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Arduino Mega to Build a System for Student Evaluation and Attendance

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Abstract

Monitoring student attendance and evaluating their performance in each lab lecture form the basis of the final evaluation at the end of the semester. These records (assessment, attendance) are stored on paper lists. Manual methods include a number of drawbacks, such as time loss, inaccurate results from human mistake, and difficulty obtaining reports when required. In order to address the problems with the manual student attendance and assessment technique, this study makes use of an Arduino Mega. In addition to assigning scores for each lab assignment, lecturers can input each student's attendance and performance rating. Together with the student's attendance record, these grades are stored in text files that may be accessed using Excel spreadsheets. The proposed approach aims to enhance information accessibility, reduce the amount of time spent on manual chores, and make it easier to obtain final evaluation results. It also reduces results accuracy, human error, and administrative overhead.

Keywords: student evaluation system, student attendance system , arduino mega, nextion HMI, grade calculation.

1 Introduction

The use of digital transformation in academic performance coupled with the development of technology and the modern information revolution in educational institutions has led to academic progress and facing the challenges of current technology [1][2][3][4].

The electronic student assessment system is seen as a new approach to assessing student performance in academic institutions as it simplifies the process of student assessment and helps in storing and generating reports, which can then be used in addition to reducing human errors to make academic institutions more efficient [5]. The system will also impact academic decision making by comparing the grades and performance of students during different academic years in order to improve the education system which will also ensure that academic accreditation standards are maintained [6].

Traditional methods of student attendance at universities involve paper copies of student names to record their attendance. This method is time-consuming and more prone to error. Developing a student attendance system using modern technology and advanced software saves time and effort and improves the accuracy of results [7].

It was noted that there are a number of loopholes or weaknesses in previous studies in terms of the need for systems to be constantly connected to the Internet, problems related to the use of RFID card readers, whether the material costs of issuing the card or the costs of the device, the problem of any student carrying another student’s card and recording attendance on his behalf without the actual presence of the cardholder and a malfunction in the fingerprint sensors or damage to the student’s fingerprint in addition to the possibility of the student recording attendance before the start of the lecture and not entering the lecture, especially in RFID systems and biometric systems. The aim of the study is to automate the process of evaluating student performance by designing a system that relies primarily on advanced technology to evaluate student performance in carrying out tasks within the laboratory, thus reducing reliance on traditional paper methods. Recording attendance and tracking absence accurately, ensuring that students’ attendance is accurately recorded in each laboratory lecture. Improving the accuracy and efficiency of assessments by ensuring that all assessment data (grade, assessment time, and attendance date) are automatically documented in text files accessible

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via Excel programs, which contributes to reducing human errors and improving the efficiency of the assessment process. Facilitating the process of managing student data and their evaluations at the level of the individual student and the group as well, which allows professors to follow the progress of each student faster and more accurately. Ease of obtaining absence reports, calculating absence rates, and issuing warnings to students accurately through the Excel program at any time during the semester and with little effort and time. The process of calculating the final grade for the student using the Excel program is easy, accurate, and efficient in terms of time and effort. Usually, the process of calculating the final grade includes collecting many student evaluations in the laboratory in addition to the daily or semester exam grades, and there may be a percentage of the grade that includes the students' attendance in the laboratory, so the process of dividing the previous evaluations and grades to obtain the final grade for the students is easy and accurate using the proposed system.

2. Literature Review

There are many different electronic systems for student assessment and attendance recording systems. The following are the most studies that deal with the subject of the study.

In 2018 the system designed based on RFID technology with wireless connectivity using Wi-Fi and GSM networks to record student attendance compared to the manual methods used which lead to wasting time. The limitations of the proposed system are the possibility of system failure if the internet connection is cut off in addition to the high cost of maintenance of the devices in case of a malfunction in the devices [8].

In 2019 proposed a comprehensive fuzzy logic-based student performance evaluation system. In this proposed system, student performance is evaluated by determining the attendance, hours spent by the student in the classroom, test scores in the semester, and final exam scores of the student. The evaluation process is more complex and requires computational resources. This is why the widespread use of this system is very difficult [9].

In 2019 the automatic student attendance checking system was created, they used RFID technology and GSM network. The system sends messages to the parents of the students about their children's attendance. The system works effectively but has some limitations like cost and fast detection distance which is less than 5 cm [10].

In 2020 developed an intelligent system for managing and recording student attendance in boarding schools. RFID technology was used with Arduino Mega 2560 and LCD display and data was stored in XAMPP database. Signal interference may occur when multiple RFID tags are read simultaneously and this is a potential problem as the system will lose data. This problem can be overcome by using anti-collision algorithms as suggested by [11].

