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Building an Electronic System to Develop Some Artificial Intelligence Techniques Skills Based on Smartphone for Computer Students

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ABSTRACT

Rapid technological progress needs technologies to improve educational institutions' teaching and learning processes, promoting e-learning for students. E-learning systems improve the accessibility, interactivity, and efficacy of educational materials, but they encounter technological and pedagogical obstacles as user and data volume grow. This study aims to develop an electronic system to develop some of the artificial intelligence techniques skills based on smart phone devices for computer students. The research tools were an electronic achievement test to measure the cognitive aspect some of the artificial intelligence techniques skills to be developed, as well as an observation card to measure the skill aspect some of the artificial intelligence techniques skills to be developed.

Keywords — Electronic System, Artificial intelligence techniques, Smartphone Application.

I. INTRODUCTION

Technology has had a huge influence on how people live, work, and socialize. Artificial intelligence (AI) has emerged as an important advancement, allowing robots to behave like humans and hence increase educational quality [1]. AI technologies, such as bots, assist individuals learn by delivering digital learning content. This has resulted in the conversion of large textbooks into more compact, easy-to-read materials such as study guides, topic summaries, and brief notes [2]. AI, a branch of computer science that enables machines to learn autonomously from programmed facts and information, is critical to the technology-mediated learning process. Whether deliberately or unknowingly, AI has been used in everyday life, with various applications taking advantage of it [3]. AI encompasses several ideas, methodologies, technologies, and subfields, such as machine learning, neural networks, cognitive computing, computer vision, and scientific language processing [4]. AI's impact on education is becoming more apparent, as it transforms the curriculum in technology, science, mathematics, and engineering [5]. AI-based technologies are being used to improve the learning process, making it more practical and efficient. Teachers, on the other hand, are concerned about the possibility of being replaced in jobs such as making teacher lists, reporting student learning outcomes, and developing instructional media and resources [6].

Intelligent tutoring systems (ITS) are computer systems that deliver tailored education or feedback to students without requiring human participation [7]. They want to use diverse computing technologies to make learning more engaging and effective [8]. ITSs are utilized in both formal schooling and professional contexts, with continuous research to increase \ their efficacy [9]. They often duplicate the benefits of one-on-one, tailored tutoring, ensuring that all students have access to a high-quality education. Mobile applications are chosen over web-based solutions because they are revolutionary and rapidly growing [10].

E-Learning employs Information and Communication Technology (ICT) to improve education by providing instructions via electronic media such as the internet, intranets, and extranets [11]. This removes time and location limitations, allowing people to take control of their own lifelong education [12]. E-learning environments cut provider costs while increasing academic institution income [13].

Universities train human resources for future industries by imparting information and skills, meeting present and future industry demands, and embracing emerging technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Edge Computing (EC) [14]. The fast expansion of mobile phone users in all economic and age groups, notably among university students, has made them an important target market for smartphones [15]. Software designed for smartphone applications covers many sciences, including teaching language skills [16], mathematics [17, 18], chemistry [19], health sciences [20], and computer sciences [21].

II. LITERATURE REVIEW

The transition from traditional classrooms to electronic, remote, virtual, and hybrid learning is gaining momentum [8]. The researcher focuses on employing Technology-Enhanced Learning (TEL) to improve learning efficiency and engagement [22]. This tendency is especially noticeable in disciplines like basic mathematics [23], health science [20] and chemistry [24], emphasizing the advantages of using technology into teaching. The rising online availability of instructional courses has made data management increasingly difficult. Big data mining and AI are becoming more common in educational systems. The numerous applications that AI may assist and give insights for study [25].

Li et. al. present a smartphone-based pH measurement approach can replace traditional pH meters in schools. Students can use an in-house program to calculate pH and perform titrations with pH strips and universal indicators. The software requires no prior coding or programming skills and is available for free download by students. The software has received favorable feedback from students and professors, indicating the need for low-cost technology for pH testing and acid/base titration [19]. This study looks into the usefulness of using Android-based applications into chemistry instruction to promote experiential learning. The study included 120 junior high school students from Alaminos, Laguna, and discovered a substantial difference in pre-test and post-test scores, as well as a strong association between factors. The findings show that teachers use Android-based applications with tailored learning activities to improve experiential learning. Additional study is required to determine the applicability and efficacy of these applications [26]. Amasha et. al. looks at how a mobile application affects student progress in a primary school mathematics course in Saudi Arabia. Using Java, the study discovered that mobile applications were more successful than traditional techniques for boosting mathematics outcomes. The change indicate a need for assistance for such activities in elementary schools, since mobile applications can improve pupils' cognitive and mathematical ability [18]. Lobos et. al. created a 4Planning smartphone application to help university students establish self-regulated learning practices. The app's creation proved to be helpful in promoting these ideas, showcasing the potential of smartphone applications to promote higher education [27]. Norbutaevich addresses the expanding usage of mobile applications and cloud technology in education, with an emphasis on the algorithms and their relationship to education [21]. Alsayed et. al. introduced a survey done at King Saud bin Abdul Aziz University for Health Sciences discovered that 94.8% of undergraduate nursing students use cellphones for instructional purposes. The poll, which included 30 participants, discovered that 92.6% of students have their phones with them at all times, 77.8% document material in class, and 24.4% utilize them in clinical situations. The most popular activity was obtaining material from websites, with 93.3% of students taking part of group study. A substantial number of pupils took part in WhatsApp study groups. According to the study, undergraduate nursing students rely extensively on their cellphones for information and communication, and might benefit from active learning strategies tailored to their educational needs [20]. Eryılmaz et. al. created a fuzzy Bayesian intelligent tutoring system (FB-ITS) to assist students in learning settings by combining artificial intelligence and Bayesian network approaches. The system was compared to two different ITS versions, fuzzy and Bayesian, as well as a regular e-learning system. The findings revealed that students who used FB-ITS performed much better academically and spent less time on post-tests than those who used standard e-learning systems. The study found that the new method improved exam performance and academic success among 120 undergraduate university students [28]. The bulk of the experiments [20, 27, 29, 30] focus on university or higher education, demonstrating a stronger interest in higher education. The teaching and learning environment is more diversified for data collection, as indicated by the variety of research objectives. The researchers' focus on higher education is likely to add to the research's diversity.

