an RFID kit. You can take the modular approach and build up your RFID system in stages, spreading the costs over time and building the system in a series of small, achievable, low-risk steps.

You can get your own application developed: Do you have a unique requirement? Can’t find an off the shelf application software that meets your needs? Why not get your own software application program written? You could get a contract programmer to write an application to your specification.

Easy to integrate into an enterprise supply chain management system: RFID is often the best way to check items coming in and going out. For a large store operation, this information can be used as part of a total inventory control and validation process. You’ll find more and more applications for RFID every day and many are prospering from the ever-increasing number of RFID benefits.

**5.5 Future Scope:**

RFID technology is becoming increasingly supportive of IoT applications and might combine with smart sensors soon to enable systems to track factors like temperature, location, and movement that can be transmitted wirelessly. As RFID applications are becoming widespread, they are also getting more targeted by researchers to take this trending technology to new heights.

**1. CCTV Cameras**

A closed-circuit television camera can produce images or recordings for surveillance or other private purposes. Cameras can be either video cameras or digital stills cameras. Walter Bruch was the inventor of the CCTV camera. The main purpose of a CCTV camera is to capture light and convert it into a video signal.

We can add CCTV Cameras near the system so that no proxy can be done. And we can monitor each and every candidate or student

**2. Voice Announcement System**

We can use a voice announcement system in this project. So whenever a user logs in, we can announce messages like, “Your attendance has been logged in” or “Your card is invalid”.

**3. GSM Technology**

GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies: TDMA, GSM, and code-division multiple access (CDMA).

GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 megahertz (MHz) or 1,800 MHz frequency band.

We can implement GSM technology. So this project will be advanced to an RFID Attendance system with SMS Notification.

**4. Secure Your Data with New Cloud-Based Capabilities**

RFID can potentially enable a whole host of new applications in retail, healthcare, manufacturing, and other sectors, but one stumbling block has always been the management of the data flowing in from thousands of tags. With cloud-based applications and services taking the heavy lifting of IT to support away from the point of activity, companies can now deploy centrally managed and centrally available solutions without the traditional support and deployment costs.

Cloud-based applications enable coordination from anywhere. Get real-time updates on inventory across global supply chains, making just-in-time production possible across borders.

The RFID industry is about to enter an exciting period in which increased adoption will provide the means for technology providers to invest in new, exciting innovations. Along with the new developments described above, advancements in materials, organic polymers, nanotechnology, and other areas will change the way RFID is incorporated into products.

The future of RFID is here, so both end users and RFID manufacturers should be prepared to leverage these new technologies and ready themselves for more widespread use of RFID.

**5.6 CONCLUSIONS:**

In conclusion, the objective to build an RFID based attendance system was successfully achieved. In terms of performance and efficiency, this project has provided a convenient method of attendance marking compared to the traditional method of attendance system. By using databases, the data is more organized. This system is also a user friendly system as data manipulation and retrieval can be done via the interface, making it a universal attendance system. Thus, it can be implemented in either an academic institution or in organizations.

However, some further improvements can be made on this RFID in order to increase its reliability and effectiveness. An indicator or an LCD screen can be incorporated into the system to indicate when any unregistered card is scanned. An IP camera can be integrated into this system to monitor the actions like buddy-punching wherein a person cheats by scanning for another person. Finally, this attendance system can be improved by adding a feature where the attendance system indicates when a student is late for work or classes as the case maybe.

**REFERENCES**

## Dorman, D., 2002). Technically speaking: New vendors heating up Radio Frequency ID market," American Libraries 33(3), 76.

## Gian Domenico Romagnosi. (2009). In Encyclopedia Britannica. Retrieved October 25, 2009, from Encyclopedia Britannica Online: http://www.britannica.com/EBchecked/topic/507231/Gian-Domenico-Romagnosi

## How Stuff Works. Accessed on Oct. 17. 2009. http://electronics.howstuffworks.com/gadgets/high-tech-gadgets/rfid.htm MacOSDarker CSS Template. Accessed October 13, 2009

## http://www.freecsstemplates.org

## Molnar, D. & Wagner, D. (2004). Library RFID privacy and security: Issues, practices, and architectures. 11th ACM Conference on Computer and Communications Security. ACM Press. [www.cs.berkeley.edu/~dmolnar/library.pdf](http://www.cs.berkeley.edu/~dmolnar/library.pdf)

## RFID Journal. Accessed on Oct. 17, 2009. http://www.rfidjournal.com/article/articleview/1337/1/129/Scanlon, L. (2003). Good vibrations. Technology Review, 106(2), <http://www.libraryjournal.com/article/CA456770.html>

## Wikipedia. Accessed on Oct.17, 2009. http://en.wikipedia.org/wiki/Radio-frequency\_identification

## Wikipedia. Accessed on Oct.17, 2009. http://en.wikipedia.org/wiki/Radio-frequency\_identification#Libraries

**ACKNOWLEDGEMENT**

We wish to extend our sincere gratitude to our project guide, Prof Mr. R. N. Patil, Department of Electronics & Tele-Communication, for his valuable guidance and encouragement which has been absolutely helpful in successful completion of this project.

## We indebted to Dr V. M. Kulkarni, Professor and Head, Department of Electronics & Communication for her valuable support.

We are also grateful to our parents and friends for their timely aid without which we wouldn’t have finished our project successfully. We extend our thanks to all our well-wishers and all those who have contributed directly and indirectly for the completion of this work.

And last but not the least; we thank God Almighty for his blessings without which the completion of this seminar would not have been Possible