In 2022 a smart electronic system of attendance has been designed it used facial recognition, fingerprint plus QR code technology for recording attendance of students, staff, etc., in educational institutions and different firms safely and efficiently. Using Internet of Things (IoT) technology with GPS (Global Positioning System) location. Student attendance is determined via mobile phone. The system was faster and more accurate when compared to the manual method, but the system faces some difficulties, including the possibility of providing the required smart devices in addition to the possibility of system failure when the Internet is disconnected [12].

In 2022 web-based electronic student performance assessment system was designed and implemented. In the implementation, the system was developed using HTML, CSS, JavaScript, PHP, and MySQL. It was observed to give better results with fewer errors and greater accuracy as compared to the existing systems. The limitation of the system would be the need for constant internet connectivity that the system requires [13].

In 2023 a machine learning model was proposed for classification based on student knowledge level and factor identification that affects their performance. In the study, they picked seven classification algorithms and results indicated that GBM algorithm came out with the highest level of accuracy [14].

In 2023 carried out research on a student assessment process, improving it through a web application. The system is likely to face issues with large files, thereby leading to possible delays in the system [6].

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3. Methodology

The design and implementation of the proposed system can be divided into two main parts:

3.1. Hardware

Many devices were used in the proposed system to achieve integration between the system components to obtain accurate results in addition to ease of use of the system. This hardware is:

3.1.1. Arduino Mega

This type of Arduino is designed for large projects because it has 54 digital input/output pins, 16 analog inputs, a reset button, a power jack, and a USB port. As shown in the Figure 1. Due to the huge number of pins, this type of Arduino is very efficient for developing those projects that require many digital inputs or outputs [15][16][17].

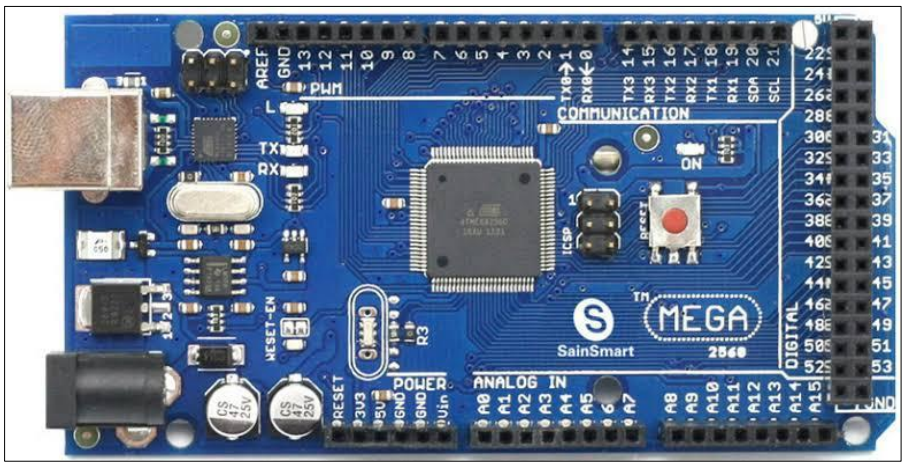

Figure 1. Arduino mega[15]

3.1.2. Nextion HMI (Human-Machine Interface)

Nextion displays are human-machine interfaces used for communication in electronic projects. As shown in the Figure 2. Such as home automation systems, to manage home appliances. They provide the opportunity to create a flexible user interface as needed and allow the design of buttons, slides, images and texts. Using the Nextion Editor, interfaces can be designed with the help of communication protocols such as UART, I2C [18].

Figure 2. Nettion display[18]

3.1.3. The Real-Time Clock

It is a device. As shown in the Figure 3. Used to store time and date in any electronic system or microcontroller like Arduino. It has the ability to record time and date in seconds, minutes, hours, days of the week, months, years and also whether the year is a leap year or not. Mostly, this device is used in time-based data logging systems and industrial automation applications [19].

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Figure 3. The real-time clock[19]

3.1.4. Micro SD Card Reader

This is a basic device which uses Serial Peripheral Interface (SPI) to communicate with small card readers, for example micro SD (Secure Digital) and micro SDHC (Secure Digital High Capacity). It also allows common power pins like VCC (Voltage at Common Collector), SCK (Serial Clock), MOSI (Master Out Slave In), MISO (Master In Slave Out), chip select, and GND (Ground). As shown in the Figure 4. Owing to its small size, where data transmission happens very fast, this is suitable for reliable and portable storage applications [20].