In this proposed electronic system, the main objective is building an electronic system to develop some artificial intelligence techniques skills based on smartphone for computer students. To improve computer students' productivity and create a conducive learning environment by teaching them artificial intelligence techniques utilizing an electronic system. The system aims to reduce students' difficulties in learning these skills, increase efficiency, create a high-quality study environment, provide reliable information, overcome time and location barriers, provide self-evaluation through short examinations, allow for multiple lesson repetitions, and accommodate people with special needs who may miss lectures.

III. PROPOSED ELECTRONIC SYSTEM

The study methodology including, study approach, tools, verification of the tool’s validity and reliability, the population, sample and procedures, in addition to the variables, and statistical treatments in analysing the study.

A. Study Approach

In order to design an electronic system to develop some of the artificial intelligence techniques skills, quasi-experimental approach was used in a way that suits the nature of the study. The quasi-experimental approach is based on designing an application based on smart phones. The level of application performance was measured through pre- and post-tests to measure the cognitive aspect and a observation card to measure the skill aspect for develop some of the artificial intelligence techniques skills.

The design of electronic system based on smartphone for developing some of the artificial intelligence techniques skills depends on:

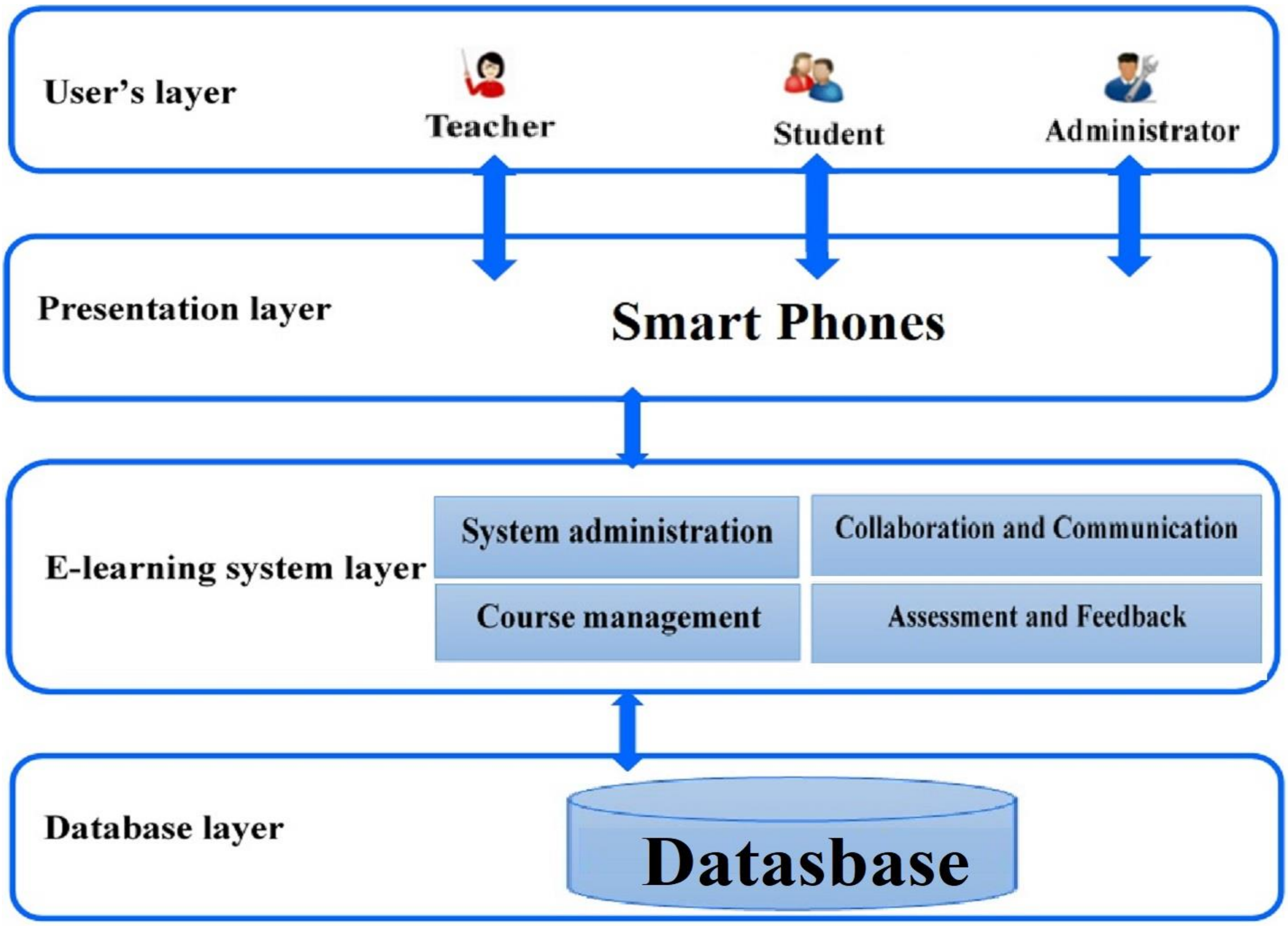


Fig. 1 Framework for proposed electronic system

- Motion recognition agent: It attempts to create a smart parking system utilizing mobile application technology. The device will monitor vehicle entry to parking lots and prevent unlawful use. This agent will make use of an Arduino UNO, a servo motor, IR sensors, and an LCD display. The sensors detect cars entering, departing parking lots, and send signals to the Arduino. This technology will notify cars of available parking places, saving fuel, time, and pollution.
- Fire detection agent: It seeks to build a fire detection system with a Flame Sensor and an Arduino. The sgent varies from the last one in that it employs a flame sensor rather than a temperature sensor. Early identification of fires is critical for safety and prevention. The device will not only detect the existence of a flame, but will also notify the surrounding area via a visual signal and a melodic alarm.

