SMART CAMPUS USING RFID

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ABSTRACT

Attendance systems are common protocol in most of the educational institutions and workplaces to keep the count of people. The system in place is more of book registry where the recordings are done manually. This is more of cumbersome and time-consuming process. But we could make this process a lot easier using technology. RFID is one such technology whose scope will be explored in this section. Storing of data in the databases and using it as record of information of people and services is another part of this project that will be explored. Automated text has also been in rounds for some years now and it will be used as medium of communication for delivering information for people and informing about the services. Integration of all these technologies and coming out with a robust way to create a attendance system is the scope of this project.

Keywords — RFID, Wi-Fi, Node MCU, Arduino IDE, Php, MySQL, RC522, ESP8266

I.   INTRODUCTION

A Smart Campus system will allow student to automate all work student want to do on regular basis using one card with the help of IoT. Smart Campus is a central system that can control and create communication between nearly all aspects of student access in campus. One of the highlights about smart campus system is it can be tailored to student lifestyle regarding with campus. Here are four of the **strongest benefits S**mart campus will provide for students which includes Decrease students extra work and also waste of time. It improves student's campus security. It is very convenient to use. It will improve the comfort of student's presence in campus. Digital Campus design is a modern technology that modifies the student campus structure to perform different works using one card instead of using various cards or papers or documents. While smart digital campus system is the central idea that makes smart campus design possible. Digital campus automation technology is new concept which is hybrid concept of many different systems, whose demand mayincrease in a wide range in a future. There are many factors that are responsible for the need of digitalization in campus to make campus "Digital and Smart".

II.   LITERATURE SURVEY

In this paper, for the problem, a system is proposed, a campus intelligent safety supervision system based on RFID technology. Through the use of RFID technology for non-contact automatic presence recognition features, the system achieves the goal of supervising the college gate, classroom, danger zone entrance and other places in the college. The information is automatically acquired and transmitted in real time, which makes the supervision and management of the school more intelligent.[1].

Even though the smart campus market has not taken off yet, there is an enormous research that is going on now all over the world to explore such technology. Several factors are driving investigators to study smart campus including: deliver high quality services, protect the environment, and save cost. In this paper, not only we explore the research conducted in this area, but we also investigate challenges and provide possible research opportunities regarding smart campus. [2].

Emerging technology of RFID can be used for building a smart university. Prototype is developed considering major use cases involved in a smart university. The system is taking care of maintaining attendance record, switching control of electrical items and security locks of rooms. Results show that consumption of energy and object tracking time is decreased while security of rooms and credibility of attendance record are increased.[3].

At present, with the increasingly growing application of Internet of Things, virtualization and

intelligent technologies, and the maturity of smart campus systems, campus card technology based on radio frequency identification (RFID) has developed rapidly. Due to the convenience of use, it is widely used in dormitory access control system, book borrowing system, attendance system, payment system, etc. Because the data carried by the RFID card is more and more complex, the requirements for its security are getting higher and higher.[4].

Analog switches are mounted on the walls. Operating them is a tedious task as they need to be physically pressed each time an appliance has to be powered on or off. The switches are interfaced with NodeMCU which has an inbuilt Wi-Fi. It can use this to enable or disable the switches. The user communicates with the processor through the Web Browser. The processor then controls the switches based on the commands received from the user and also updates the user about the status of the switches after the control operation is performed to the cloud. The intensity of light, the speed of the fan and other devices can be controlled using the Web Browser. This application can be found in home automation systems,VR tracker, serial port monitor, Security alarms etc. [5].

The use of an alternative new system is becoming a mandate to manage students and staff attendance. The Radio Frequency Identification is the technology which will be applied as infrastructure in the indoor environment to enable the college administration to get the advantages and to improve the university's monitoring framework, taking into considerations some factors such as time saving, reliability, efficient and easy to control. This system initially uses a web-based database coupled with RFID tagging system which acquire a framework with which the majority of the data may be manipulated. [6]

III.   METHODOLOGY

The working smart campus is carried out using open source hardware components and software tools available in the open market. The project design and development involve the following two components –

Hardware Parts -

- RFID Scanners and cards
- Node MCU module
- Computer system with Router

Software Part –

- Arduino IDE
- Php and MySQL
- Bootstrap

IV.   COMPONENTS REQUIRED

HARDWARE REQUIREMENTS

- RFID Scanner

RFID or Radio Frequency Identification system consists of two main components, a transponder/tag attached to an object to be identified, and a Transceiver also known as interrogator/Reader. A Reader consists of a Radio Frequency module and an antenna which generates high frequency electromagnetic field. On the other hand, the tag is usually a passive device, meaning it doesn't contain a battery. Instead it contains a microchip that stores and processes information, and an antenna to receive and transmit a signal. To read the information encoded on a tag, it is placed in close proximity to the Reader (does not need to be within direct line-of-sight of the reader). A Reader generates an electromagnetic field which causes electrons to move through the tag's antenna and subsequently power the chip.

