

An Effective Health Care System for Early Detection and Treatment of Drug Abuse among Egyptian University Students

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ABSTRACT

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The university years are considered some of the most important years for students because they help them shape their personalities, develop their skills, and discover their creative potential. Additionally, it will help student grow into young people capable of contributing significantly to society. Unfortunately, these days drugs have become a very serious problem for college students due to their low price, easy availability, and rapid spread among the youth population. This study aims to propose a software system for early detection of drug materials among university students, as well as provide therapeutic support to patient student groups who demonstrate drug abuse. To evaluate the proposal's quality, a panel of specialized experts confirmed its large-scale usability and tested its efficacy in identifying and treating drug abuse among college students by conducting experiments on a sample of Mansoura University students. The test results showed that the proposed system achieved 90% and 93.43% accuracy rates for drug detection and treatment, respectively. As such, it can be broadly used in real educational settings.

Keywords: University Institutions; College Students; Drug Addiction; Drug Abuse; Drug Screening; Drug Detection; Drug Treatment

1. INTRODUCTION

The transition from high school to college is a critical stage in the life of undergraduate students, as many changes can impact the life of a college student and lead to stressful experiences for the first time, such as not understanding puberty changes, increasing academic load, and living with peers from different cultures, systems, and beliefs, which can lead to the exacerbation or emergence of mental health problems and substance abuse for the first time, with the possibility of receiving no or inadequate treatment [1].

Generally, the issue of substance use has garnered increased attention on a global scale in recent years. Therefore, the prevalence of substance use among college students has been the subject of numerous studies over the last ten years [2].

The major symptoms of substance abuse include having a wide variety of friends, spending a lot of time alone, losing interest in previous hobbies, and neglecting personal hygiene, such as not showering, changing clothes, or brushing one's teeth [3]. They typically exhibit signs of exhaustion and depression, eating more or less than normal, acting destructively, speaking quickly, or expressing illogical thoughts, in addition they usually have a sour mood and can quickly go from a bad mood to a nice one, thus they frequently struggle in school, have trouble paying attention, speak incoherently, and have issues with their relationships with friends and family [4].

Currently, substance abuse is a worldwide problem that has a negative impact on people's physical and mental health, the security, livelihood, and health of entire countries, as well as it affects individuals' social status and responsibilities, and abusers usually suffer from different concurrent medical, psychological, and social conditions [5]. Adolescent drug abuse has emerged as a major contributor to health issues in many regions of the world, causing some students to struggle with mental health issues, while others become unprepared for their academic environment and ultimately leave college [6,7].

The Egyptian government is concerned about drug addiction because it leads to a number of problems, such as poor social adaptation, decreased productivity at work, or termination from employment [8]. The literature review indicates that peer drug use, peer pressure, family structure, and well-being are important factors in the prevalence of substance abuse among youth [9].

Drug use by teenage students in educational institutions has serious repercussions that affect their future productivity and behavior in the workplace and these repercussions affect both the drug abusers, and the community as a whole [10].

Actually, drug abuse hinders students' ability to learn because it affects their academic performance and causes withdrawal symptoms, which make it hard for them to concentrate on their studies or even communicate with their teachers or peers, thus drug addicts deal with a variety of issues, such as trouble in school, health issues, strained peer relationships, and involvement in the juvenile justice system [11].

Given the foregoing, drug abuse among college students has emerged as a pressing problem deserving of consideration and investigation. As a result, the current study offers a software system for identifying and treating drug abuse among college students early.

The paper's remaining sections are arranged as follows:

The study problem is described in Section 2. The objectives of the study are presented in Section 3. The study approach is presented in Section 4. The study questions are defined in Section 5. The study hypotheses are determined in Section 6. The relevant studies are illustrated in Section 7. The research's materials and methodology are presented in Section 8. The details of the proposed smartphone-based system are covered in Section 9. The results of the research are discussed in Section 10. The research is concluded and future work is outlined in the final Section.

2. STUDY PROBLEM

The issue under investigation is the rising rate of drug abuse among Egyptian university students, which poses major health risks and impairs one's capacity for rational thought, effective communication, and reality recognition.

Despite increased awareness of the harmful effects of drug abuse, many college students still become addicted, frequently as a result of academic, social, or psychological pressures, etc. Unfortunately, there is a significant gap in the current healthcare infrastructure within universities to address drug abuse, often due to: lack of early detection mechanisms, limited awareness and education on drug abuse, insufficient support systems and treatment options, absence of prevention programs, and psychological and emotional impact on students.