The operating environment for the design was run through Android and IOS applications. The framework of the proposed electronic system as shown in Figure 1.

The proposed electronic system consists of three layers including:

- The presentation layer is essential for improving the usability, accessibility, legitimacy, and user experience in learning ecosystems. It offers a uniform interface for all services while concealing system complexity. The presentation layer guarantees that e-learning systems enable mobile learning, allowing learners to access material more easily. The layer combines instructional resources such course registration, user profiles, assessments, and communication. It serves as a bridge between the presentation and database layers, gathering and transferring learning information while also allowing for flexible access to specific educational materials.
- The e-learning system layer combines instructional materials using features such as course registration, user profile management, evaluation, and collaboration. It includes components that enable instructional models and serves as a critical link between the presentation and database. It gathers and distributes learning information, allowing students to have flexible access to particular resources.

- The database layer is for hosting e-learning data, since it ensures its collection, storage, and utilization.
- Figure 2 shows the block diagram for stages of building the proposed electronic system based on a smartphone, including:

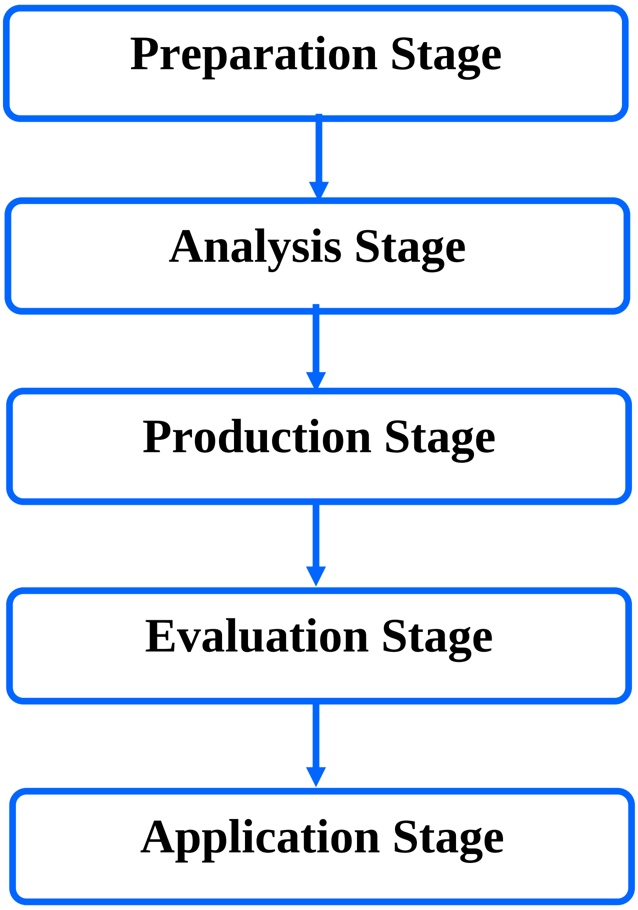


Fig. 2 Block Diagram For Stages Of The Proposed Electronic System.

- *Preparation stage*: determines the requirements for the student, the teacher, and the person responsible for the system, determining the administrative and technological requirements, determining the requirements that must be available in the system environment, providing the programs used to build this proposed system.
- *Analysis stage*: determines ways to match the requirements of students and the system to be designed, creating a detailed plan for all system requirements and the steps of construction, review and evaluation.
- *Design stage*: The appropriate content is identified and designed, the interfaces and interactions within the proposed electronic system are designed, the production programs and programming languages are determined, and the assessment, evaluation and measurement tools are determined. Table I shows the structure of the content of the proposed electronic system. Table II, shows the programs used to build the proposed electronic system.
- *Production stage*: What was achieved in the design stage is transformed into a product ready for use. This stage includes the production of multimedia, content, training activities, production of interaction interfaces, production of the system registration method, management and support system, production of evaluation, measurement tools, and preparation of a user guide for the proposed electronic system.
- *Evaluation stage*: The proposed system is tested, the results are monitored, and final modifications are made
- *Application phase*: The environment of the electronic system based on the smartphone was prepared through the screens shown in Figure 6.

TABLE I
THE STRUCTURE OF THE TRAINING CONTENT OF THE PROPOSED ELECTRONIC SYSTEM

Model	**Dimension**	
Courses	**Motion recognition Agent**	• Arduino • Bluetooth Sensor • Servo motor • Breadboard • LCD Display • Proteus software • Connecting wires
	Fire detection Agent	• Flame sensor • Buzzer • Red light
Student Model	**Achievements**	• Work Performed • Unfinished work
Test	**Questions**	• True-false. • Multiple choice.
Reports	**Display Results**	Showing the student's total score on exam questions automatically
Feedback	**Display Revision Topics**	Show topics that show the student's weaknesses

Table I, includes the content structure of the proposed electronic system from components that include: Courses, which contain the development some of the artificial intelligence techniques skills by presenting two technologies, namely motion recognition agent and fire detection agent, and each of them includes subtopics aimed at reaching the basic skill, and contains details. The part of the student model includes what has been accomplished and what has not been accomplished in terms of skills that must be learned, mastered, and developed. It also includes the test on which the evaluation will be based. It includes reports and display of performance indicators related to the development of the student's grades and levels of mastery of the skills, and finally, feedback to inform the student of weaknesses.

TABLE III
PROGRAMS USED IN PRODUCING THE PROPOSED ELECTRONIC SYSTEM AND PREPARING ITS CONTENT.

Program Name	Description
Arduino	Arduino is an Italian open-source software company that creates and sells single-board microcontrollers and microcontroller kits for creating digital devices.
Proteus	Proteus Design Suite is a proprietary software program for electrical design automation that is primarily used by engineers and technicians to generate schematics and electronic prints for circuit boards.
Tinker cad	Tinker cad is a popular free web tool for 3D design, electronics, and coding, used by over 50 million users worldwide to create 3D printing models.
Flutter	Google's Flutter is an open source framework for creating natively built, multi-platform apps that can be customized and run quickly on a variety of devices, revolutionizing the development process.
Dart	Dart is a flexible, open-source programming language for creating high-quality programs on a variety of platforms, with modern features such as null safety and pattern matching.

