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Survey on RFID Based Contactless Attendance Monitoring System

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ABSTRACT: During a pandemic personal contact or sharing accessories or utilities with an infected person may lead us to getting infected by virus as in the case of the COVID-19. In this paper we have developed a contactless system for monitoring attendance of an organization using Internet of Things (IoT) and Radio Frequency RFID. The Radio-frequency identification is a technology which works on the concept of electromagnetic fields where in the RFID reader can read the unique identity transmitted by the passive RFID tag through radio wave transmission which is leveraged to record the attendance of a person by bringing the RFID tag in the proximity of the reader. The Internet of Things is a widespread technology used to connect the different physical objects consisting of sensors and software which connect and exchange the data with devices over the Internet. The attendee is allotted with RFID tag which he/she will use to record their attendance by bringing the RFID tag near the reader. The reader connects to ESP 32 through which the attendance information is transmitted to a webpage which stores information in MySQL database.

KEYWORDS: Radio-frequency identification, Internet of Things.

1. INTRODUCTION

Conventional methods of marking attendance of participants registered for a learning course or students in academic institutions involves manually marking attendance in a ledger by instructors or teachers respectively. The attendance is taken through participant's signature in ledgers or filling ledgers manually by teachers. This is in fact tedious, time consuming and error prone. In academic institutions the criteria of maintaining minimum percentage of attendance for a course in turn lead students to proxy attendance for their classmates. Looking up for attendance of a particular participant or student is time consuming involving lot of manual effort for searching through ledgers. The chances of loss of ledgers due to natural calamities or theft and securing against unauthorised updates should also be taken care of. During pandemic like COVID-19 the major disadvantage would be sharing of ledgers and materials like pen among participants may lead to spread of viruses to the entire class if one of them is infected.

The system prototype developed in this work is an effort to overcome all the possible demerits in existing system. This system is a RFID based attendance tracking system which is simple, cheap to implement yet efficient in terms of performance and security. The system leverages the concepts of Internet of Things (IoT) to build a scalable solution which is also secure.

The system is more organized which marks attendance when a participant brings his/her unique RFID based ID card in the proximity of the RC522 RFID card reader. The reader which is connected to the ESP 32 kit transfers the attendance data to ESP32 which connects to internet through Wi-Fi and stores in a centralised database residing in a server. The system provides the web page which is Graphical User Interface (GUI) through which the concerned authorities can access to attendance data and also generate statistical reports through a simple click of a mouse instead of going through a painful effort of manual calculations. The system is very swift in terms of performance and secure since we have user authentication which provides access only to authorised persons.

II. LITERATURE SURVEY

RFID Technology: The RFID technology comprises of two major components RFID reader and RFID tag. This is a wireless system of communication which uses radio waves of different frequencies to transmit data. The RFID reader is a device which has antenna to transmit and receive data from the RFID tags. The tags may be active or passive. An

active tag is battery powered and they are read from a long distance of 100 feet or more. Active tags are further categorized as transponders and beacons. Transponders wait for the reader to send the signals to which it responds with necessary data. Beacons emit signals periodically. A passive tag is not battery powered instead it uses the radio energy of the RFID reader.

There are different types of RFID based on the range of frequencies used for transmissions which are Low frequency ranging from 30kHz to 300 kHz, High frequency generally 13.56 MHz and Ultra high frequency ranging from 300 to 3000MHz.

Applications of RFID: This technology is used in very wide variety of applications ranging from Access management in organizations, tracking of inventory and goods in supply chain management, healthcare, Personnel and animal tracking specifically tracking endangered species protected in wild life sanctuaries, transportation and logistics, toll gates for contactless payments, libraries, museums and sports and many more.

Internet of Things: Internet of Things the term was first got to be used by British technology pioneer Kevin Ashton to describe a system in which the physical world objects could be connected to the Internet by sensors. Ashton framed this term to demonstrate the power of connecting RFID tags used in corporate supply chains to the Internet in order to track and count the goods without the human intervention. Currently the Internet of Things has become so widespread that describes many scenarios where the Internet connectivity and computational capability extends to a large variety of objects, sensors and devices which are used in everyday life.