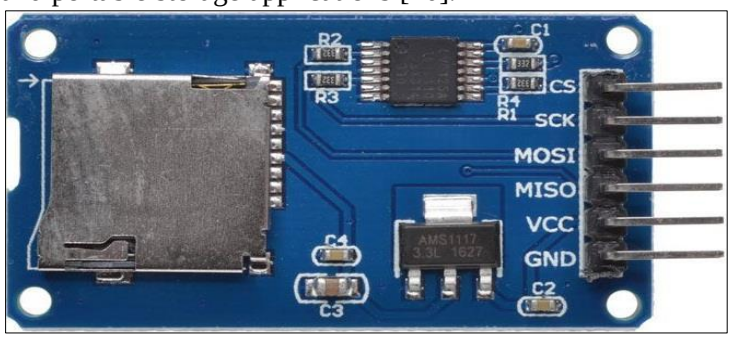

Figure 4. Micro SD Card Adapter [20]

3.1.5. Circuit Design of the Proposed System

1. Connecting the Arduino Mega to the Nextion HMI:
   - Connect the TX (Transmit) pin on the Nextion HMI to RX1 (Receive), which is Pin 19 on the Arduino Mega board.
   - Connect the RX (Receive) pin on the Nextion HMI to TX1 (Transmit), which is Pin 18 on the Arduino Mega board.
   - Connect the Ground pin on the Nextion HMI to the Ground pin on the Arduino Mega board.
   - Connect the VCC (Voltage at the Common Collector) pin on the Nextion HMI to the 5V pin on the Arduino Mega board.
2. Connecting the Arduino Mega to the SD Card:
   - Connect the GND (Ground) pin on the SD Card to the GND (Ground) pin on the Arduino Mega board.
   - Connect the MISO (Master In Slave Out) pin on the SD Card to Pin 50 on the Arduino Mega board.
   - Connect the MOSI (Master Out Slave In) on the SD card to pin 51 on the Arduino Mega board.
   - Connect the SCK (Serial Clock) on the SD card to pin 52 on the Arduino Mega board.
   - Connect the CS (Chip Select) on the SD card to pin 53 on the Arduino Mega board.
3. Connecting the Arduino Mega to the RTC DS3231:
   - Connect the VCC pin of the RTC DS3231 to the 5V pin on the Arduino Mega board.
   - Connect the GND pin of the DS3231 RTC to the GND pin on the Arduino Mega board.
   - Connect the SDA (Serial Data Line) pin of the RTC DS3231 to pin 20 on the Arduino Mega board.
   - Connect the SCL (Serial Clock Line) pin of the RTC DS3231 to pin 21 on the Arduino Mega board.

   The connections between the devices are shown in Figure 5.

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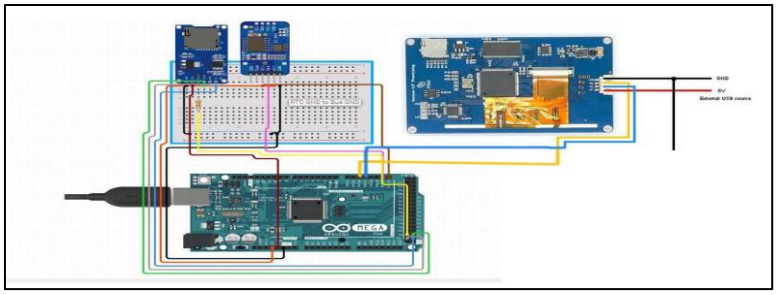

Figure 5. An illustration of the proposed system's breadboard circuit design

3.2. Software Requirements

In addition to the hardware requirements, the design and implementation of the proposed system requires some basic software requirements, which can be classified into two main categories:

1. Programming Language: The proposed system was designed in Arduino C, the primary language used to program the Arduino Mega board. This language provides precise and efficient control over various processes, making it ideally suited for embedded system applications that rely on direct hardware control. This contributes to improved performance and processing efficiency. Furthermore, Arduino C is a low-level language, allowing direct interaction with input and output devices, enhancing the system's accuracy and efficiency in handling data.

