An Automatic Student Attendance System Based on

the Internet of Things: A Framework

Aziza A. Sultan , Mohamed A. Amasha, Marwa F. Areed, Rania A. Abougalala, Salem Alkhalaf

Abstract

We live in a world where everything is automated and connected. Online machine learning is developing day by day. Many systems have been completely modified thanks to this development to help achieve more correct results. The Internet of Things allows us to develop a system that is able to operate without human intervention. In other words, the Internet of Things is a technology that has the ability to transmit data on the Internet without human-computer cooperation.

The Internet of Things is used in different ways in most regions. This study aims to develop an automated attendance management system where attendance is recorded via mobile devices and the student's presence is limited to a specific place based on a specific network. Recent advances in wireless technologies have led to the development and growth of smart systems in everyday life. Nowadays, the Wi-Fi localization mechanism can cover a specific area so that any user connected to the Wi-Fi station can be recognized. We developed the design and implementation of class attendance monitoring system through Wi-Fi signal. The developed software system will be able to store, retrieve and deliver student information, such as attendance or absence, through a mobile device with server knowledge.

Keywords: Student attendance system, mobile phone, Internet of Things (IoTs), Android system-Wi-Fi

1. INTRODUCTION

The Internet of Things (IoTs) points towards an organizational framework of physical gadgets and a couple of elective things that square measure incorporated with material science, programming, sensors, and organization property. There is a fusion of many different things, including periodic machines, cell phones, dishwashers, headphones, devices a person wears, lights, and more. These associated things gather and trade information between themselves by virtue of a correspondence medium. The objective is to omit human intervention so that the item becomes a gadget that can be remotely controlled through the current correspondence network to interface the real world with the digital world, with the aim of improving proficiency, offering a great deal of exactness, and providing economic advantage. In recent years, numerous applications have been developed that use the IoTs. Attendance might be an important piece of instruction on a very basic level. Instructive foundations need an unfailing method of recording understudy participation for following helpless participation record as well as to strengthening quality learning. (Akter et al., 2018)

It is hard to oversee undergraduate students going to schools or colleges particularly in study halls that incorporate numerous undergraduate students where the checking of their participation utilizing the manual strategies devours time and end eavors to recognize or recall their appearances by instructors.

Educational institutes with internet access all over the region have the opportunity to move to a robotic time participation framework. Individuals as executives are one

of the highly troublesome issues at such places, and keeping the quality of paper sheets or records is another issue that expands the multifaceted nature of the conventional/manual time participation framework. Moreover, cheating in signatures happens quite frequently; missing undergraduate students request their companions to help them sign the participation sheet (Alassery, 2019). We propose an automatic student attendance system that supports the most recent technology known as the IoT.

2. LITERATURE REVIEW FOR THE ATTENDANCE SYSTEM
2.1 Radio Frequency Identification

Radio frequency identification (RFID), which is considered an automatic attendance management system using RFID perusers, was actualized in the portable and electronic stage. The Arduino board based on ATmega1280 was designed for the fingerprint attendance system, where a ZFM-20 fingerprint scanner with its own processor and memory was used. The user-friendly interface was provided by the thin film transistor (TFT) touch screen, and the Secure Digital (SD) card was used for understudy records with a real-time clock, which provides a specific participation date and time. The Caesar Cipher cryptographic strategy is used to confirm information against an unapproved client (Azim et al., 2020).

The RFID-based framework distinguishes labels and is used to stamp understudy participation in using a PC. The RFID peruser distinguishes the tag, and the framework measures the data in the PC, as indicated by customized directions, manage the ability, accessibility, and

responsiveness of the innovation, profoundly influencing the straightforwardness with which the RFID framework can be incorporated into current tasks (Azim et al., 2020).