III. SYSTEM DESIGN

The proposed application works on the principle of IOT, each attendee will be given an RFID enabled ID card, each ID card will have a unique identification number, at the entrance of the hall RFID detection will be mounted, attendees needs to scan their ID before entering the hall, soon after scanning the card a beep sound will be notified through a buzzer. The RFID reader is connected to the ESP32 system on chip microcontroller which has integrated Wi-Fi in it. The read information is communicated to ESP32. The ESP32 connects to internet through its Wi-Fi and contacts the web server to which it sends the data received by RFID reader. The web server runs a server side script which connects to the centralized database where the attendance data is stored. The administrator or instructor is provided with a web based GUI which displays a dash board using which track the details of attendees batch wise and generate statistical reports with a mouse click without spending much of effort. Various RFID implementations were reviewed in order to build an efficient design which is cost effective and ranks high in performance. Figure 1 illustrates the architecture of the system.

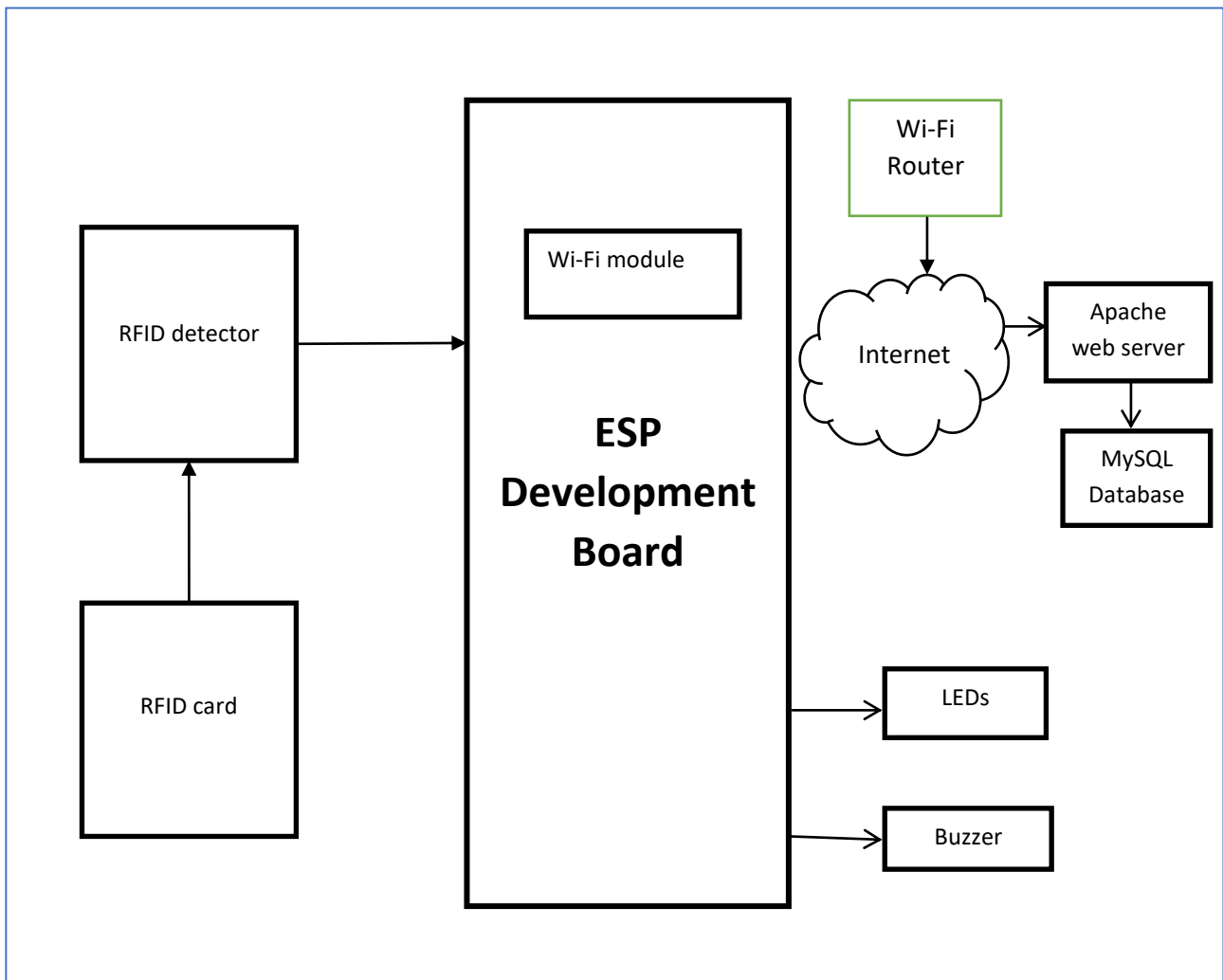


Figure 1: Block diagram depicting the system architecture

The system consists of both hardware and software components which are described below.

RFID Reader and card: As already discussed in the literature survey section which explains the RFID technology we use RFID reader which is MFRC522. The MFRC522 is a highly integrated reader/writer IC for contactless communication at 13.56 MHz, The MFRC522 reader supports ISO/IEC 14443 A/MIFARE and NTAG. The RFID tag used is a passive tag which is not powered by battery instead they are powered when they are in the proximity of RFID reader's radio frequency energy. The passive tags communicate using Backscatter technology which reflect back the radio waves from the reader, usually the reflected signal is modulated to transmit the data. Figure 2 depicts the image of MFRC522 RFID reader and RFID tag.



Figure 2: Image depicting MFRC522 RFID reader and RFID tag