It is clear from Table II: The software that the proposed electronic system will rely on, whether in the design or production phase, is the system that relies on the smartphone to develop some of the artificial intelligence techniques, including the skills of the motion and fire detection agent. This software includes the following: arduino, proteus, tinker cad, flutter and dart as shown figure 3 and 4.

The design shown in Figure 3 was based on the following components:

- *Arduino*: The Arduino Uno is an open-source microcontroller board developed by Arduino.cc and based on the Microchip ATmega328P microprocessor. It has 14 digital and 6 analog I/O pins and can be programmed via a USB wire using the Arduino IDE. It may be powered by a USB connection or an additional 9-volt battery. The Uno is the first in a line of USB-based Arduino boards and is the standard version. Instead of the FTDI driver chip, a USB-to-serial converter based on the Atmega16U2 is used.
- *Bluetooth Modulo:* is a wireless device for Bluetooth-enabled devices that communicates with microcontrollers via serial (USART). The default parameters can be changed using AT commands. The module's 3.3 V RX/TX voltage level necessitates a change to the microcontroller's RX.
- *Servo Motor*: A servomotor is a linear or rotatory actuator that can precisely regulate its angular or linear location, velocity, and acceleration. It is made up of a suitable motor and a position feedback sensor

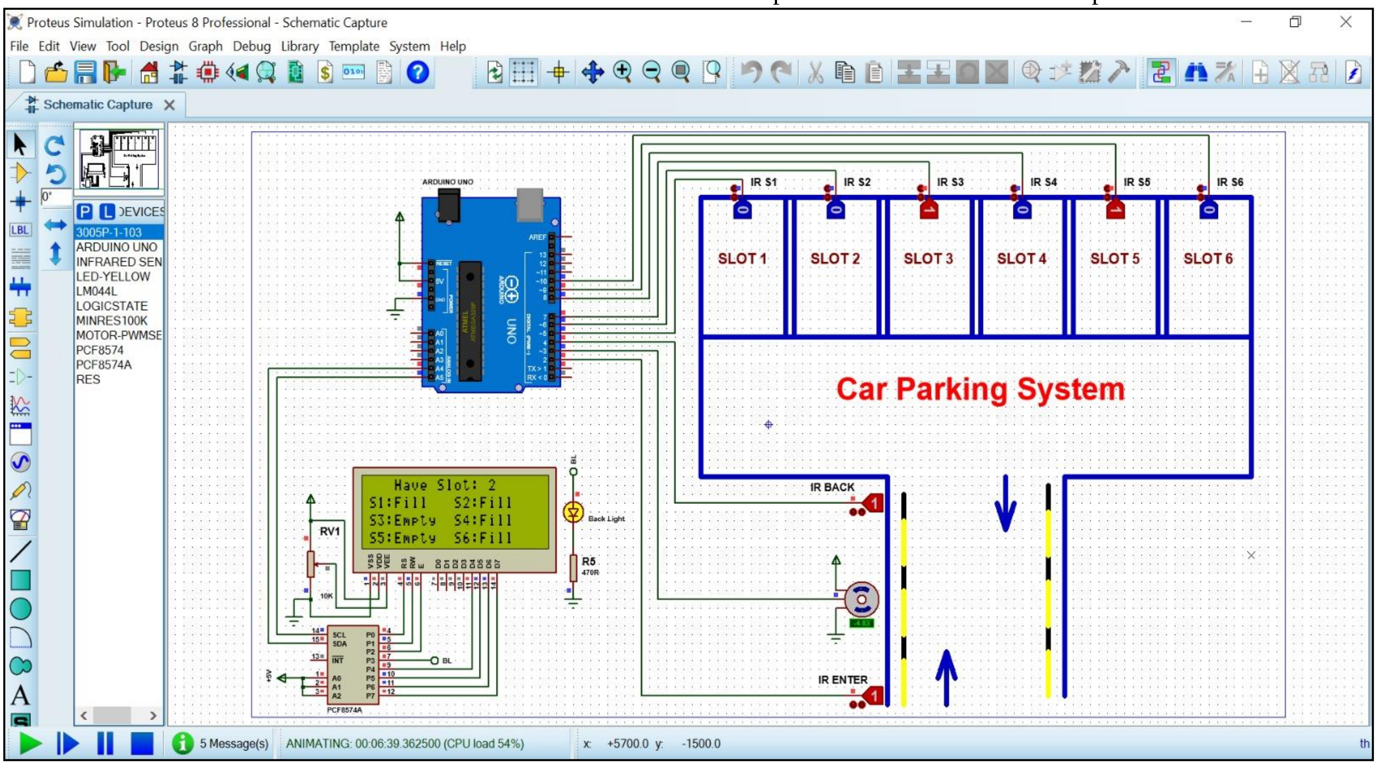


Fig. 3 : Design for motion recognition agent.

and requires a sophisticated controller. Servomotors are a popular high-performance alternative to stepper motors because they may be utilized for open-loop position control without a feedback encoder. To do so, the controller must first determine the position of the stepper motor when it is powered up. Servomotors have an advantage in bigger systems, when a strong motor represents an increasing proportion of the total cost. Closed-loop stepper motors are becoming more popular, as they are inexpensive and do not require tweaking. They come in two price ranges: low-cost stepper motors and high-performance.

- *Breadboard*: The breadboard, a prototype electrical gadget, has changed dramatically throughout time. In the early days of radio, amateurs glued electrical components onto bare copper wires or terminal strips on wooden boards. Breadboards have evolved over time into different prototypes, including the wooden plate breadboard with springs and the printed circuit breadboard. Ronald J Portugal created the original, pluggable plastic breadboard in 1971.
- *Liquid Crystal Displays (LCD)*: LCDs have a parallel interface, which means that a microcontroller must operate many interface pins at the same time. These include a register select pin for data writing, a Read/Write pin for reading/writing mode, an Enable pin for writing to registers, and eight data pins (D0-D7) for writing or reading bit values.
- *Tinkercad Software*: Tinkercad is a free online 3D modeling program developed in 2011 by former Google engineer Kai Backman and co-founder Mikko Mononen. It is widely used for 3D printing models and teaching constructive solid geometry in schools. The firm, created in the European Union, wants to make 3D modeling available to the general population.