2.2 Face Recognition

It is one of the most proficient frameworks in distinguishing the proof of individuals. It is used in schools, universities, or associations. To tackle the trouble of gauging participation, which is in vast numbers, there is a need for a robotic participation framework that is quick and decreases the opportunity of phony participation. This innovation framework conveys a simple and protected method of bringing down participation. Participation is recorded by constantly distinguishing between the countenance of workers or undergraduate students through camera as they enter the study hall. The product recognizes the appearance and at the same time contrasts it with the predefined information base (Patel et al., 2018).

2.3 Fingerprint

Fingerprint is aimed at providing a staff attendance system that tracks the academic activities of employees in an institution which will help Verification the performance of employees. The lecturer's fingerprint is captured via a fingerprint scanner, and the trivia is extracted and processed. The feature sets square measure hold on within the information as a guide. On taking another lecture, the lecturer's fingerprint is captured once more for verification, and conjointly, the lecture count is recorded several times. Once there exists an amount of promotion or honors for an employee, the performance rating of the employee is conducted via an internet respondent survey

containing numerous performance indices and filled by the undergraduate students. The outcome will be examined and assessed to approve staff fulfillment. The results are analyzed and evaluated to validate staff performance (Omomule et al., 2020).

2.4 Cloud Computing

This study supports the IoTs paradigm; a prototype of a cloud-based end-to-end sensible attendance system has been developed that makes an attempt to resolve the issues of manual attendance systems that have been observed in education institutes. Manual attendance systems will be replaced by automated attendance records, where monitoring, reporting, and alerting for different entities can be done across the institution. The attendance device is designed to be portable so that the time needed to record attendance can be reduced and students can easily mark their presence (Yadav & Bhole, 2019).

2.5 Bar Code

In this innovation, undergraduate students convey scanner tags imprinted on their understudy cards, which at the time of introducing standardized identifications read using scanner tag perusers. This process is sufficiently quick and does not cost a fortune; however, this framework has the downside that standardized identifications can be effortlessly copied by printing using a customary printer (Dedy Irawan et al., 2018).

3. METHODOLOGY

The framework we propose in this study aims to manage issues related to the registration of student participation in schools via an Android-based attendance management application. Assuming that the majority of the lecturers own Android devices, the choice of this proposed framework will undoubtedly hamper equipment appreciation and maintenance. In addition, Android gadgets are small in size, light in weight, and convenient to organize, allowing them to be used anywhere with ease. Seeing the result, we started the fundamental progress in improving the framework by publishing the highlights provided by the device. The teacher will initially get a chance to provide the Android Package Kit (APK) history on their Android devices. When you start using the device, the trainer will get a chance to log in to the device by providing the customer ID and password. The application has already been implemented on a sample of students and each student is taken to log into a specific network domain and we start to notice that every student who logs in is logged in the Firebase database and the student who exits outside the specified range, their logout time is also logged in a database firebase.

4. REQUIREMENTS TO REALIZE THE AUTOMATIC ATTENDANCE SYSTEM
4.1 Wi-Fi

Wi-Fi is a remote innovation used for system administration, permitting PCs or other gadgets to set up over a sign. Vic Hayes has created correspondence wireless fidelity. Nowadays, Wi-Fi is used to convey extremely rapid wireless local area networks so as to interface a huge number of public areas such as emergency

clinics, bistros, and air terminals. It is likewise being incorporated in handheld gadgets, tablets, notepads, and purchaser electronic gadgets (Chopra et al., 2019). The understudy application provides a reaction to choose a class by communicating encoded accreditation from a brief Wi-Fi hotspot that has been made. On the teacher's side, in the wake of broadcasting class information, the application makes an audience tune in to participate, recording demand. When the solicitation is received, the application decodes the qualification data. Both telecommunication measures use Wi-Fi Direct service. The confirmation cycle is used to check whether the application associated with the teacher is authentic or not. The instructor application interfaces with the Wi-Fi hotspot with certifications obtained from past advancements. At a point when the application is associated with the Wi-Fi hotspot, the teacher application sends a test code that must be replied to by the understudy application on the off chance that the response is correct. At that point, the understudy is viewed as being present at the lecture.