ESP32 Development board: ESP32-WROOM-32D and ESP32-WROOM-32U are powerful along with generic Wi-Fi and Bluetooth modules that target a wide variety of applications, ranging from low-power sensor networks to the most demanding tasks, such as voice encoding, music streaming and MP3 decoding. ESP32 integrates a rich set of peripherals, ranging from capacitive touch sensors, Hall sensors, SD card interface, Ethernet, high-speed SPI and UART.

Web server: A web server is a program/software or a machine or group of machines which are dedicated to run this software. It can accept incoming requests from the clients typically web browsers in the form of HTTP requests which are processed and HTTP responses are sent back. Web servers accept requests over the world wide web or through private LANs and WANs.

Database: A database is systematic collection of data where we store and access it electronically through computers. We can use the data stored in the database to summarize and query to find results.

Graphical User Interface (GUI): This is designed for effective and user friendly interaction between application and its users. Users interact through web pages which are means of communication between them.

IV. IMPLEMENTATION

The implementation of the system was carried out as per the system design described above. The process of the system implementation is depicted in figure 3 which consists of 5 main steps which are described below.

RFID device: The device which is used in tracking the attendance constitutes of RFID reader which is MFRC522 and ESP32 development board are inter connected as per the configurations specified in the data sheet provided. The device is powered with battery or power banks and it includes a buzzer which beeps on successful reading of a RFID tag. The programming is done using the Arduino IDE. The device is connected to internet and the data is transferred to web server.

Web server configuration: The web server chosen is Apache HTTP server since it is predominantly used all over the world and supports many server side programming languages like Perl, Python, PHP etc. The server is first configured on the local machine where we develop the web application and test it. Later the web application is deployed in the production environment hosting server.

