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Smart Wireless Attendance Monitoring Using NFC

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Abstract - With the ever growing trends in technology its has become essential to develop smart systems in each field which give more output in less involvement of man power. This paper represents one such idea of Smart Attendance System which uses the concept of NFC to control the attendance system wirelessly. The proposed model not only overcomes the drawbacks of conventional attendance monitoring manually but also proves better than other technologies introduced till date by maintaining the confidentiality and security of the system. Concept of NFC technology is implemented through RFID card. This project uses a Microcontroller to store the database, RFID TAG to store the identification data, RFID Reader to transmit and receive the data through microcontroller, a display device to display the information and a Zig-Bee module to make the whole system wireless and handy to use.
Keywords— Radio Frequency Identification (RFID), Smart attendance system, Zig-Bee module, Near Field Communication (NFC),

I. INTRODUCTION

The issue of attendance registration in present-day institutions is really posing a great challenge in academic setting, because of the way the process is done and various hurdles surrounding it. The attendance is an important part of student's academic record; since in some institutions without a certain percentage student cannot sit for an examination, while in some other institutions it is a part of the continuous assessment. However, the traditional way of attendance registration is time consuming and prone to cheat by some students. The process involves the lecturer passing a paper to the students in a class to write their names and sign, or find their names in the paper to sign along their names. In this situation some students may deceive the lecturer by signing attendance for their friends who are not present in the class. Another way which is more difficult and time consuming is the lecturer will be calling names from the list of the students that are enrolled into the course, and mark present for each and every student who is in the class. Imagine how many minutes it will take to register attendance in a class of like 100 students in this fashion. These are some of the challenges that call for an improvement in the attendance registration process. Several technologies like Biometric, Bluetooth, RFID and NFC have been used to simplify and improve the attendance system, since user identification is the most important aspect that needs to be handled cautiously in this type of applications [1]. The paper proposes a system wherein any staff after entering into the classroom can record the attendance of the students using reader. This reader communicates with the PC placed at office rooms or server rooms and the students' details, time of attendance are all recorded in the PC. The PC does the rest of the job and no manual calculation is required. Also errors are prevented to a greater extent. The teachers can login to their respective id to check the student's attendance status and save it. The project proposes a novel and secure way of identification system that is tamper proof and is easily usable by everyone concerned. For that it uses NFC technology that is known for communication between multiple tags at a specific time and less power consumption. These particular features of NFC make identification and processing very easy as the system is completely wireless and has a collision free algorithm to transmit and receive signals from multiple units.

II. LITERATURE SURVEY

RFID has for some time, been used to access control in many different areas from asset tracking to limiting access to restricted areas. Although the use of RFID systems in educational institutions is not new, it is intended to show how the use of it came to solve daily problems in our university. Nowadays, there are so many institutions that have been growing for eg. in Malaysia , One of that is University of Malaysia Pahang (UMP). Universities in Malaysia still using old method to take student attendance by giving attendance sheet to be sign out by student. After that, lecturers have to analyze it manually to know who is absent and who attended the class. This gives lecturer a lot of work to do. So after looking into the problems of different organizations automatic attendance monitoring were introduced using various other technologies like Bluetooth based system, Wi-Fi based system, biometric like fingerprint, eye scanning etc came into existence. After years of research; in a developing country like ours, lot of latest technology that has been developed such as RFID, wireless, Bluetooth, robot and so on. Therefore, these technologies can be adopted to improve our daily routines so to make our life more comfortable. A lot of work has been done towards improvising the conventional attendance monitoring.

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Following are some related works presenting the use of recent technology in attendance monitoring.

A. Bluetooth Based Attendance Management System

These days, instructors in universities and colleges take the attendance manually either by calling out individual's name or by passing around an attendance sheet for student's signature to confirm his/her presence. Using these methods is both cumbersome and time-consuming. Therefore a method of taking attendance using instructor's mobile telephone has been presented in this paper which is paperless, quick, and accurate. An application software installed in the instructor's mobile telephone enables it to query students' mobile telephone via Bluetooth connection and, through transfer of students' mobile telephones' Media Access Control (MAC) addresses to the instructor's mobile telephone, presence of the student can be confirmed. Moreover, detailed record of a student's attendance can also be generated for printing and filing, if needed. The reason of the development of biometric system is to take student attendance more efficiently. This method uses the student's matrix card to track student's attendance and sent information to the computer and the computer will send data to a mobile phone of lecturer. The listing of students will be automatic, quicker and more security intensive than current methods of registration [3].