Taking into account the aforementioned, there is a need to design and implement a system to raise awareness and provide support services to prevent drug abuse among university students. This is what the present study provides, as it suggests a smartphone-based system for the early detection and treatment of drug abuse among college students in Egypt.

3. STUDY OBJECTIVES

The main objective of the current study is to detect and treat drug abuse among university students with complete confidentiality.

This goal gives rise to the subsequent sub-goals:

- Developing and evaluating a smartphone-based system for the early detection and treatment of drug abuse among Egyptian university students.
- Providing a reliable, accessible, and efficient method for identifying students who are struggling with drug addiction, while also offering the necessary support and treatment procedures to aid

in their recovery.

- Improve student well-being and contribute to a healthier university environment by addressing the widespread issue of drug abuse among students.

4. STUDY APPROACH

The current study used the descriptive approach to review the results of the previous research on the topic of the study in order to formulate the theoretical background of the study. Also, it employed the experimental approach to evaluate the effectiveness of the proposed system in identifying and treating drug-addicted students at Mansoura University.

5. STUDY QUESTIONS

The following questions form the basis of the current study:

- **Q1:** What is the level of satisfaction of software experts with the proposed system?
- **Q2:** How effective is the proposed system for early detection of drug abuse among university students?
- **Q3:** How effective is the proposed system for treatment of drug abuse among university students?

6. STUDY HYPOTHESES

The following hypotheses form the foundation of the current investigation:

- **H1:** The proposed system is broadly usable in real-world settings.
- **H2:** The proposed system is able to detect drug abuse among university students.
- **H3:** The proposed system is able to treat drug abuse among university students.

7. LITERATURE REVIEW

Because it offers a precise overview of the most recent developments made by scientists in the field at hand, a literature review is an essential part of scientific research. In the discussion that follows, the most important prior research on the topic of the current study is reviewed and arranged chronologically from oldest to newest.

- A study entitled “Knowledge, attitude, and practice of medical students regarding smoking and substance abuse, Cairo University, Egypt,” which was conducted by Shalaby, S.F., & Soliman, M.A.(2019), it aimed to evaluate the knowledge, behavior, and attitudes of medical school students regarding smoking and substance abuse, as well as their perceptions of their future role as physicians in combating smoking and substance abuse. The study contributed to enhancing the involvement of healthcare professionals in smoking cessation activities and understand their preparedness to address these issues in the community. The study concluded that medical students had generally correct knowledge about the hazards of smoking and substance abuse and showed positive attitudes toward their future role in helping patients quit. The study recommends organizing stress management training, such as “stress coping strategies” sessions, to help students handle stress in healthy ways and prevent reliance on substances. Also, counseling programs should be implemented for students, future doctors, to support their well-being and help them effectively combat smoking and substance abuse in the community [12].

- A study entitled “Evaluation of relation between interpersonal violence and drug abuse on cases attended to Menoufia University hospital (a prospective study),” which was presented by El-Farouny, R.H., & Habib,N. (2019), it aimed to examine the relationship between injuries caused by violence and drug abuse in individuals who attended Menoufia University Hospital for medico-legal reports.The study assessed the prevalence and patterns of drug use among these individuals over a six-month period. The study concluded that drug abuse, particularly cannabis, is highly prevalent among individuals involved in violence-related injuries. The study recommends routine urine screening for drug abuse in all cases of injuries related to violence. It also emphasizes the need for more accurate tools and techniques to measure drug levels in the blood to better monitor trends in substance abuse and to identify emerging problems more swiftly [13].

- A study entitled “Assessment of knowledge and attitudes of secondary school students regarding

drug abuse at Minia city,” which was presented by Mohammed, O.H., E Hossein, Y., & H Mohamed, A.(2021), it aimed to assess the knowledge and attitudes of secondary school students regarding drug abuse in Minia city. The study concluded that the majority of secondary school students had poor knowledge about drug abuse, and about half of the students in technical schools had similar knowledge deficits. In addition, A significant portion of secondary school students exhibited positive attitudes toward drug abuse, while a higher percentage of technical school students displayed negative attitudes [14].

- A study entitled “Pattern, barriers, and predictors of mental health care utilization among Egyptian undergraduates: a cross-sectional multi-center study”, which was conducted by Baklola, M., Terra, M., Elzayat, M.A., Abdelhady, D., El-Gilany, A.H., & Collaborators, A.T.O.(2023), it aimed to assess the prevalence of psychological distress, the need for professional mental health care, and the barriers preventing undergraduate students in Egypt from seeking available mental health services. The study identified factors influencing students' levels of distress and help-seeking behaviors. The study concluded that there is a high prevalence of psychological distress among undergraduate students in Egypt, with 64.7% of students experiencing distress. Among those with distress, 90.3% recognized the need for professional mental health care. However, significant barriers, both instrumental and attitudinal, prevent students from seeking help. The primary barrier identified was the desire to solve problems on their own. The study also found that female students, those living away from family, and those with a positive family history of mental disorders were more likely to experience psychological distress. Additionally, students from urban areas were more likely to seek professional help than those from rural areas. Factors such as age above 20 and a positive family history of mental disorders were independent predictors of seeking help [15].