The design shown in Figure 4 was based on the following components, Flame Sensor, Red Led and Buzzer. A flame sensor is a device that detects fire or light sources in a specified wavelength range, usually 760nm to 1100nm. It is essential in safety systems and frequently used in fire detection. The YG1006 sensor, a high-speed and very sensitive NPN silicon phototransistor, detects fires. An IR sensor is made up of an emitter and detector circuit, where the emitter is an IR LED and the detector is an IR photodiode. The detector has an LED indication that illuminates when a flame is detected, as well as an adjustable threshold for

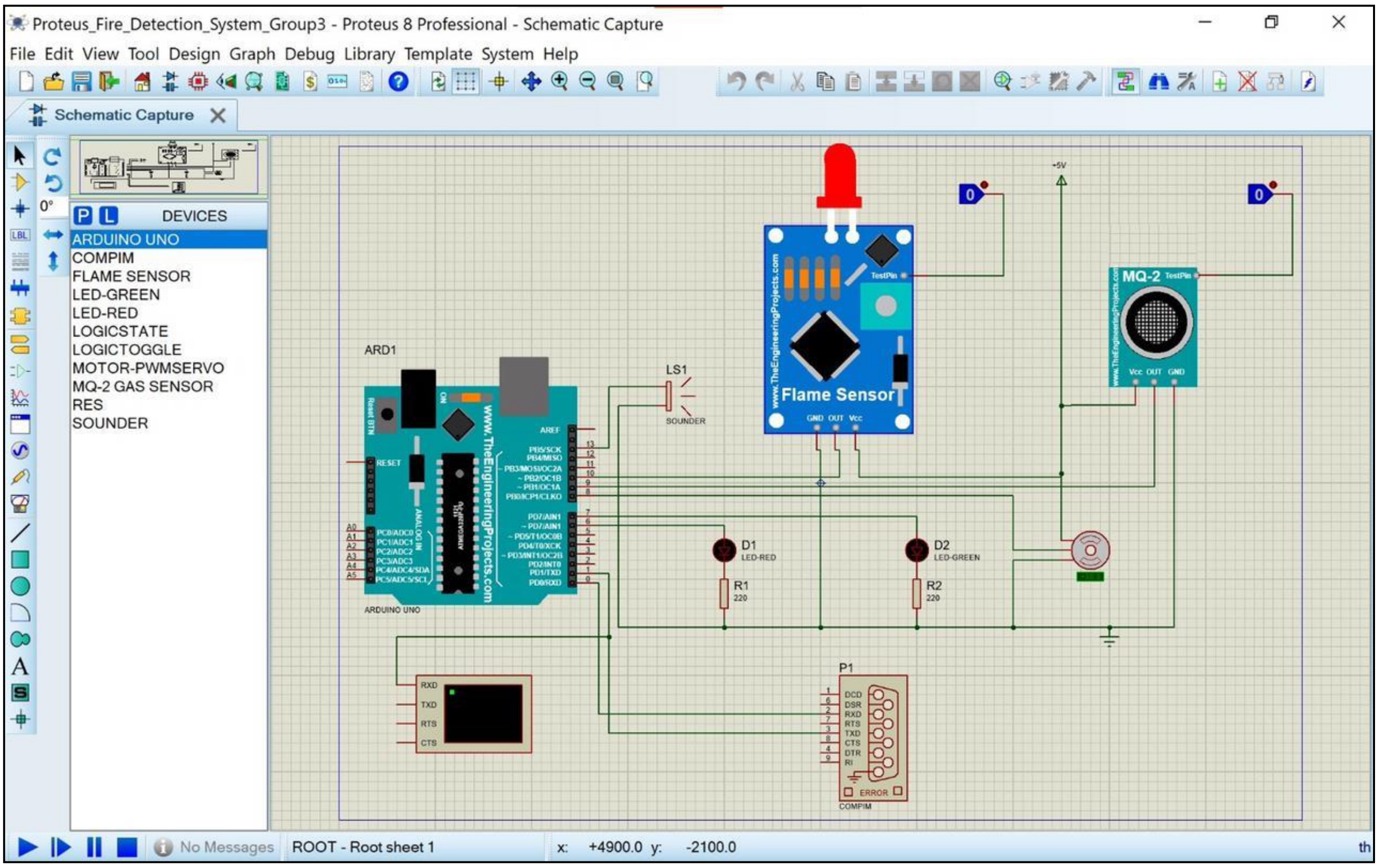


Fig. 4 Design for fire detection agent

varying flame intensities. The flame sensor module usually has three or four pins, with the buzzer linked to Arduino pin 3, the LED attached to Arduino pin 2.

B. Study Tools

The researcher used two tools to test the proposed electronic system related to the study including electronic achievement test to measure the cognitive aspect, and an observation card to measure the performance aspect.

- *Electronic achievement test*: A cognitive test was designed to measure the cognitive aspect of the research sample for a proposed electronic system using smart phone applications. Objective tests, such as true and false questions and multiple choice questions, were found to be suitable due to their flexibility, ease of access to correct answers, and speed of correction. The test was initially developed with 30 items, divided into true-false and multiple-type questions, and four alternatives to avoid guesswork. The test's design considers accuracy, linguistic integrity, length, consistency, equivalentity, and homogeneity to avoid stereotypes and reduce guessing effects.
- *Observation card:* A card was created to measure the performance aspect of develop some of the artificial intelligence techniques skills for university computer students. The card included (2) main skills and (10) sub-performance indicator linked to each skill. The main skill was performance, and the performance indicators were formulated in short, specific, and clear behavioral statements. The statements were accurate, concise, and safe from linguistic errors. The card also ensured clear results and a logical order of skills, highlighting the effectiveness of developing a smart electronic system in developing these skills.