The fundamental focal point of the proposed technique is to expand adaptability and limit cost while keeping up the security and legitimacy of the check cycle. The cycle should likewise be as simple as conceivable without client mediation (Pambudi & Bariyah, 2020).

4.2 Administrator Module

This module is employed to provide log-in for the administrator. It has the rights to watch and manage the whole project. Through this module, any new information is often easily inserted, updated, deleted, or viewed (Singh et al., 2017).

4.3 Android Application

The landing page for the application includes the login screen where clients, depending on their positions, will be able to enroll. Individuals who previously enrolled can have the option to enter their existing usernames and passwords (Alassery, 2019).

4.4 Database

The database of undergraduate students is made before the acknowledgment cycle, which incorporates client name and ID. This is finished by the regarded educator through the admin board. During this cycle, the admin enters understudies' names and their parents' email addresses (Patel et al., 2018).

Table 1

Requirements of an Automatic Attendance System

No.	Requirements
1.	Wi-Fi
2.	Administrator module
3.	Android application
4.	Database
5.	**For utilitarian necessities:** Requirements exemplify to the activities that ought to be handled on the information received from the framework. They should incorporate the following: • New understudies will have the option to enlist the framework by tapping on the Take Attendance button. This is done just a single

	time at the first run-through. • After the registration of understudies, they ought to have the option to log into the framework by entering the novel username and ID. On the off chance that the log-in is fruitful, they will have the option to gain admittance to the principle highlights of the application. Otherwise, a blunder message will be expeditious.
6.	**For non-utilitarian necessities:** Exemplify to regulation abilities regarding security, execution, unwavering quality, adaptability, and so forth. They will incorporate the following: • Systems are frequently ready to peruse the unique mark of an understudy and contrast data put away in the information base to keep participation data. • Efficiency of the framework ought to be high. • Simplicity of the interfaces altogether so that the client can undoubtedly utilize the highlights without experiencing any inconvenience. • Flexibility to include and change a few highlights in the framework. • In terms of safety, client data can be spared in a safe information base.

Table 1 presents the practical prerequisites; they speak to the activities that ought to be handled on the information of the system.

• The admin can have the option to add new students to the lecture by tapping on the Add New Student

button. Likewise, the admin can have the option to erase the existing gatherings by tapping on the Delete Student button.

- The system can have the option to recover data when required by the admin or undergraduate students.

- For non-utilitarian necessities: Exemplify to regulation abilities regarding security, execution, unwavering quality, adaptability, and so forth.

- For information prerequisites, the requirements speak to the information that ought to be accessed and introduced in the application, for example, speaker recognizable proof number, client log-in data, and e-mail address. For information necessities, they exemplify to the information that ought to be access and introduced in the application, for example, unique mark photographs, names, ID numbers, time of attendance, address dates; teacher names; instructor ID numbers, and report of attendance (Alassery, 2019).

## 5. IOT-ENABLED AUTOMATIC ATTENDANCE SYSTEM FRAMEWORK

5.1 IoTs

The IoTs comprises arranged, installed gadgets furnished with a specific degree of knowledge. A quick development in hidden innovations gives heterogeneous gadgets, such as cell phones, vehicles, sensors, and actuators with information-preparing and -organizing abilities. Such gadgets structure IoTs conditions and become IoTs keen gadgets (De Matos et al., 2020).

5.1.1 Architectural differences

IoTs design might even be treated as a framework that can be physical, virtual, or a half and half of the two, comprising an assortment of shifted, dynamic physical things, sensors, actuators, cloud administrations, explicit IoTs conventions, correspondence layers, clients, engineers, and undertaking layers. Explicit designs do go about as a turn component of IoTs explicit framework, though encouraging the efficient methodology toward unique components results in answers to associated issues. A well-outlined style of IoTs design is presently on the market for data purposes: "a dynamic world network infrastructure with self-configuring capabilities supported commonplace and practical communication protocols wherever physical and virtual 'Things' have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the data network" (Ray, 2018).