B. Automatic Wireless Attendance Recording and Management Using Near Field Communication (NFC)

RFID is increasingly used with biometric technologies for security. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint. Hence, this can be very much useful and can be implemented in real time applications for recording the attendance. By integrating both RFID and microcontroller generates a project with wider boundaries and effective solutions. The system can be improved by increasing the range of reader in which the tag can be read. Further improvement can be done by using a method in which the tag encrypts its ID and then sends to the reader, which will eliminate the capturing of the tag IDs and hence cloning the tags. Extending the benefits of wireless communications for communication of data, to and from portable low cost data carriers, we can appreciate the nature and potential of radio frequency identification (RFID) [4].

C. RFID Based Security System

The application and standardization of RFID are widely increasing but its adoption is still relatively new and hence many features of the technology are not well understood. Developments in RFID technology continue to yield larger memory capacities, wider reading ranges, and faster processing. Though the RFID technology is advantageous compared to bar code, it's highly unlikely that the technology will ultimately replace bar code, even with the inevitable reduction in raw materials coupled with economies of scale, since the integrated circuit in an RF tag will never be as cost effective as a bar code label. If some standards commonality is achieved, whereby RFID equipment from different manufacturers can be used interchangeably, the market will very likely grow exponentially. RFID is an area of automatic identification that is now being seen as a radical means of enhancing data handling processes, complimentary in many ways to other data capture technologies such bar coding [5].

M. Strommer et al.-Stated that the NFC-based applications simplify various human day-to-day activities by simply touching an object fixed or integrated with NFC tag. For instance, Smart Touch is one of the early NFC projects that focuses on NFC technology which was coordinated by VTT Technical Research Centre Finland, applications in various areas were developed under this project such as mobile payment and ticketing, smart poster, attendance system for schools, home use, household access control and security, blood glucose meter, etc [6].

Mohamed A.B, Abdel-Hamid A and Mohammed K.Y - Mentioned, A number of related works exist in literature, application of RFID Technology to different areas and specifically to the area of academic attendance monitoring problem. In this, authors designed and implemented a model of a secured and portable embedded reader system to read the biometric data from the electronic passport. The authors attempted to solve problems of reliability, security and privacy in E-passports by authenticating holder online using Global System of Mobile Communication (GSM) network. Hence, it is observed that in combination with several other technologies RFID can also be used for advancement of human comfort ability and ease in today's era. [7]

III.INTRODUCTION TO RFID

In day-to-day lives there are different types of identification systems present for the detection of animals, students, products and also for transportation. The system like Barcode system, Smart-card and Bio-metric technology are present. When compared to them RFID is faster than barcode and smart card system and cheaper than bio-metric system. Hence we preferred the RFID for our Project. This work is basically a Smart Attendance System using RFID. RFID stands for Radio Frequency Identification and Detection. In this RFID reader and passive RFID chips are used. Reader located on fixed location sends signal to passive RFID

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chip detected in range of reader. Chip re-transmits the acknowledgement signal with its unique Identifier code, hence chip is identified. Also, a single reader can identify many no of chips in very short period of time. So we are using these properties of RFID reader and tag to monitor the student's attendance conveniently. [8] In addition, a Graphical User Interface (GUI) provides more efficient way to review the attendance. Thus, the integration of RFID technology and the GUI in an attendance system produces an automatic system which will give better performance and efficiency than the traditional method of monitoring student. Furthermore, RFID technology can help to identify and to monitor items (products, people, animals, etc) wirelessly within a specified distance. Hence, by seeing and researching of various surveys we came at the conclusion that RFID based system is very useful and can be reliably used in development of further technologies. This is not only used for attendance monitoring but can be implemented for security assessment online servicing, and many more.

IV. OBJECTIVES

Based on the above works done it is found that most of the universities still use old method to take attendance of student by giving attendance sheet to student and student only needs to sign that paper. By use of this method, many students can cheat and ask their friends for proxy. With this method, lecturers have burden to analyze and record the attendance list manually to know the number of students who are absents which in itself is a very hectic and time consuming task. Also if unfortunately attendance sheet gets lost then the task level becomes double which is quite cumbersome and time consuming. Due to which there is a possibility of inaccurate data calculation and faulty records.