C. Study Population

The study population is defined as: all individuals or elements that suffer from the problem of the study and are related to it, and the researcher seeks to generalize her results to them. Thus, the population in this study is major computer students in university, the number of (80) students.

D. Study Sample

The researcher relied on a quasi-experimental design based on two groups, one experimental and the other control, with pre- and post-measurement, where the measurement tools were applied pre-treatment, the traditional method was used, and then the design of an electronic system based on smartphone was followed. Figure 5, shows the researcher used a quasi-experimental design based on two groups:

- *Experimental group:* Students studying through an electronic system based on smartphones. The number of students is 40 students.
- *Control group*: 40 students studying through the traditional method.

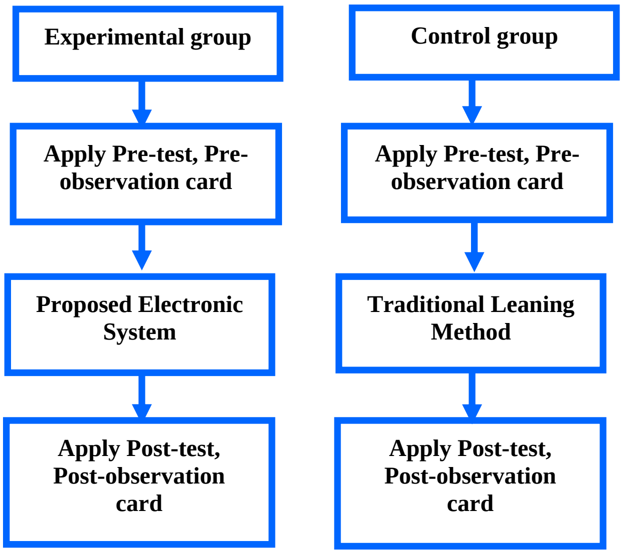


Fig. 5 Steps to apply the working mechanism of the proposed electronic system with the traditional learning system to the experimental and control group.

E. Statistical Treatments

A test statistic is a statistical measure used in hypothesis testing that provides a numerical summary of a dataset. It evaluates behaviors that distinguish the null hypothesis from the alternative hypothesis and must allow for p-value calculations. Test statistics are unique to each test and are akin to descriptive statistics [31]. This part explains an overview of the statistical treatments used in this study, which are as follows: the arithmetic mean, standard deviation, t-test, Cronbach's alpha, KMO-test and Chi-squared test.

After applying the pre- and post-test, as well as the observation card, on the proposed electronic system and traditional teaching methods to measure develop some of the artificial intelligence techniques skills, including motion and fire detection agents. The data was then processed statistically using the statistical package for the social sciences program. The statistical treatments used are:

Mean: The mean is a statistical metric that represents the average of a collection of variables, whereas the median and mode are common measures of central tendency [32, 33]. They are computed by adding together all the values and dividing by the total number. Mean may be calculated using the following formula:

$$\text{Mean}(y) = \sum x/n \tag{1}$$

Where ‘x’ is the data value, ‘n’ the number of values, since ∑ is the symbol used to indicate that values are to be summed [34].

Standard Deviation: The standard deviation is a statistical metric that measures the volatility of a random variable in relation to its mean. It's represented by the Greek symbol σ (sigma) and the Latin letter S. The standard deviation of a population or sample and the standard error of a statistic, such as the sample mean, are related but not interchangeable. The standard error determines the standard deviation of an estimate. Standard Deviation may be calculated using the following formula:

$$Standard\ Deviation = \sqrt{\frac{\sum_{i=1}^{n}(x_i - y)^2}{n-1}} \quad (2)$$

Where x_i refers to value of the i^{th} point in data set, ‘*y*’ refers to the mean value of the data set, ‘*n*’, refers to the number of data points in the data set [33].

Cronbach's Alpha Coefficient: Valid and precise measurement methodologies are required for study outcomes, which are classified as valid, biased, or wrong scores. Factor analysis and Cronbach alpha, which evaluates random measurement error, may both be used to assess construct validity and reliability [35]. Cronbach's Alpha coefficient (Cronbach, 1951) serves as a lower bound on dependability, with Rel(O) >= α. The standardized Cronbach α coefficient is defined as:

$$\alpha = (n^* \bar{r})/((1+(n-1)^* \bar{r})) \quad (3)$$

Where, mean correlation of all n elements on the scale is denoted as $\bar{r}$. In theory, α may vary from -∞ to 1. However, unless the mean correlation between all items on a scale is negative, the value is often between 0 and 1 [36].

T-Test: A t-test is an inferential statistic that is used to detect if two groups differ significantly and how they relate to one another. It is used to represent data with a normal distribution and unknown variances. The test determines statistical significance using the t-statistic, t-distribution values, and degrees of freedom [37]. The t-value and degrees of freedom are used to assess the difference between two sample sets. When samples are matched pairs or repeated measurements, the correlated t-test is useful for comparative investigations. The t-value and degrees of freedom for a paired t-test may be calculated using the following formula:

$$T = \frac{M_1 - M_2}{\frac{S(diff)}{\sqrt{(n)}}} \quad (4)$$

Where M_1 and M_2 refers to the average values of each samples, *S*(*diff*) refer to the standard deviation of the different of the paired, *n* refers to sample size ”the number of paired differences”, *n-1* refer to the degrees of freedom [38, 39].

IV. RESULTS AND DISCUSSIONS

Before implementing the experimental action research, a basic test on personal resume design and production was conducted in the experimental and control classes to assess the two classes' initial state of knowledge prior to the implementation of the proposed electronic system in-class teaching model. The exam results used as the pretest data for assessing students' mastery of knowledge. At the conclusion of the experimental action research, the experimental and control classes were assessed individually for mastery of knowledge, and the test results were utilized as post-test data for students' mastery. After data collection was finished, we ran a statistical analysis of the students' pre-test and post-test scores and conducted an independent samples t-test utilizing using SPSS.