There are four different layers of IoTs architecture that are shown in Figure 1 (Nord et al., 2019)

Fig. 1: Different layers of Internet of Things (IoTs) architecture Nord et al., 2019.
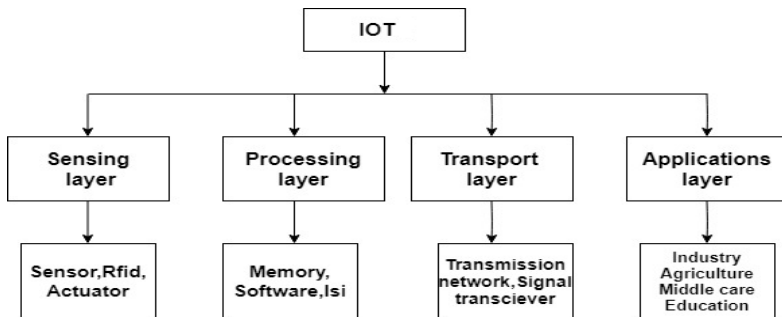
5.2 IoT Applications and Related Work

It is difficult to list all the areas that are subject to IoTs applications. It is possible to cover some common applications, with the aim of summarizing their various requirements and design implications and obtaining a general understanding of them. Challenges to their progress. There are countless potential applications that can fall under the Internet of Things umbrella overall characterization for applications used incorporates medical care, savvy climate, transport, industry, and military applications Military, Health care, Home automation, Smart environment, Industry, Pilgrim monitoring (Kharrufa et al., 2019).

5.2.1 Military

The IoT locates its basic applications in the military field. ZigBee or Global System for Mobile communications (GSM) networks are some of the remote organization advances. IoT-based frameworks can help the military in recognizing foes, checking the equipped faculty's physical and mental state, and synchronizing furnished staff with safeguard frameworks (Ramson et al., 2020).

5.2.2 Health care

This section discusses the use of the IoT in distant health checkups, ingestible sensors, versatile well-being, savvy clinics, and improved treatment of persistent infections In smart clinics, IoT assumes a fundamental part to redesign the hospital to an Intelligent level by recording Appointments on smart mobiles Inside the medical clinic, premises are regularly embedded with RFID chips to decide on their tracking (Ramson et al., 2020).

5.2.3 Home automation

The IoT has reclassified the way an electronic machine is controlled in the home climate. Today, each machine—for example, lights, cooling, media, security frameworks, coolers, and stoves—is frequently associated with the web, using a hand-off switch, a miniature regulator, and a networkdevice.By using a graphical interface, the client can control the apparatuses even from a far-off area (Ramson et al., 2020).

5.2.4 Smart environment

A savvy climate incorporates different IoT applications, such as discovering fire in woods, measuring snow in high-elevation areas, forestalling avalanches, recognizing quakes early, and observing contamination. These IoT applications are firmly connected with the lifetime of the populace and creatures in these zones. Governmental organizations engaged with such fields rely on the information received from these IoT applications. Accordingly, keen climate applications must be profoundly exact, and security penetration and information altering must be kept away (Hassija et al., 2019).

5.2.5 Industry

It is one of the applications of the Internet of things, sensor hubs screen the climate about the surrounding environment, gather information, and act via actuators, giving complete control and performing mechanization. The savvy network application is an example of the shut circle control framework, where Wireless Sensor Network WSNs are used. The office lattice is altered to turn into

"brilliant" energy in sustainable power source applications (Hassija et al., 2019).