RC522
The RC522 RFID module based on MFRC522 IC from NXP is one of the most inexpensive RFID options that you can get online for less than four dollars. It usually comes with a RFID card tag and key fob tag having 1KB memory. And best of all, it can write a tag, so you can store some sort of secret message in it.
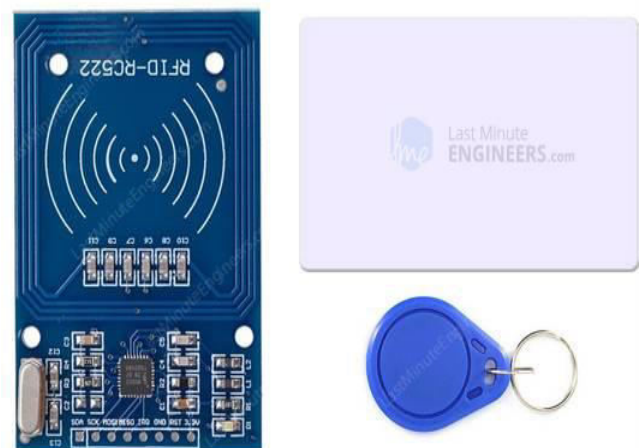

Fig 1. RC522

- Wifi module

The ESP8266 is a really useful, cheap WiFi module for controlling devices over the Internet. It can work with a micro-controller like the Arduino or it can be programmed to work on its own. The Internet of Things (IoT) has just been made a whole lot cheaper and easier.

The ESP8266 comes with factory installed firmware allowing you to control it with standard "AT commands". You can also easily create and upload your own code and this makes it hugely powerful and flexible.

Node MCU is an open source firmware for which open source prototype board designs are available. The name "Node MCU" combines node and "MCU" (microcontroller unit). The term "Node MCU" strictly speaking refers to the firmware rather than the associated with the developmental kits. Both the firmware and prototyping board designs are open source. The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.
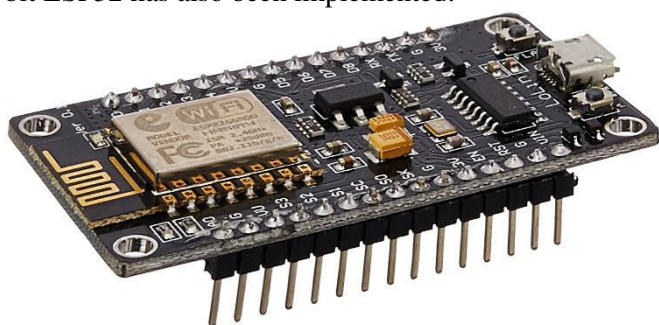

Fig 2. Microcontroller Unit

- Computer system with Router

A personal computer is required to host the servers and database. The router connected to the computer connects with Wifi modules present at different locations like entrance and classrooms. The task manager of the system is used sendautomated text messages in hourly basis. The system needs an internet connection and electricity.

SOFTWARE REQUIREMENTS

- Arduino IDE

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.

It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.

Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.

The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module.

This environment supports both C and C++ languages.

- Php

PHP files can contain text, HTML, CSS, JavaScript, and PHP code. PHP code is executed on the server, and the result is returned to the browser as plain HTML. PHP files have extension ".php". PHP can generate dynamic page content. PHP can create, open, read, write, delete, and close files on the server. It can collect form data, can send and receive cookies, can add, delete, modify data in your database. PHP can be used to control user-access and can encrypt data.

- MySQL

With PHP, you can connect to and manipulate databases. MySQL is the most popular database system used with PHP.The data in a MySQL database are stored in tables. A table is a collection of related data, and it consists of columns and rows.Databases are useful for storing information categorically. It is a database system used on the web and runs on a server. It is very fast, reliable, and easy to use. MySQL compiles on a number of platforms and is free to download and use.