2. Software Libraries: The proposed system software includes a set of software libraries used in the design and implementation of the proposed system, as follows:

- SPI.h Library: This library was used in the proposed system to facilitate communication between the Arduino and other devices via the SPI (Serial Peripheral Interface) protocol. Communication is initiated using the SPI.begin() function, while the SPI.transfer() function is used to send and receive data between the master device (Arduino) and the slave device (Micro SD card adapter).
- SD.h Library: This library was used to access Micro SD memory cards using the SPI protocol, allowing the Arduino to read and write data to the memory card. Communication between the Arduino Mega and the microSD card was initialized using the SD.begin() function. Using this library, the Arduino Mega can handle files on the microSD card in an efficient and simple manner. This library is ideal for applications that require temporary or permanent data storage.
- EEPROM.h Library: This library is used to access the Arduino Mega's built-in EEPROM, which provides persistent data storage even in the event of a power outage. Functions such as EEPROM.write(address,value) are used to store data at a specific memory address, and EEPROM.read(address) is used to retrieve data.
- Wire.h Library: This library is used in the proposed system to communicate with devices via the I2C protocol. The library allows the Arduino Mega to communicate with dependent devices such as displays using the Wire.begin() functions to initiate the connection, Wire.write() to send data, and Wire.requestFrom() to request data. This library is ideal for projects that require connecting multiple devices using a few wires, making it particularly suitable for applications that require data transfer between multiple different devices.
- DS3231.h Library :This library is used to control the DS3231 real-time clock module via the I2C protocol. This library allows you to read and write the time and date using functions such as rtc.getTime() to read the time and rtc.setTime() to set it. This library is ideal for applications that require high-precision time tracking.
- Nextion HMI Library: This library is used to facilitate communication between the Arduino and the touch screen. The library relies on serial (UART) communication to transfer data between the Arduino and the screen in a flexible and easy manner, allowing control of user interface components such as buttons and text fields. The library also contributes to simplifying the process of integrating a graphical user interface into the system.

3.3. Mechanism of operation of the proposed system

When the system starts, a message appears on the screen that the micro-SD memory card is ready to work. The lecturer enters his code to start the evaluation process for his students. Then the lecturer chooses the academic stage and the department he is evaluating. Then he chooses the student to be evaluated. Then he determines the grade of the student he is evaluating from 0 to 10. The student is

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recorded as present. If the lecturer gives him a grade more than 10 , the student is recorded as absent. If the lecturer does not complete the evaluation process for all students, the system returns to selecting the student who was not evaluated. If the lecturer completes the evaluation process, the data of the evaluated student is stored on the memory card in a text file that can be exported later to the Excel program, through which reports on student attendance can be issued in addition to the possibility of calculating the student's final grade. Then this data is stored on the computer to be used when needed. Figure 6 illustrates how the proposed system works.

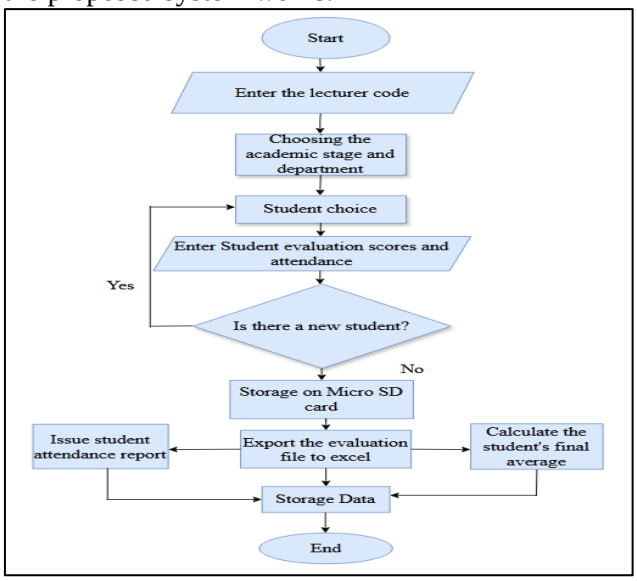

Figure 6. The proposed system

4. Results

This prototype of an electronic student assessment and attendance system has demonstrated improved operational efficiency, data management and accuracy through the creative use of contemporary technological frameworks such as Arduino. The prototype design integrates attendance recording and student performance assessment systems into a single system. This approach is superior to existing manual techniques due to a number of advantages. The key points that present the results of the proposed system are as follows:

1- Increased operational efficiency in recording assessment and attendance: Compared to manual calculations and paper-based methods used in traditional methods of entering, assigning, storing and updating grades in real time, the proposed system reduces the amount of time required to enter and record students' grades and attendance. As a result, the assessment procedures are fast and efficient.

2- Accuracy of data provided without human error: Many traditional methods of recording attendance and assessments can lead to errors due to human interaction with the system. By automating the entire data entry process, the proposed method overcomes this drawback and ensures a high degree of accuracy while maintaining student grades and attendance. Students who participated in the lab lecture receive a score from 1 to 10, while those who did not attend receive a score of zero. In addition, the time taken to complete each assessment is included along with the assessment date. This reduces the possibility of further errors resulting from human data entry.