5.2.6 Pilgrim monitoring

A more noteworthy group can be big at whatever point a pilgrimage session Increased. Pilgrims move in gatherings of impressive sizes in this way, where the likelihood of losing important things and missing individuals from gatherings is high. In the event that a traveler loses their path from the gathering, which creates tension for the family, it poses a challenge to specialists who are dealing with the group. The IoTs based explorer-observing framework could notice someone who is lost, hurt, or in trouble, and then guide and connect the traveler to the particular gathering and oversee and control pilgrim swarms (Ramson et al., 2020).
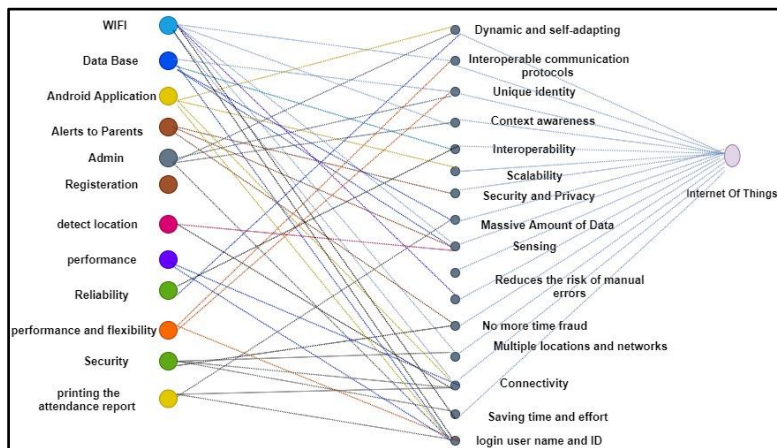

Fig. 2: Automatic attendance system and Internet of Things: An interrelationship diagram.

5.3 Interrelation of an Automatic Attendance System and the IoT

To analyze how IoT innovation can assist with conquering a manual attendance system, we interrelate IoT functionalities with the necessities of an automatic attendance system. Figure 2 shows the prerequisites of an automatic attendance system in an amassed structure, which is dependent on Table 1 on the left side, and the highlights and functionalities of the most basic programmed attendance framework are provided on the right side. As presented, every necessity of a programmed attendance framework is met by any one usefulness of the IoT while most prerequisites are met by a blend of various commonly subordinate highlights. In addition, it is important to note How to activate the necessities and requirements of the Internet of things to achieve an automatic attendance system

5.4 IoT Structure Design for the Attendance System

IoT highlights and functionalities can possibly meet the usage prerequisites of the attendance system just as defeating the boundaries and limitations of the manual attendance system. The achievement and execution of a joint application, nonetheless, exceptionally relies upon the engineering and setup of the IoT, which should be planned as per the particular qualities of the attendance system idea. There are two modules of this system architecture: (i) students and (ii) admin. When students connect to the Wi-Fi network, their attendance will be calculated and sent to the teacher for analysis, as shown in Figure 3.
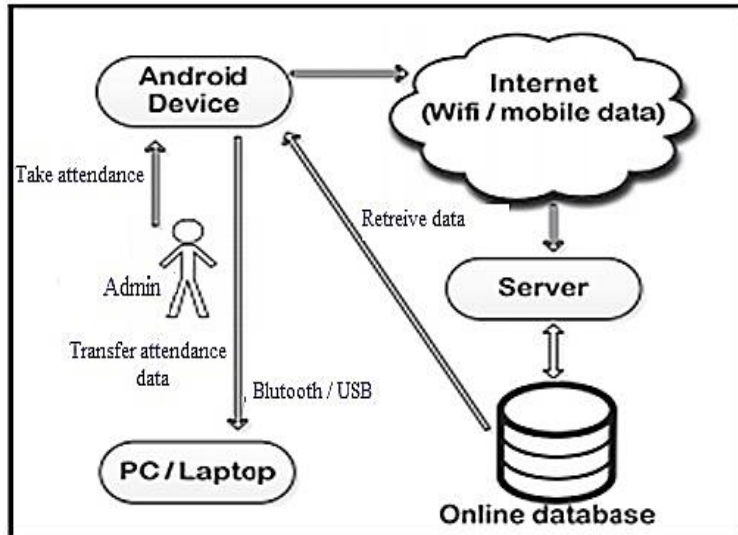
Fig. 3: System architecture.