Thus the main objectives of the proposed system are:

A. To automate the whole system of students' attendance registration using RFID. In addition, this system can help the lecturers to manage and analyse students' attendance and records very easily.

B. To save time resulting in an efficient and most reliable attendance recording system.

C. To maintain the privacy and uniqueness of students and teachers' identification.

V. BLOCK DIAGRAM

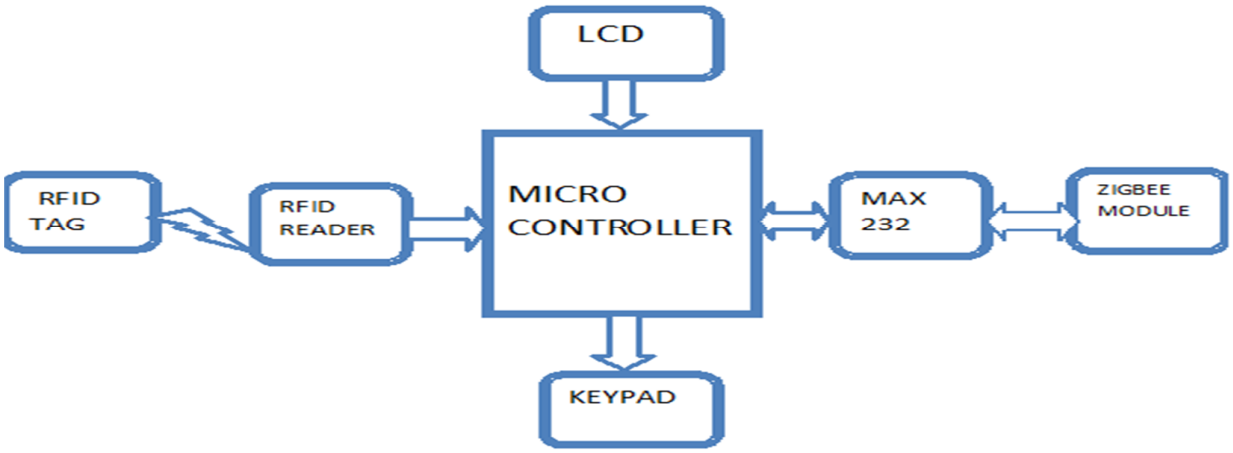


Fig.1 block diagram

Based on the objectives defined, the block diagram for the proposed model is as presented above. There are two basic users:

a) Administrator b) Students

A. Every user of the software should be a student of the organization.

B. The presences of the students within the organization premises are calculated by detecting the code in the tag carried by them and thus calculate their attendance.

C. Admin can view their attendance date wise.

D. The concerned authorities get a generated report of the attendance of the students after required time interval.

In this system of attendance monitoring; RFID reader responses the tag and reads the code of the tag. After taking input from the tag, reader sends the information like roll no and time to the microcontroller which do the required processing .When the operation is done by the microcontroller the information is compared to the database stored in the system and verification

message is displayed on the LCD. Keypad is used as a backup just in case if the student will have to put their roll no manually. MAX 232 is used an interface between server unit and the zigbee module by converting information into suitable signals.

VI. COMPONENTS REQUIRED

A. RFID Tag

RFID tag is sometimes referred as a transponder. It contains the identifying data of the object where it is sited on and it generates a signal containing that relevant information. RFID tags consist of an integrated circuit (IC) attached to an antenna-typically a small coil of wires-plus some protective packaging (like a plastic card) as determined by the application requirements. Data is stored in the IC and transmitted through the antenna to a reader. RFID tags are either “passive” (no battery) or “active” (self-powered by a battery). Tags also can be read-only (stored data can be read but not changed), read/write (stored data can be altered or rewritten), or a combination, in which some data is permanently stored while other memory is left accessible for later encoding and updates. Technical Specifications of tag:

Read range is upto 35cm.
Weight is approx. 30gms.
Operating range (Mhz)=860 to 960.