- Bootstrap

Bootstrap is a framework to help you design websites faster and easier. It includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels, etc. It also gives you support for JavaScript plugins.
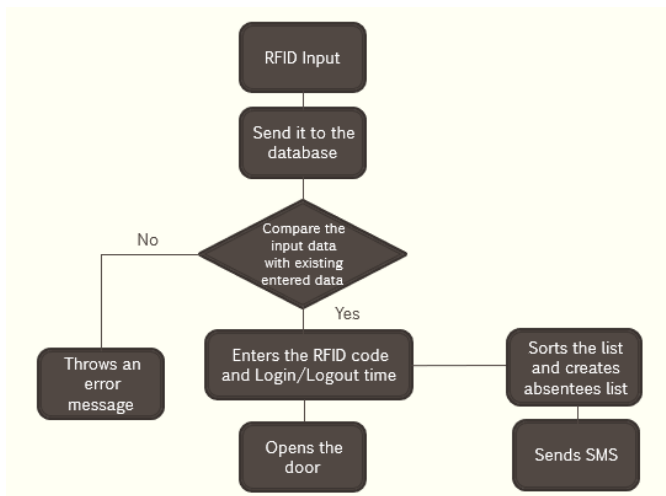
V.   FLOWCHART & BLOCK DIAGRAM

Fig 3. Sequence of working

In this work, a user defined algorithm has been implemented, and the flow has been represented here.

Step 1: Initialize the System

In this step, the system is reset and the ports/pins of the microcontroller are defined for the interconnection with the RFID readers and the actuators.

Step 2: Get the Sensor Data

Once the student scans his RFID Tag data present in it is captured and it is sent to the microcontroller for the further processing.

Step 3: If SensedData is not present goto Step 2, else goto Step 4

The received sensor data is compared with the data in microcontroller. If the sensed data is not present it displays "Access Denied" and return echoed output to nodeMCU.

Step 4: Sends Required Information to Student

Once it authenticates student it will send the respective day time table to the student.

Step 5: Sends Data to Admin through nodeMCU

The sensed user data is sent to Admin's PC through nodeMCUWifi module.

Step 6: Segregating the details

The Admin segregates absentees list from the data received through microcontroller and deletes the remaining details.

Step 7: Sending Segregated information to Bulk SMS provider

In this step, the system sends segregated absentees list to bulk SMS provider.

Step 8: Send SMS to the Parents

An alert SMS is sent to the absentees parents to take necessary actions.
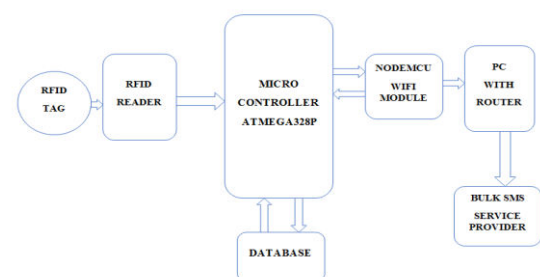
Step 9: Continue with Step 2

Fig 4. Block-diagram of the work flow

The RFID Readers are placed in the different locations of the college campus to scan students RFID tags. The sensed data from the readers are fed to the microcontroller. In the microcontroller the data are compared with the threshold values stored in the database for making the authentication of the student and marks attendance for the student and also sends respective day time table for that student. The admin who sits in front of PC collects the attendance of all the students through nodeMCUWifi module. Once admin gets the attendance of all the students for the present day he segregates the absentees and sends their data to bulk SMS service provider to send alert Message to their parents.
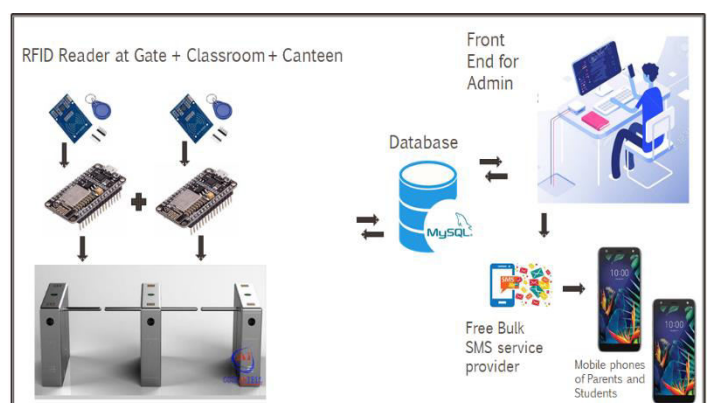
VI.   WORKING