5.4.1 Use case diagram

Students enjoy these features when using the Android application, which includes facilities such as taking attendance, viewing attendance, registering students, creating courses, and creating timetables, as shown in Figure 4.
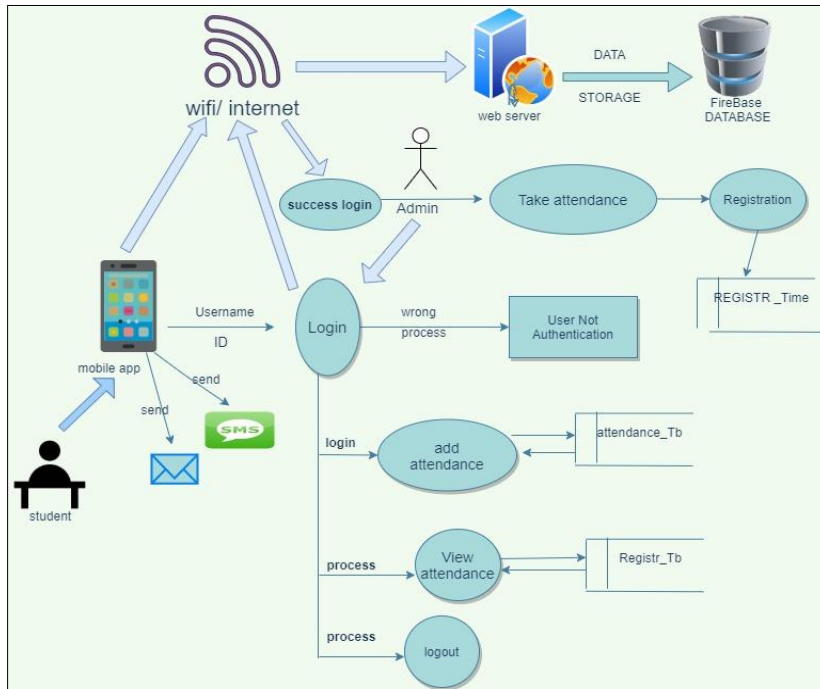
Fig. 4: Use case diagram of the attendance system.

6. IMPLEMENTATION

We will plan a few operations for deciding student attendance using the proposed IoT system in a faculty.

TheAndroid platform by MIT App Inventor will be used to meet certain needs of the automatic attendance system. Educators will first get to enter the APK document in their Android gadgets. When the machine is started, the admin will get the chance to sign into the apparatus by providing the ID and password. This will connect students to the Wi-Fi network by entering their name, ID, and faculty name, as shown in Figure 5. This is often especially helpful in retaining and appropriately maintaining students' knowledge of the lecturers upon successful authentication.

Fig.

5:

```
Code 1 Create event button

When button of Take Attendance click

Do call Notifier of a variable FN

IF    Textbox1.text equal text Or Textbox2.text equal text

Then Create message "Enter your A or B or choose C"

       Where A {Name}, B {ID} and C {Faculty name}

Else Set create a variable and create list with a variables

       Call Notifier message "welcome"

       Set Textbox1.text.enable to logic"false"

If    get global a variable FN equal text

Then Set global a variable equal zero

Set global a variable equal username

Set global a variable equal password

Call FunctionTaifunwifi and makes it is enable
```
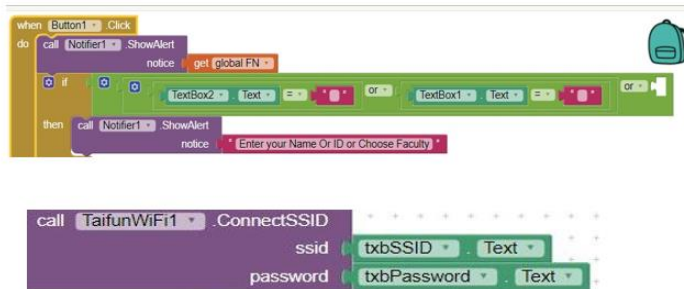

Program logic for the attendance system.

An element of MIT App Inventor permits clients to associate a gadget with a PC using Wi-Fi to test their applications and connect to a service set identifier (SSID).