B. RFID Reader

A reader, now more typically referred to as an RFID interrogator is basically a radio frequency (RF) transmitter and receiver, controlled by a microprocessor .The reader, using an attached antenna, captures data from tags, then passes the data to a computer for processing. Readers can be affixed in a stationary position, portable, or even embedded in electronic equipment such as print-on-demand label printers. The RFID reader recieves the energy transmitted by the tag and sends it in the form of signal which is being further processed by microcontroller.

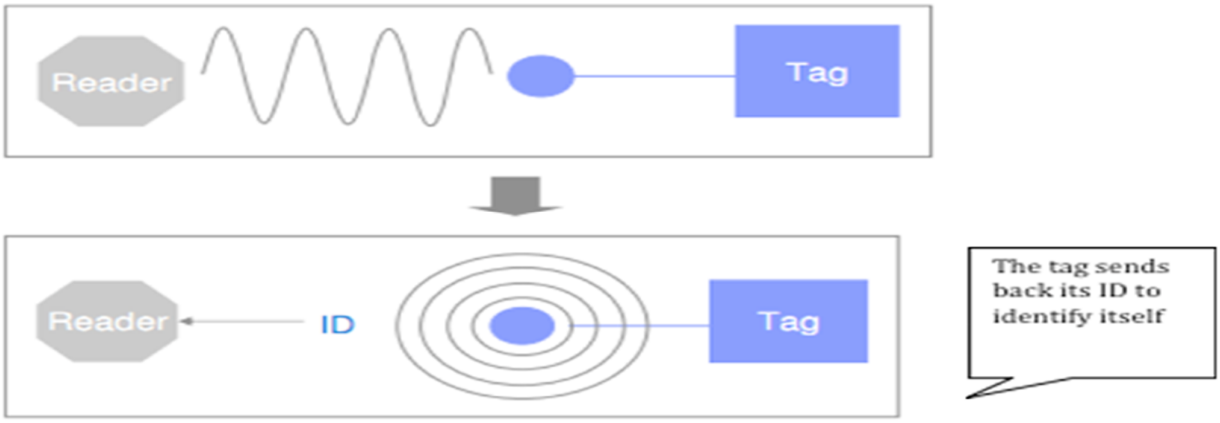


Fig.2 tag reader option

C. *MICROCONTROLLER*

Microcontroller is a single chip microcomputer that has everything inbuilt. PIC belongs to a class of 8 bit microcontroller of RISC architecture. It is a smaller though useful element which is responsible for all the major operations to be performed. The PIC microcontroller program reads the data of RFID. The microcontroller programming is done using embedded C, a middle level language for control units. The PIC microcontroller 16F877A has an operating speed Max 20 MHZ, voltage (2-5.5v). Memory consists of flash program RAM, EEPROM and data memory. Displayed data of RFID are transferred into RS 232, which is interfaced with microcontroller through MAX232.

D. MAX 232

It is an IC which converts signal from RS 232 serial port to signal suitable for use in TTL(transistor transistor logic) compatible logic circuit. The MAX232 is a dual driver/receive and typically converts the RX, TX, CTS and RTS signals.

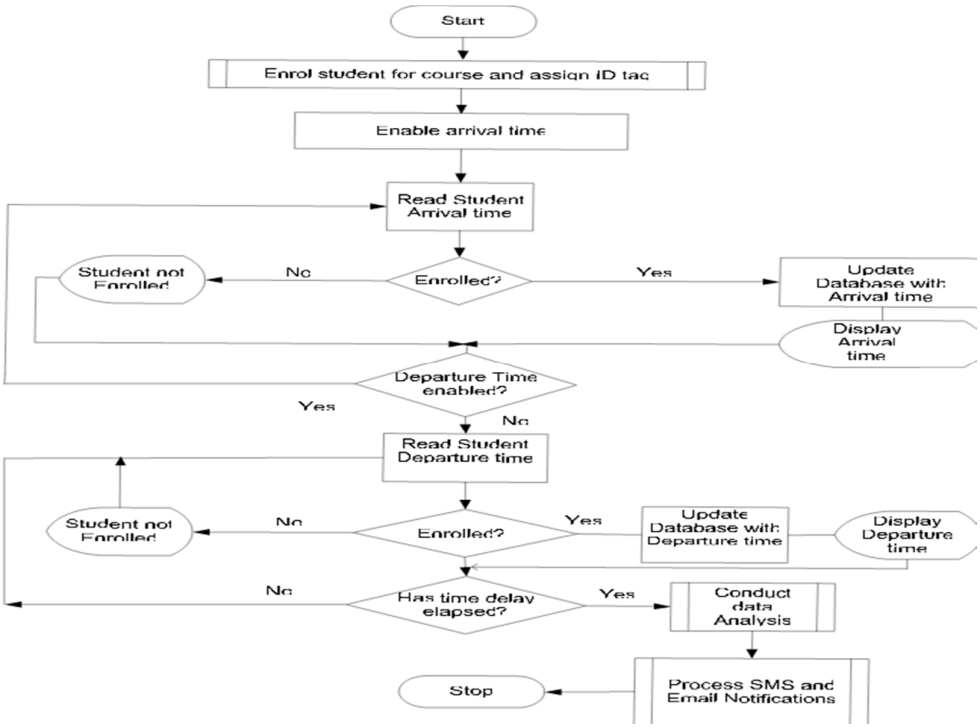
The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a

typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

E. ZIGBEE Module

It is a specification for a suite of high level communication protocols which is used to create a personal area network. It is typically used in low data rate applications that require long battery life and secure networking. Zigbee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. Zigbee is typically used in low data rate applications that require long battery life and secure networking.

VII. FLOWCHART



VIII. WORKING

The technology used for this project is Near Field Communication (NFC) which is nothing but the radio frequency identification technique. Now let us see the detailed explanation of the above.

A. Near Field Communication

Near Field Communication (NFC) is an upcoming technology with a great potential for many application that were either not possible earlier. It is give a higher platform for attendance system where the no. of students is very high and it is not possible to take attendance manually. NFC is one technology that can bridge the gap between wired communication and conventional wireless communication technologies like Bluetooth and Zigbee etc. ,it is with reduced cost and complexity with increase in efficiency of education. [1]

NFC is a new, short range, high frequency, low bandwidth, and wireless communication technology. The range is usually few centimeters, and it operates at the frequency of 13.56 MHz. The maximum data transfer rate is 424kbit/s.NFC is based on Radio frequency Identification(RFID) thus its communication involves initiator and a target, the initiator actively generates a Radio Frequency (RF) field that can be used as a signal to power a passive target. The initiator (active) has its own internal power that can be used to power the ICs that generate the outgoing signal; while the target (passive) has only ICs with no internal power, which makes it to be in different forms like tags, stickers or cards.NFC support three modes of operation they are: reader/writer mode, card emulation mode, and peer to peer mode. The communication in reader/writer mode is between NFC device and a tag in which device either read from a tag or write to a tag. Peer-to-Peer mode involves exchange of data between two NFC devices. While in card emulation mode the NFC device acts as a tag which will appear to an NFC reader as a contact-less smart card. [5]

Various applications of NFC in other field includes;
NFC can be used in any company or an organisation for security purpose.
NFC also enables proper facilitation of e-ticketing, online banking etc.
Nowadays, NFC enabled smartphones are available which is being by students for various purposes.

B. Radio Frequency Identification

RFID is an automated identification and data collection technology, that ensures more accurate and timely data entry. RFID is not actually a new technology; it only quickly gained more attention recently because of its current low cost and advances in other computing fields that open up more application areas. RFID combines radio frequency and microchip technologies to create a smart system that can be used to identify, monitor, secure and do object inventory. At their simplest, RFID systems use tiny chips called tags that contain and transmit some piece of identifying information to an RFID reader, a device that in turn can interface with computers. An RFID system primarily comprises of RFID Tags, RFID Reader, Middleware and a Backend database. RFID Tags are uniquely and universally identified by an identification sequence. A tag can either be passively activated by an RFID reader or it can actively transmit RF signals to the reader. The RFID reader, through its antenna, reads the information stored on these tags when it's in reader's vicinity. The reader, whose effective range is based on its operational frequency, is designed to operate at a certain frequency. [4]

Components of RFID are;