Fig 5. Architecture of the system

The attendance system records student data and sends an SMS to student about the particular day's and additional info about classes, labs and other important notification. The system checks for any absentees after the class commences as per the data it compares with the class data. If it matches then the system sends a message to student notifying the student to attend class. If the classes are being missed on a regular basis the record can be deleted and it needs to be manually reactivated from teachers after giving a proper valid reason.The project involves setting up of a smart campus using RFID and Wifi technology supported along with SMS alert system. The current system uses a Wi-Fi network to connect unlike the convectional system which uses LAN/Ethernet, the system is more secure and reliable. It is easy to implement as it doesn't need to be connected through cables. Addition or deletion of RFID slave modules to the system is easier. The system is comparatively low cost as it doesn't include wiring cost and the embedded system is open source. As the SMS services are from a web-based application there is no requirement of an active GSM module making the product compact and cost effective. The replacement cost in case of damage of the hardware is also low.

The module when switched ON runs the Arduino code which includes all the required libraries. The built in Wifi. Client will check the SSID and Password and establishes the connection with the Wifi router. In the setup section the code calls the function of HTTP. Client which establishes the connection between the server and the Arduino. Once established, the information of RFID scan is POSTED via http protocol socket to the server and the php file receives it and sends a return code. Once the return code is 200 the RFID code has been successfully posted.

Once the php code receives the RFID code it searches the RFID code in the database. If the record exists then the display it on the screen. If it doesn't exist then show the Access Denied on the screen. Return echoed Output to the nodeMCU.

The front end consists of three options

- ADD New data/Edit Old data
- Delete Old data
- Read RFID data

Once the user input is taken code flows through one of the mentioned options as per the user input. Accordingly, the data is stored into the MySQL database. This data is fetched and displayed on the screen. The third function is sending automated

SMS to the numbers in the database. This particular code gets triggered every 60 minutes. And this is done with the help of task manager of the personal computer.

Task manager is basically responsible for carrying out different tasks in the computer that runs parallelly.

The php code fetches RFID data from the column and compares it with the original fed data to find the duplicates and get the list of absentees.

The php code sending out automated text message is basically fed into the task manager.

The php script is an API from the online SMS gateway named www.way2sms.com

The numbers in the list iterates from the text file and the SMS php file loops with 5 seconds delay until it sends SMS to all the numbers present in the text file.

VII.   COMPARATIVE ANALYSIS

In the previous survey papers mentioned student attendance is either completely manual or it is done through biometric system. Since it is manually done storing the data of the student is also by manual methods. The surveillance is done by manual methods.

Drawbacks :

The surveillance is done manually, whichmay majority of the times put up errors.

The current student attendance system uses manual methods through which the faults are risedmost of thetimes.

These systems that involve manual methods cannot be considered authentic, for malpractices can take place by thismethod.

Advantages of the proposed system over the previous observations:

The attendance system is automated, and hence considered to be the most reliable source of data to maintain therecords.

This system adds on to be a time efficientsystem.

By using this RFID technique, the attendanceandthe surveillance are all made paper-less.More accuracy can be observed by thismethod.

VIII.   FUTURE ENHANCEMENTS

The RFID based smart attendance system is more secure and reliable and fast responded. RFID technology provides tactical and better comfort and also promises an increased effectiveness and improves efficiency. RFID system can be implemented in real time application for attendance

recording purpose. There can be improvements over the proposed system –

i. Enhance the security of RFID systems to ensure privacy protection through mutual authentication.

ii. Reducing the number of readers by using smart antenna and increasing coverage area.

iii. Estimate the variable distances of tag from the reader and distribute power to tags based on this calculation.

iv. Personalised learning could be implemented where in the students' performance status is considered and based on this the learning activities are formulated.

v. Smart campus development areas are not confined to only attendance recording and student tracking, but could also support all aspects of campus life .

vi. Couple the system with biometrics and additional control equipments to cater for misuse and deceit.

IX. \CONCLUSION

The project was designed to build a RFID based smart campus using open source components and software tools. The code was tested and developed on nodeMCUWifi module which shared RFID data with the server that was hosted in the computer. The two are connected via a Wifi router. Automated text was sent using SMS php code which was nothing but an API from online SMS gateway. The prototype was tested using 6 different RFID tags and the SMS code was also tested.

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