In the event that you enter a nonexistent SSID or wrong password, it will simply be disregarded and the gadget will attempt to associate with a known SSID, where the application tests the username and password of the Wi-

Fi network of the college affiliated with student attendance through the Taifun Wi-Fi tool (Fig. 6)

Code2: After CallingFunctionTaifunwifi

When

The negotiation with the WifiConfiguration was successful

do

 If   get a variable successful equal true

Then set a variable equal false

Else

Call notifier show alert message unable to connect

```
when TaifunWiFi1 .AfterWifiNegotiation
     successful
do   if  get successful = true
     then  set global conn to 1
           set Button1 . Visible to false
           set Spinner1 . Visible to false
```
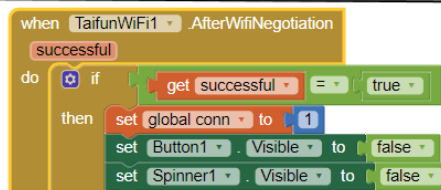
Fig. 6: Taifun Wi-Fi to determine the location of the student.

We need to create a timer that can be reset when an action takes place in order to complete the application form. The application will determine the time when a student enters the application and presses the Take Attendance button, and the application stores the student's attendance in the database (Fig. 7).

Code3: Clock Timer Event

When The Clock component has a key event, Clock. Timer

do

If the clock. Timer enabled property determines if the clock. Timer event will trigger at all. In some apps, you'll initially set this property to false

Then set a variable date to calling provide the default format, which is "mmm d, yyyy HH:mm:ss a" for Format Date Time, "MMM d, yyyy" for Format Date
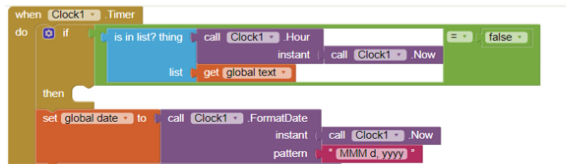

Fig. 7: Clock timer element for automatic attendance.

7. CONCLUSION AND FUTURE WORK

This article proposes an application architecture that addresses the limitations of the current attendance system by utilizing IoTs innovation in implementing and selecting the prerequisites for the attendance system on a reasonable basis. The real development of the Internet of Things does not lie in innovation itself, but in its application in believable conditions. Another framework for attendance management was introduced here for universities, where a questionnaire was conducted on the students and expert opinion was taken and the results were satisfactory. The results proved that the program was more accurate and effective and that the program was more beneficial for the learners. Through the questionnaire, the result showed the usability of this system and indirectly helped increase the student's adherence to punctuality. This framework has some

important capabilities, for example, attendance monitoring. This strategy meets the requirements of daily activity and teamwork in colleges and educational institutions. The framework will be really useful for undergraduate students just as it will be useful for faculty members of individual colleges and institutions. As this innovation progresses, they can use their conversations in the most optimal way. The purpose of this study is to reach the main points about student attendance data. We can build a secure, versatile, and transition-ready presence system using the Internet of Things. This framework uses a logical approach and provides intelligent responses to monitor student attendance and has an enormous scope. The proposed attendance monitoring system uses the idea of the Internet of Things to log in and get information on the server and make this information accessible to students anytime and anywhere.

REFERENCES

Akter, F., Akhi, A. B., Farin, N. J., Khondoker, M. M., & Saklayen, M. G. (2018). IoTSAMS: A novel framework for Internet of Things (IoT) based smart attendance management system. Intelligent Control and Automation, 9(3), 74–84.

Alassery, F. (2019, March). A smart classroom of wireless sensor networks for students time attendance system. In 2019 IEEE Integrated STEM Education Conference (ISEC) (pp. 324–331). IEEE.

Azim, N. A., Hussein, A. M., Shawky, H. I., & Joudah, H. A. (2020). Bluetooth smart based automated attendance system. International Journal of Advanced Trends in Computer Science and Engineering, 9(3), 4137–4140.

Chopra, K., Gupta, K., & Lambora, A. (2019) Future internet: The Internet of Things—a literature review. In 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon) (pp. 135–139). IEEE.