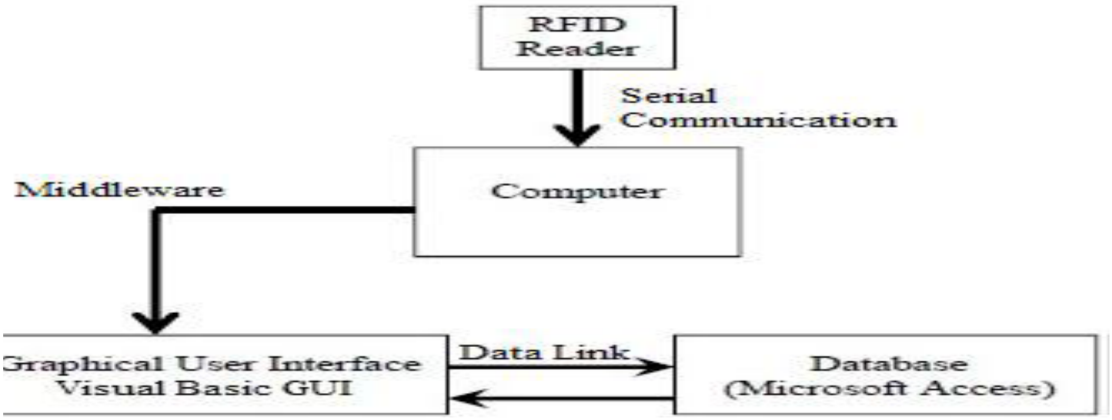
Tags – an object that is attached to any product and uses a unique sequence of characters to define it. It comprises of a chip and the antenna.

Antenna – it is responsible for the transmission of information between the reader and tag using radio waves.

Reader – a scanning device that uses the antenna to realise that tags are in its vicinity. It transmits signals at a certain frequencies.

Middleware – it is a communication interface to interpret and process data being fed by the readers into information. It takes into account all relevant ports of communication and a software application to represent this information.

Backend Database – a repository of information, which is designed specific to the application. The database stores records of data specific to individual tags.



C. RFID System Operation

A careful observation of the trend of usage of RFID tags leads one to consider the possibility of its utilization for monitoring the attendance of students in educational institutions, with the aid of program driven computers. While every student given a specific RFID tag attends the lecture

through entrance door, a serial number (related to each student's matriculation number) of tag is

associated with the student database entry. So every time a student uses his/her card, the entries will be entered into the database with the time stamp. The use of webcam might be optionally necessary to take a snap of the person using the card. Webcam reduces proxy attendance attempts. This is used to cross-verify in the event of an undesirable event or dispute. Consequently, the attendance data then can be used to create many types of reports like daily attendance details, monthly, weekly and real time feedback to parents. The attendance score calculation can be automated using the collected data. After setting up the student attendance RFID system from the mode of operation depicted in the diagram shown in figure 5 (a), (b), (c). The tag is activated when it passes through a radio frequency (RF) field (125 kHz in this case), which is generated by the antenna embedded within the reader box. The program checks whether the tag is valid or not. If the tag is valid, it will continue to the database program

and registers the student's attendance for the course. If the tag is invalid, the program gives a notification that the tag has not been registered to any student and requires the user to either supply a valid tag. In this way RFID tag and reader communicate with each other.

Key Specifications-

Power requirements :7-9VDC

Current Requirement : <110mA

Communication : RS232 Serial at 9600 baud (8N1)

Dimensions : 63mm x 98mm x 5 mm

Operating temp range : -40 to +185 °F (-40 to +85 °C)

IX. ADVANTAGES

Although many techniques have been introduced to overcome the drawbacks of manual attendance monitoring, but they all differ in one way or the other. Based on the study of these techniques below are some reasons why one should go for a wireless attendance monitoring based on Near Field Communication.

A. Two devices need not to be connected or paired as in case of Bluetooth.
B. Less time Consuming
C. Suitable for short range communication.
D. Very low or no power consumption.
E. Maintains the uniqueness of identification of individuals.
F. Secure method.
G. By addition of wireless feature, the system become very handy ad easy to port.

X. CONCLUSION

RFID is increasingly used with biometric technologies for security. The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Hence, this project can be very much useful and can be used in a real time application of attendance monitoring system which will make traditional way of taking attendance less cumbersome ,time saving and easily manageable. Attendance management in education institutions is a very important issue, because in most institutions attendance is part of student's continuous assessment or is a condition that student must met before they are allowed to sit for examinations. The system presented in this project will substantially improve the current day's attendance registration system and eliminate many paper works involved in it. Other benefits include eliminating the chance of losing attendance data, different attendance reports can be easily generated by a click of mouse, simplifying the decision making process related to attendance, etc. One of the major distinct characteristics of our proposed system is that the hardware required are minimal, i.e. only NFC tag and NFC-reader. This is as oppose to most systems where other devices like NFC or RFID reader is required. In the future, the system will be implemented in a real institution setup in order to validate it.