A score was assigned to each question, and a button to correct the test was placed in the application, and the total score for the test was 30 points. The validity of the electronic cognitive achievement test was calculated by calculating the validity of internal consistency, which means the strength of the correlation between the scores of each question and the total score of the level to which the question belongs. The Pearson correlation coefficient was calculated and this is evident in the following Table III.

TABLE IIIII
INTERNAL CONSISTENCY VALIDITY OF THE TEST LEVELS

Test levels	**Questions Number**	**Correlation Coefficient**
Memory	3	0.839 *
Understanding	5	0.88 *
Application	14	0.786 *
Analysis	8	0.82 *
*** Significance level (0.01)**		

It is clear from Table III that the correlation coefficients for all levels of the test are all significant at the significance level (0.01), where the values of the correlation coefficients for the levels ranged between (0.786) and (0.839), which indicates that the test has a high degree of construct validity and internal consistency.

An experiment was conducted for the test without a research sample, and the test's reliability coefficient was calculated using Cronbach's alpha coefficient, and the following Table IV shows the reliability of each level of the test.

TABLE IVV
OVERALL RELIABILITY VALUE FOR EACH LEVEL USING CRONBACH'S ALPHA COEFFICIENT

Test levels	Questions Number	Cronbach's Alpha Coefficient
Memory	3	0.878
Understanding	5	0.899
Application	14	0.874
Analysis	8	0.869
All Questions Test	30	0.942

It is clear from the table IV that all levels of the test enjoy a high degree of reliability, and the overall reliability coefficient reached (0.942), which is a high value that indicates the suitability of the test for application and that it achieves a high degree of reliability.

The construct validity of the observation card was also calculated by calculating the internal consistency validity between each main skill and the total score of the card items by calculating the correlation coefficient between the score of each skill and the total score as shown in table V

TABLE V
VALUES OF CORRELATION COEFFICIENTS TO CALCULATE CONSISTENCY VALIDITY FOR THE OBSERVATION CARD

Main Skill	Indicators Number	Correlation Coefficient
Motor recognition agent	7	0.879 *
Fire detection agent	3	0.898 *
*** Significance level (0.01)**		

It is clear from Table V that the correlation coefficients for all levels of the observation card are all significant at the significance level (0.01), where the values of the correlation coefficients for the levels ranged between (0.879) and (0.898), which indicates that the test has a high degree of construct validity and internal consistency.

An experiment was conducted for the observation card, which reliability coefficient was calculated using Cronbach's alpha coefficient, and the following Table VI shows the reliability of each level of the test.

TABLE VV
OVERALL RELIABILITY VALUE FOR EACH LEVEL USING CRONBACH'S ALPHA COEFFICIENT

Main Skill	Indicators Number	Cronbach's Alpha Coefficient
Motor recognition agent	7	0.897
Fire detection agent	3	0.85
Observation card	10	0.917

It is clear from the Table VI, that all levels of the test enjoy a high degree of reliability, and the overall reliability coefficient reached (0.917), which is a high value that indicates the suitability of the observation card for application and that it achieves a high degree of reliability.

Post-test: Before running the independent samples t-test, the Chi-square test was used. F was 0.002, and the significance level was 0.958, which above 0.05. Thus, the two samples passed the Chi-square test. The independent sample t-test revealed a significant difference in scores between the two classes (p = 0.000, <0.05). Furthermore, the mean of the experimental class was greater than that of the control class, showing that the suggested electronic system in-class teaching model was superior to the traditional teaching model.

To determine whether the proposed electronic system in-class teaching model improved students' levels of dimensions in motion and fire detection agents, we conducted a pre-test and post-test to assess students' state and ability to develop some of the artificial intelligence techniques skills, respectively. First, in this study, we examined students' ability to use artificial intelligence approaches in two dimensions. One is to assess students' mastery of motion recognition agents, while the other is to assess students' capacity to grasp fire detection agents. We assessed the reliability and validity of test from these two aspects. We handed electronic achievement test to a total of 80 individuals. We then ran the validity test with SPSS.

According to the reliability analysis, the Cronbach coefficient was 0.942 and 0.917 for test and observation card respectively, suggesting strong dependability. Reliability study was also performed on each dimension independently, and the Cronbach coefficient obtained for each dimension was greater than 0.7 for both dimensions, suggesting that the electronic achievement test is very reliable and may be used officially.

The results demonstrate that this electronic achievement test has good validity and may be formally used. Following the reliability and validity analysis, the pre-test and post-test data were analysed to examine the level of artificial intelligence technique skills of the students in the experimental group (using the proposed electronic system in-class teaching model) and control group (traditional in-class teaching model).

Table VII: shows Statistical analysis of students' pre-test and post-test scores and shows pre-test and post test results as following:

Pre-test: Prior to doing the independent samples t-test, the Chi-square test was done. F was 0.755, and the sig was 0.511, which was more than 0.05. Thus, the two samples passed the Chi-square test. The independent samples t-test revealed no significant difference in scores between the two classes (p=0.828, >0.05). The results suggest that this test is very valid and may be used in a formal setting. Following the reliability and validity study, the pre-test and post-test data were evaluated to determine the degree of AI methods abilities of the students in the experimental group (using the

TABLE VIVI
STATISTICAL ANALYSIS OF STUDENTS' PRE-TEST AND POST-TEST SCORES.

	Class	Number of cases	Mean	Standard deviation	t-test	P
Pre-test	Experimental class	40	51.49	20.095	-0.254	0.828
	Control class	40	52.60	18.284	-0.254	0.828
Post-test	Experimental class	40	72.65	13.641	4.366	0.000
	Control class	40	58.48	13.112	4.366	0.000

TABLE VIVIII
THE INDEPENDENT SAMPLE'S T-TEST OF THE PRE-TEST AND POST-TEST FOR EACH DIMENSION OF THE LEVEL IN THE TWO GROUPS.