De Matos, E., Tiburski, R. T., Moratelli, C. R., Johann Filho, S., Amaral, L. A., Ramachandran, G., ... & Hessel, F. (2020). Context information sharing for the Internet of Things: A survey. Computer Networks, 166, 106988.

Dedy Irawan, J., Adriantantri, E., & Farid, A. (2018). RFID and IOT for attendance monitoring system. MATEC Web of Conferences, 164, 01020.

Hassija, V., Chamola, V., Saxena, V., Jain, D., Goyal, P., & Sikdar, B. (2019). A survey on IoT security: application areas, security threats, and solution architectures. IEEE Access, 7, 82721–82743.

Kharrufa, H., Al-Kashoash, H. A., & Kemp, A. H. (2019). RPL-based routing protocols in IoT applications: A review. IEEE Sensors Journal, 19(15), 5952–5967.

Nord, J. H., Koohang, A., & Paliszkiewicz, J. (2019). The Internet of Things: Review and theoretical framework. Expert Systems with Applications, 133, 97-108.

Omomule, T. G., Akingbesote, A. O., Bayode, O. O., & Aju, G. O. (2020). Development of lecture attendance system for staff performance rating in a tertiary institution using fingerprint technology. International Journal of Engineering and Management Research, 9(1), 73–86.

Pambudi, D. S., & Bariyah, T. (2020). Student attendance system using WiFi direct and temporary Wi-Fi hotspot. Journal of Computer Science and Information, 13(1), 1–8.

Patel, S., Kumar, P., Garg, S., & Kumar, R. (2018). Face recognition based smart attendance system using IOT. International Journal of Computer Sciences and Engineering, 5, 871–877.

Ramson, S. J., Vishnu, S., & Shanmugam, M. (2020, March). Applications of Internet of Things (IoT)—an

overview. In 2020 5th International Conference on Devices, Circuits and Systems (ICDCS) (pp. 92–95). IEEE.

Ray, P. P. (2018). A survey on Internet of Things architectures. Journal of King Saud University-Computer and Information Sciences, 30(3), 291–319.

Singh, M., Tripathi, D., Pandey, A., & Singh, R. K. (2017). Mobile based student attendance management system. *International Journal of Computer Applications*, 975, 8887.

Yadav, V., & Bhole, G. P. (2019, February). Cloud based smart attendance system for educational institutions. In *2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon)* (pp. 97–102). IEEE.

الملخص :

نحن نعيش في عالم حيث كل شيء آلي ومتصل،يتطور التعلم الآلي عبر الإنترنت يومًا بعد يوم. تم تعديل العديد من الأنظمة بالكامل بفضل هذا التطوير للمساعدة في تحقيق المزيد من النتائج الصحيحة. يتيح لنا إنترنت الأشياء تطوير نظام قادر على العمل دون تدخل بشري. بمعنى آخر ، إنترنت الأشياء هي تقنية لديها القدرة على نقل البيانات على الإنترنت دون تعاون بين الإنسان والحاسوب.

يتم استخدام إنترنت الأشياء بطرق مختلفة في معظم المناطق. تهدف هذه الدراسة إلى تطوير نظام آلي لإدارة الحضور حيث يتم تسجيل الحضور عبر الأجهزة المحمولة ويقتصر وجود الطالب على مكان معين بناءً على شبكة معينة. أدت التطورات الحديثة في التقنيات اللاسلكية إلى تطوير ونمو الأنظمة الذكية في الحياة اليومية. في الوقت الحاضر ، يمكن لآلية توطين Wi-Fiتغطية منطقة معينة بحيث يمكن التعرف على أي مستخدم متصل بمحطة Wi-Fi. قمنا بتطوير تصميم وتنفيذ نظام مراقبة حضور الفصل من خلال إشارة Wi-Fi. سيكون نظام البرمجيات المطور قادرًا على تخزين واسترداد وتسليم معلومات الطالب ، مثل الحضور أو الغياب من خلال جهاز محمول مع معرفة بالخادم.