Figure 7. Suggested system device screen

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Column1	Column2	Column3	Column4	Column5	Column6
Date	Time	Group-Name	Student-Name	Degree	
22-02-2025	13:42:22	GroupA	Alaa-Faisl	absent	
22-02-2025	13:42:22	GroupA	Ibtihal-Thamer	0	
22-02-2025	13:42:22	GroupA	Ahmed-Majed	10	
22-02-2025	13:42:22	GroupA	Aeyad-Adil	0	
22-02-2025	13:42:22	GroupA	Joan-Ghazwan	5	
22-02-2025	13:42:22	GroupA	Rand-Majid	9	
22-02-2025	13:42:22	GroupA	Roslyn-Daoud	4	
22-02-2025	13:42:22	GroupA	Zeina-Salam	absent	
22-02-2025	13:42:22	GroupA	Teba-Osama	8	
22-02-2025	13:42:22	GroupA	Eisaa-ghayib	8	
22-02-2025	13:42:22	GroupA	Ghufran-Muhamd	9	
22-02-2025	13:42:22	GroupA	Muthana-Ali	10	
22-02-2025	13:42:22	GroupA	Muhamad-Yunus	2	
22-02-2025	13:42:22	GroupA	Nadine-A.Wahed	4	
22-02-2025	13:42:22	GroupA	Noor-Raad	3	
22-02-2025	13:42:22	GroupA	Taha-Sobhi	4	
Date	Time	Group-Name	Student-Name	Degree	
19-02-2025	16:43:13	GroupD	Hakeem-Hamza	3	
19-02-2025	16:43:13	GroupD	Rahma-Ahmed	2	
19-02-2025	16:43:13	GroupD	Sajjad-Taher	9	

Figure 8. Excel file of the final results of the proposed system

3- Accessibility of information: The main benefit of the proposed system is that we can get all the information when we need it. Lecturers or administrators can get the information quickly at any time because of what the system can do by keeping records of assessments and attendance, and saving them on a small memory device in the form of a text file that can be simply exported to Excel spreadsheets.
4- Reduced administrative burden: The administrative burden that often falls on lecturers and other university staff is greatly reduced by automating assessment as well as attendance monitoring. In order to save time in the classroom and provide constructive feedback to students, lecturers will not need to manually maintain student attendance records or calculate their grades manually.
5- Compliance with academic accreditation standards: The proposed system complies with all standards set by accreditation bodies in order to provide accurate and comprehensive data on student attendance and performance. To ensure that the educational institution meets accreditation standards and improves its teaching methods, this information can be used to meet quality standards, prepare reports for accreditation, verify the performance of the educational institution, and ensure that it is updated and readily available.
6- In addition to the ease and speed of obtaining statistical reports on student attendance in the laboratory using Excel tables on the values recorded in the system, the ease of preparing reports includes calculating the final grade with less effort and greater accuracy by adding several different values, such as laboratory implementation grades, daily exam grades, semester exam grades, laboratory attendance rate, and others, where the student's final result can be calculated with greater ease and accuracy. This information will help administrative college professors track performance measures and formulate plans to enhance learning outcomes.

5. Results analysis

The proposed system was tested by a group of lecturers and laboratory managers at the University of Mosul in the College of Computer Science and Mathematics, the College of Education, and the College of Administration and Economics, whose number reached (43 lecturers). After testing the system, they answered the questions of the following questionnaire shown in the Figure 9.

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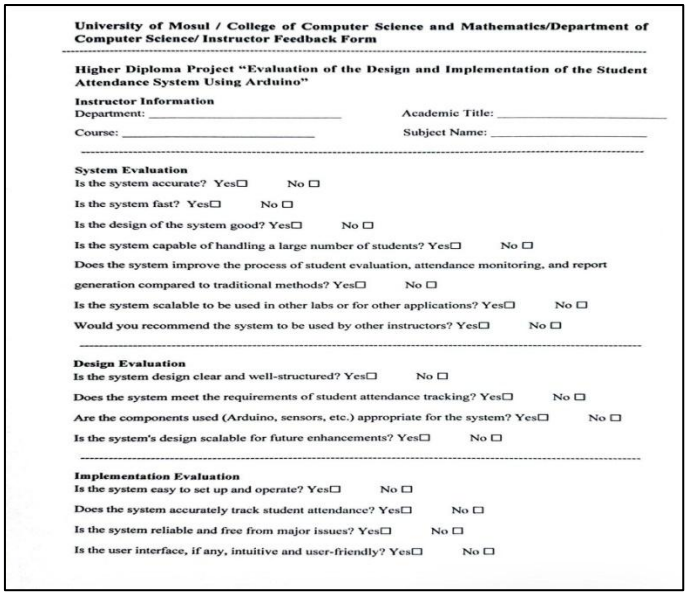