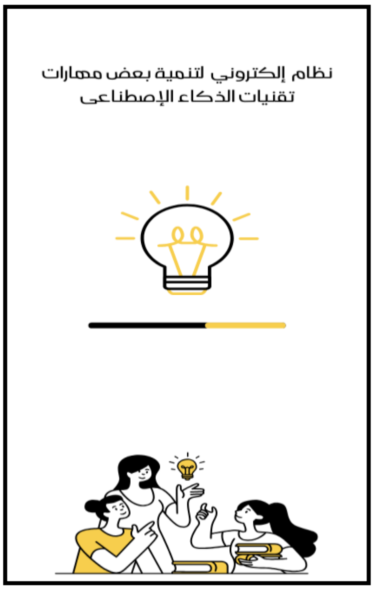
Dimension		Group	Research sample	Mean		Standard deviation		Significance (two-tailed)	
				Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Motion recognition agent	Arduino	Experimental Class	40	2.2019	1.7019	0.93121	0.64522	0.748	0.005
		Control Class	40	2.1000	2.1833	3.1833	0.91015		
	Bluetooth sensor	Experimental Class	40	1.6833	1.6556	0.76368	0.71205	0.101	0.045
		Control Class	40	2.0537	1.9796	1.21028	0.76739		
	Servo motor	Experimental Class	40	1.8317	1.5444	0.86353	0.55774	0.510	0.002
		Control Class	40	2.0259	2.0259	1.28217	0.76242		
	LCD display	Experimental Class	40	1.7852	1.6278	1.9217	0.65990	0.337	0.023
		Control Class	40	2.0362	2.0362	1.9462	0.71284		
Fire detection a gent	Flame sensor	Experimental Class	40	1.6764	1.6903	0.68499	0.54382	0.388	0.023
		Control Class	40	1.8847	2.0722	1.10739	0.87639		
	Buzzer	Experimental Class	40	2.1347	1.7875	0.92841	0.63577	0.920	0.005
		Control Class	40	2.0861	2.2250	0.99274	0.99274		
	Red light	Experimental Class	40	2.0861	1.5871	0.89044	0.50508	0.423	0.008
		Control Class	40	2.3153	1.9264	1.23256	0.71766		

intelligent in-class teaching model) and the control group (conventional in-class teaching model) as shown in Table VIII.

Following the execution of the action research, 20 students were randomly chosen from the experimental class to engage in interviews. The findings demonstrate that students favoured the proposed electronic system for in-class instruction and thought that this style of instruction might help them enhance all parts of their abilities quickly, consolidate knowledge, exercise practical skills, and promote learning incentives and group inquiry capabilities. Students' levels of knowledge in motion and fire detection agents' field improved as a result of the action research, indicating that in-class teaching using the proposed electronic system in teaching model can effectively promote students' abilities to develop some of the artificial intelligence techniques skills. Because the entire course design is step-by-step and progressive, this model eventually realized the promotion of artificial intelligence methods skills and provides an intelligent and tailored learning environment.

V. IMPLEMENTATION

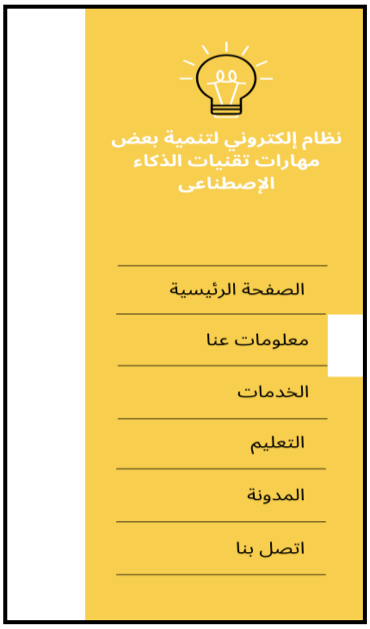
A proposed electronic system's major components are student modeling, interactive learning, and self-improvement, which allow it to reflect students' knowledge demands, engage them in context-appropriate activities, and enhance teaching effectiveness. Figure 6 shows screens for the proposed electronic system for developing some of the artificial



a. Loading screen

b. Sign In screen

c. Components screen



e. Index screen

f. Topic screen

intelligence techniques skills. The system contains a loading screen that appears when the application is opened, as shown in Figure (6.a). After downloading the program, the login screen appears and depends on entering the student's email and password. The screen also allows for the possibility of retrieving the password in case it is lost or forgotten and there is also the feature of registering a new student for the application and recording his data as shown in the figure (6.b). The main screen contains components and control buttons for the application components of the student form, and inside it appears a record of what courses and tests have been completed and what has not been completed. The courses provide many topics to be learned, and the test consists of true-false and multiple-choice questions, and the feedback includes a detailed report. About the skills the student needs to learn based on his grades in the test. The reports consist of the student's average in the tests, his grades, and the number of times the test was repeated. The main components appear in figure (6.c). Figure (6.d) shows the components of the main menu of the smartphone program and has many available options that allow the user ease of use. The index of topics appears in the figure (6.e) for the topics to be learned. Finally, the figure (6.f) shows one of the topics and contains an image, text, and an explanatory video for this topic.

VI. CONCLUSION AND FUTURE WORK

This proposed electronic system aimed to develop some of the artificial intelligence techniques skills based on smartphone for computer students in university. To this end, the smartphone app was designed and a quasi-experimental design application was conducted with students from computer major to identify the effects on students learning and the functionality of the tool. The smartphone application of AI techniques skills in university teachers' teaching and students' learning processes is an innovative way to promote the quality of teaching and learning. The study showed that the use of the smartphone app generates benefits in the increase enhancement in university students, providing a technological tool, with theoretical–empirical support, with a youthful, versatile, communicative tone and an intra-curricular component in its approach, which is designed for higher education and to be useful and easy to use. It is aimed at students who wish to increase their enhancement learning or teachers who intentionally seek to support their students in the development of learning skills in the development of their courses. As future work, it is possible to use this system and expand it to include other fields in various sciences, in addition to integrating this system with learning management systems to make the system more comprehensive.

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