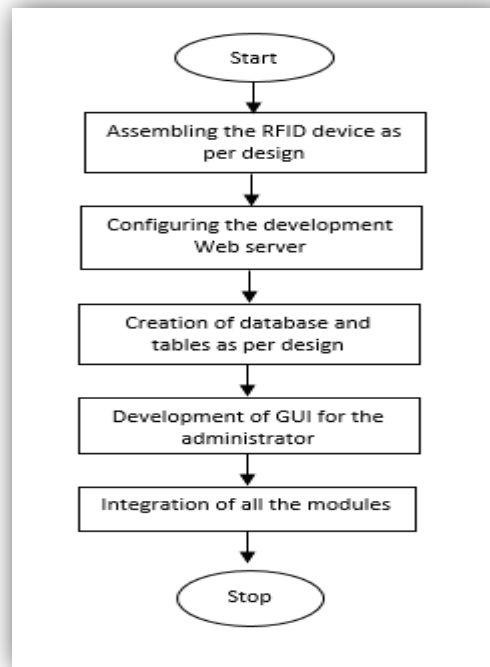


Figure 3: Process involved in the implementation of the system

Database: The web application uses the database where it stores all the data of the system. MySQL is the database used in the project in which different tables are created as per the requirement of the system. We create tables namely members to store the personal details of the registered members of the course and attendance to store the attendance details of the attendees with the details like Timestamp batch wise. Later after testing, the database is pushed to production MySQL database server.

Web Page Development(GUI): User friendly web pages are developed using PHP server side scripts for interaction. Instructors are provided with a web page for Adding, deleting and updating user information. They are also provided with the web page where they can view the attendance information date wise and batch wise. They also have web pages which help instructors for different notifications regarding fee payment etc. and view different statistics related to attendance.

VI. RESULTS

The objective of the project was to develop a contactless and automated attendance monitoring system which reduces human intervention and avoids traditional method of maintaining attendance. The project was successful wherein we built an RFID based contactless system. The below are the webpages which are the screenshots of the system running in the production environment. We were able to successfully integrate and test the system both on local machine and also in the operating environment.

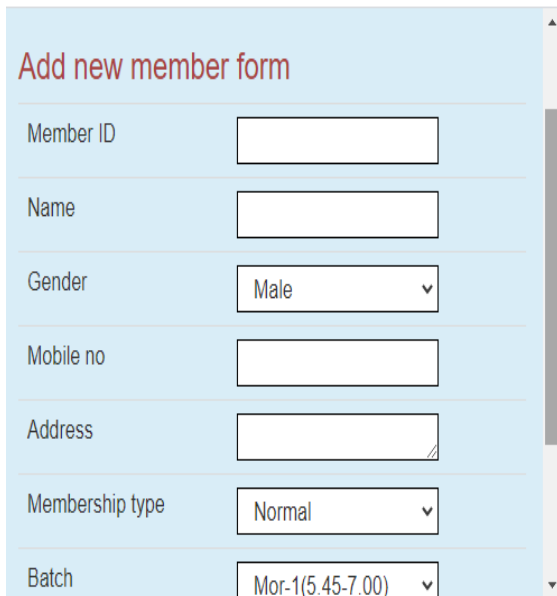
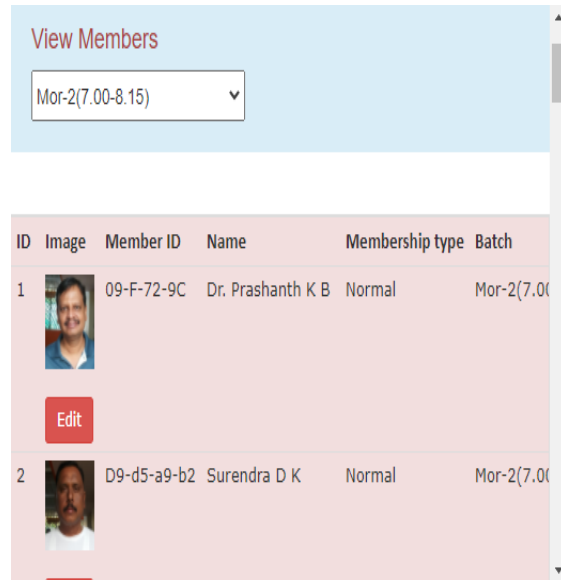