University of Mosul / College of Computer Science and Mathematics/Department of Computer Science/ Instructor Feedback Form

Higher Diploma Project "Evaluation of the Design and Implementation of the Student Attendance System Using Arduino"

Instructor Information
Department: _____ Academic Title: _____
Course: _____ Subject Name: _____

System Evaluation
Is the system accurate? Yes☐ No ☐
Is the system fast? Yes☐ No ☐
Is the design of the system good? Yes☐ No ☐
Is the system capable of handling a large number of students? Yes☐ No ☐
Does the system improve the process of student evaluation, attendance monitoring, and report generation compared to traditional methods? Yes☐ No ☐
Is the system scalable to be used in other labs or for other applications? Yes☐ No ☐
Would you recommend the system to be used by other instructors? Yes☐ No ☐

Design Evaluation
Is the system design clear and well-structured? Yes☐ No ☐
Does the system meet the requirements of student attendance tracking? Yes☐ No ☐
Are the components used (Arduino, sensors, etc.) appropriate for the system? Yes☐ No ☐
Is the system's design scalable for future enhancements? Yes☐ No ☐

Implementation Evaluation
Is the system easy to set up and operate? Yes☐ No ☐
Does the system accurately track student attendance? Yes☐ No ☐
Is the system reliable and free from major issues? Yes☐ No ☐
Is the user interface, if any, intuitive and user-friendly? Yes☐ No ☐

Figure 9. The questionnaire that was conducted

The statistics of the responses to the questionnaire questions conducted showed that the proposed system was accurate and fast and users recommended adopting the proposed system in the laboratories. The system was also good at recording students' attendance and the use of Arduino and other sensors was very suitable for the work of the proposed system. are shown in the following Table 1.

Table 1. Questionnaire statistics

Topics	Questions	Yes	No
System evaluation	Is the system accurate?	43	0
	Is the system fast?	43	0
	Is the design of the system good?	39	4
	Is the system capable of handling a large number of students?	36	7
	Does the system improve the process of student evaluation, attendance monitoring, and report generation compared to traditional methods?	42	1
	Is the system scalable to be used in other labs or for other applications?	41	2
	Would you recommend the system to be used by other instructors?	43	0
Design evaluation	Is the system design clear and well-structured?	42	1
	Does the system meet the requirements of student attendance tracking?	42	1
	Are the components used (Arduino, sensors, etc.) appropriate for the system?	43	0
	Is the system's design scalable for future enhancements?	41	2