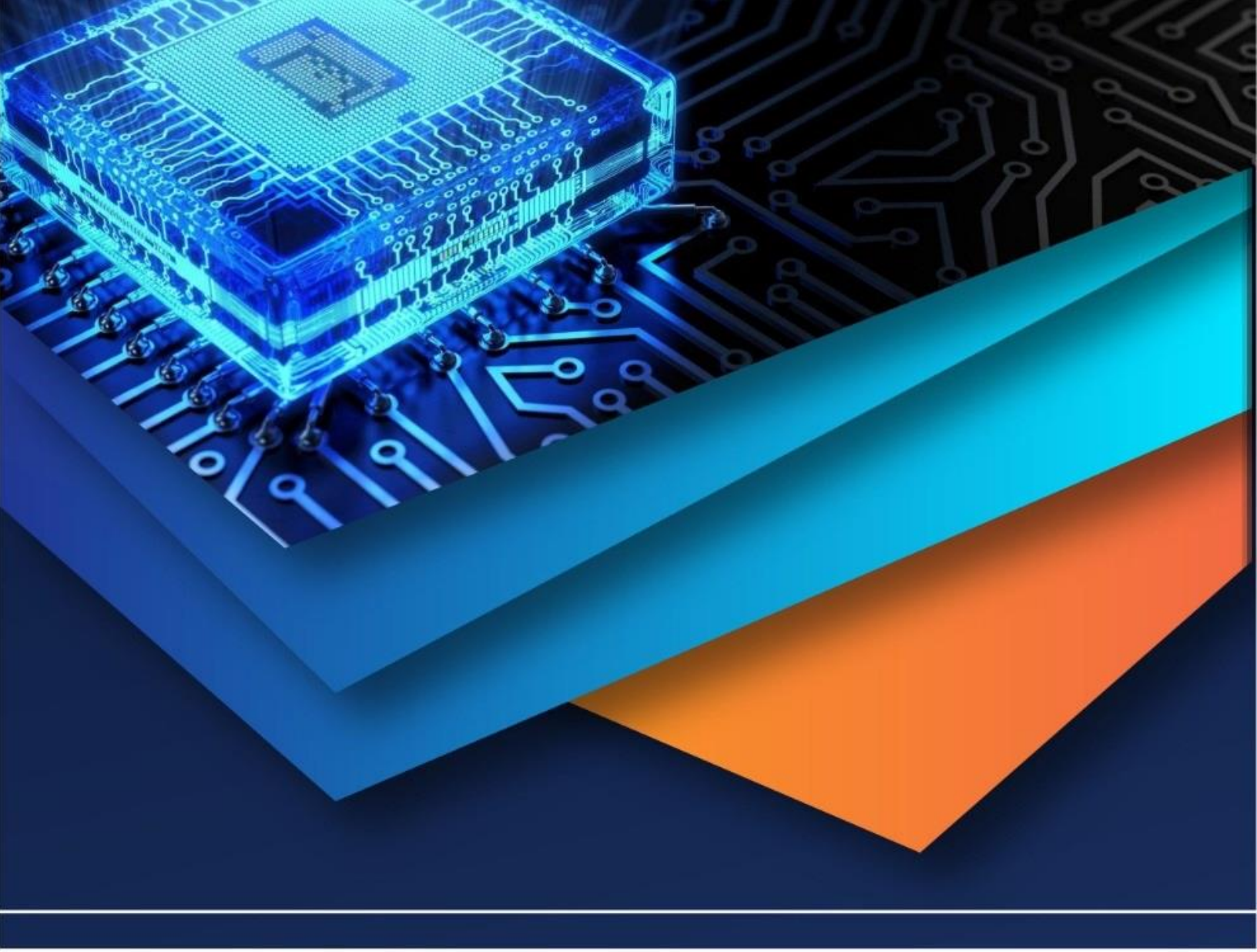
XI. ACKNOWLEDGMENT

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