Figure 4: Showing the add new member web page






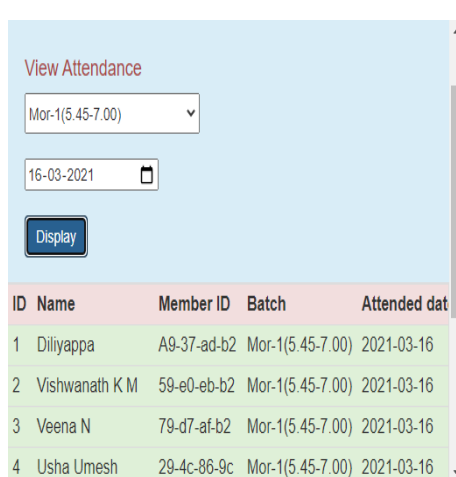
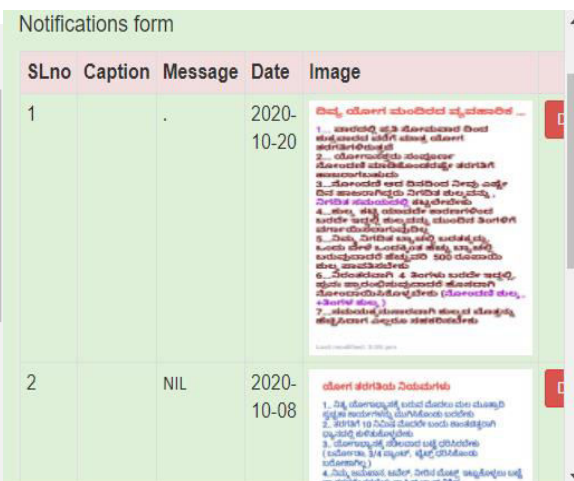
ID	Image	Member ID	Name	Membership type	Batch
1		09-F-72-9C	Dr. Prashanth K B	Normal	Mor-2(7.00-8.15)
					
2		D9-d5-a9-b2	Surendra D K	Normal	Mor-2(7.00-8.15)

Figure 5: Showing the registered members



ID	Name	Member ID	Batch	Attended date
1	Diliyappa	A9-37-ad-b2	Mor-1(5.45-7.00)	2021-03-16
2	Vishwanath K M	59-e0-eb-b2	Mor-1(5.45-7.00)	2021-03-16
3	Veena N	79-d7-af-b2	Mor-1(5.45-7.00)	2021-03-16
4	Usha Umesh	29-4c-86-9c	Mor-1(5.45-7.00)	2021-03-16

Figure 6: View attendance web page



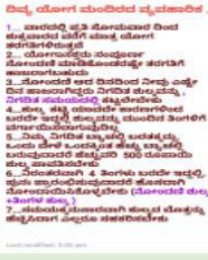
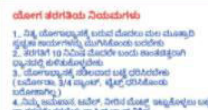
SLNo	Caption	Message	Date	Image
1			2020-10-20	
2		NIL	2020-10-08	

Figure 7: View notifications web page

The RFID device was successful in scanning the RFID tags and connect to the internet and send the attendance information to the server to store it in database. It was tested that the web server stores only the attendance of registered users and discards the unknown RFID tags. The COVID-19 pandemic situation which introduced several standard operating procedure focusing on social distancing were easily met by the RFID based monitoring systems which aligned in terms of regulations enabling users to carry out their learning activities without any hindrances.

VI. CONCLUSION

The project RFID based attendance system was developed successfully leveraging the RFID technology. The system has the capability of recording the attendance automatically. It will be definitely advantageous in coaching centres and academic institutions where the instructors can save lot of time and man power during their sessions which would otherwise be spent over attendance management. The system enables users to generate reports in a few mouse clicks over the web pages without spending hours in calculations of traditional system. The system prevents the chances of proxy attendance and manual errors when compared to the manual system.



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