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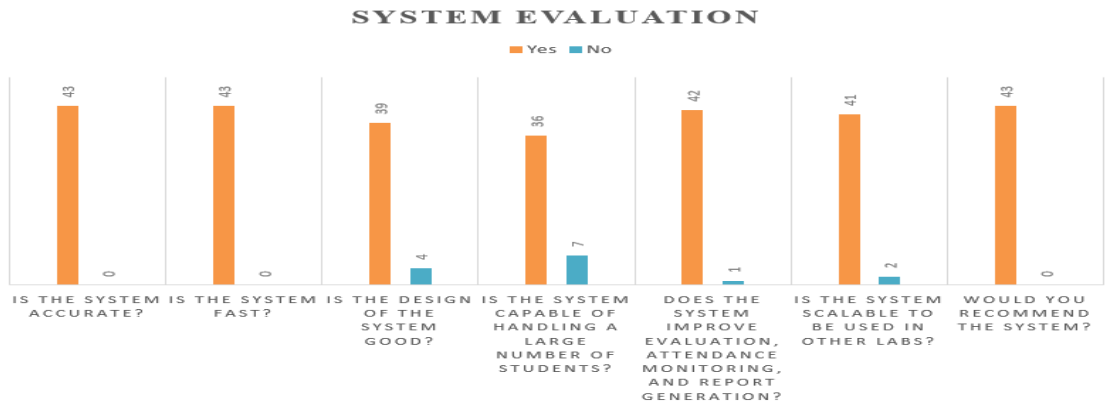
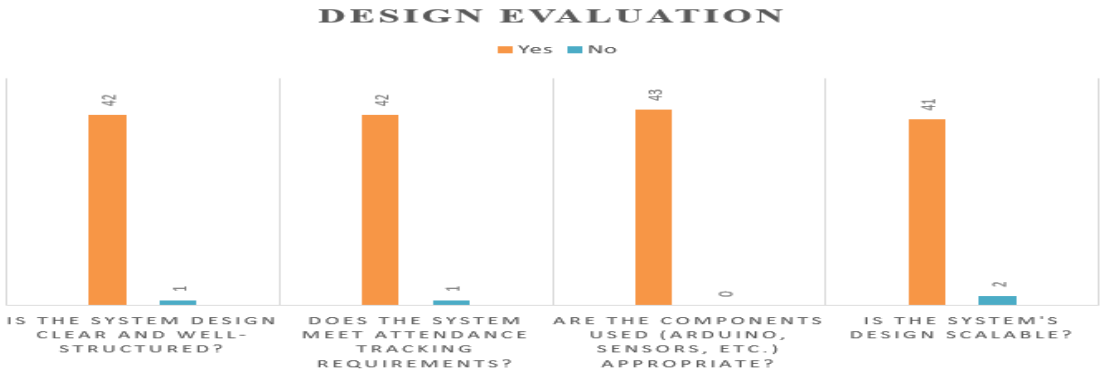
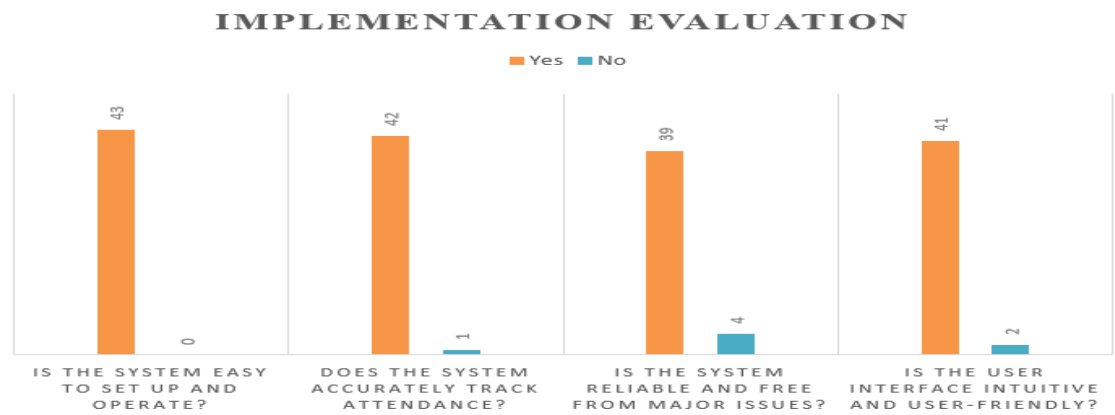
Implementation evaluation	Is the system easy to set up and operate?	43	0
	Does the system accurately track student attendance?	42	1
	Is the system reliable and free from major issues?	39	4
	Is the user interface, if any, intuitive and user-friendly?	41	2



(A) System Evaluation



(B)Design Evaluation



(C)Implementation Evaluation

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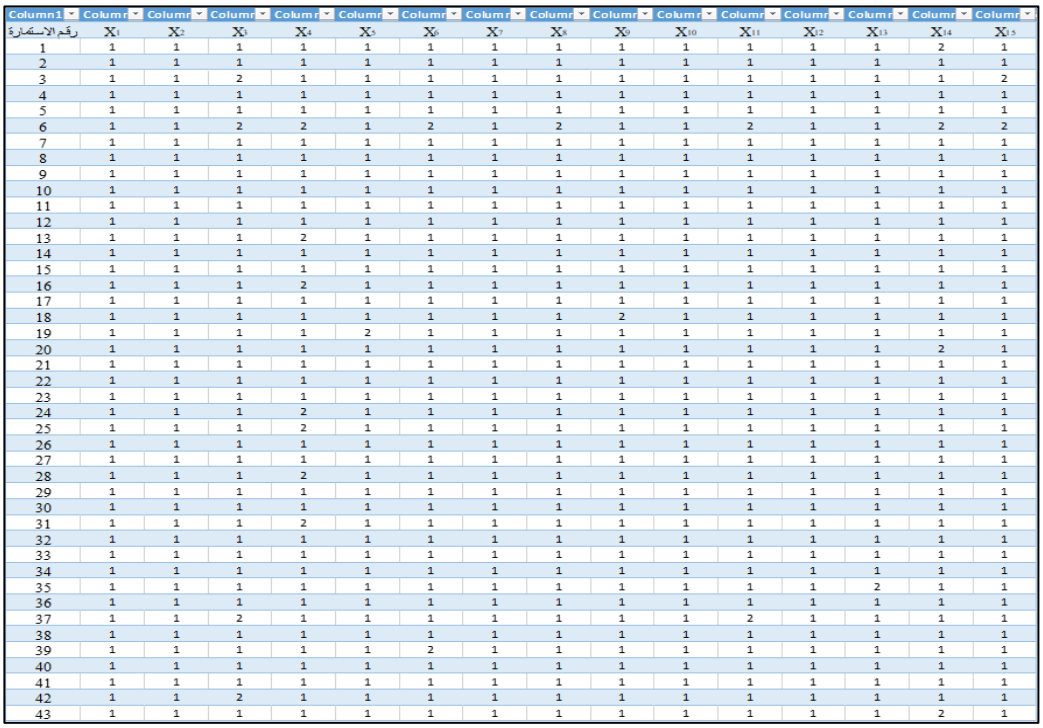
Figure 10. Questionnaire statistics charts

The statistical analysis program (SPSS) was used to analyze the survey results, which had a significant impact on the proposed system by providing an accurate and comprehensive analysis of the survey results. This leads to a more effective system design, potentially allowing developers to identify key points and areas for improvement that are critical to the success of the proposed system. Future insights help improve system features and ensure the proposed system meets the needs and expectations of its users. In addition, SPSS contributed to enhancing the system's functionality by enabling it to measure key variables of system performance, such as user satisfaction, system usability, and system effectiveness. When using SPSS, each question in the survey was assigned a specific code, with the first question in the survey being represented by the code (X_1), and so on. The value of each question was entered into a table, with the word "yes" represented by the number (1) and the word "no" represented by the number (2), as shown in Figure 11.



رقم الاستمارة	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}
1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	2	1	1	1	1	1	1	1	1	1	1	1	2
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	2	2	1	2	1	2	1	1	2	1	1	2	2
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
19	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
28	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
37	1	1	2	1	1	1	1	1	1	1	2	1	1	1	1
38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
42	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
43	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1

Figure 11. Variable value entries in the questionnaire

Then two main statistical measures were used, which are the arithmetic mean ($\bar{X}$) and as shown in Equation (1).

$$\bar{X} = (\Sigma X_i) / N \qquad (1)$$

When:
$\bar{X}$ = arithmetic mean.
X_i = individual data points (responses).
N = total number of responses.

The standard deviation coefficient was calculated as shown in Equation (2).

$$SD = \sqrt{(\Sigma(X_i - \bar{X})^2 / N)} \qquad (2)$$

When:
SD = Standard Deviation.
X_i = Individual Data Points (Responses).
$\bar{X}$ = Arithmetic Mean.

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N = Total Number of Responses.

The results of the arithmetic mean and standard deviation for the questionnaire results are shown in Table (2).

Table 2. Results of statistical analysis of the questionnaire

Variables	Total Entries	Invalid Entries	Arithmetic Mean	Standard Deviation
X1	43	0	1.00	0
X2	43	0	1.00	0
X3	43	0	1.09	294
X4	43	0	1.16	374
X5	43	0	1.02	152
X6	43	0	1.05	213
X7	43	0	1.00	0
X8	43	0	1.02	152
X9	43	0	1.02	152
X10	43	0	1.00	0
X11	43	0	1.05	213
X12	43	0	1.00	0
X13	43	0	1.02	152
X14	43	0	1.09	294

The smaller the standard deviation, the closer the values are to the mean, indicating that the data is homogeneous. The larger the standard deviation, the further the values are from the mean, indicating that the data is heterogeneous.

The results obtained demonstrated the system's efficiency, speed, and accuracy in recording student attendance. Survey participants recommended the system's use in laboratories.

6. Conclusion

In this study, an automated system for student performance and attendance assessment is presented. By integrating hardware and software applications (Arduino), this system will help in digitizing Iraqi universities. The proposed system solves the fundamental problems related to manual systems, such as inefficiency, high error rates due to human errors, and time wastage. Automating assessment and attendance recording procedures will save administrators and lecturers time while providing highly reliable student data with the aim of transforming Iraqi institutions into electronic systems and raising the level of academic services in general. The proposed solution provides a practical approach to automating student assessment and attendance recording in order to achieve academic excellence and enhance the institutional identities of universities. These technological developments will help universities meet the challenges of digital development. The proposed system could also support mobile applications in the future. Developing a mobile application for both students and teachers could make the system more accessible, allowing on-the-go access to performance data, attendance records, and assessments. Cloud storage of data could also be used, enabling the proposed system to leverage cloud computing to store assessment and attendance data, ensuring that records are securely backed up and easily accessible from anywhere, while also reducing the risk of data loss.

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