- A study entitled “Substance possession and school discipline: how substance type and student race/ethnicity affect decisions to suspend,” which was presented by Austin, S.C., Anderson, D., Seeley, J.R., & McGovern, S.(2025), it aimed to understand how students in US schools receive different punishments for possessing drugs depending on the type of substance and the student's race or ethnicity. The study was conducted on a nationwide sample of 99,181 students (grades 6–12) from 3,285 schools across the 2012–2013 to 2018–2019 school years. The study concluded that students who possess alcohol, tobacco, or drugs on university may face various forms of disciplinary action (e.g., out-of-school suspension [OSS], in-school suspension [ISS]) by year, substance type, and student race/ethnicity (i.e., White/Caucasian, African American/Black, Hispanic/Latino/a/e) [16].

8. MATERIALS AND METHODS

The materials and methods of the current study include the following:

8.1 Study Design and Ethical Approval

The study was conducted at the beginning of the academic year 2024-2025 on Mansoura University students. To begin with, the authors of this study directed a formal letter to the Scientific Research Ethics Committee of Specific Education Faculty, Mansoura University, with the aim of registering the study for early detection and treatment of drug-addicted students. In turn, in accordance with the regulations, the Ethics Committee sent a formal letter to the Computer Department Council to register the study, and the ethical approval was obtained from the Ethics Committee and the Computer Department Council at the Faculty of Specific Education, Mansoura University. After that, the information sheet was distributed to all participants in this study, whether students, referees, or official bodies... etc, and written informed consent was obtained from all of them independently.

8.2 Study Sample

The current study included different types of human elements, whether medical, referee, or student, but the most important element is the students because they are the ones who undergo a drug screening test, so in this sub-section we will only focus on presenting the data of the students participating in the experiment, and later each of the human elements mentioned will be clarified.

The study was applied to a random sample of students at Mansoura University, Egypt. The total number of students enrolled in the study was 120 male and female students, who were distributed in almost equal proportions between the four academic groups: First, second, third, and fourth. Table.1 displays the general characteristics of the study sample.

Table 1: The General Characteristics of the Study Sample

Variable	Clustering	Frequency [F]	Percentage [%]
Gender	Male	57	47.5
	Female	63	52.5
Age (Years)	Under 20	89	74.17
	Over 20	31	25.83
Grade Level	First	30	25.0
	Second	33	27.5
	Third	26	21.67
	Fourth	31	25.83

8.3 Study Instruments

The following methods were used to gathered the required data from the study sample:

- The first method aimed to ascertain the usability level of the proposed system through designing a survey questionnaire with multiple questions covering common aspects of evaluating software systems.
- The second method aimed to measure the efficiency of the proposed system at the level of drug detection or drug treatment by conducting an experiment to reveal the efficiency of the proposed system on two levels: drug detection and drug treatment. In this experiment, a urine sample was collected from each student participating in the experiment and medically examined through a rapid multi-drug test, then the result sheet was entered one by one into the proposed system to measure its ability to detect and treat the most prevalent narcotic substances, including Amphetamine; Marijuana; Methylenedioxymethamphetamine (MDMA); Morphine; Opiate; Tramadol; Barbiturates; Benzodiazepines ... etc.

In this context, it is crucial to emphasize the methods employed to measure the validity and reliability of the study instruments:

8.3.1 Validity of Questionnaire

The current study used the "Limits of Agreement" method to get the reviewers' opinions regarding whether or not the suggested usability measurement questionnaire could accurately measure what it was supposed to measure.

To apply this method, the suggested usability measurement questionnaire was presented to a group of arbitrators with expertise in the current study's field, and the results were recorded.

The findings showed that 92% of the usability arbitrators agreed that the suggested usability measurement questionnaire was a valid tool for assessing the proposed system's usability.

8.3.2 Reliability of Questionnaire

The current study used the "Test-Retest" method to determine whether or not the suggested efficiency measurement questionnaire could yield the same results when used repeatedly under similar conditions.

To apply this method, the suggested efficiency measurement questionnaire was conducted on 10% of the study sample, and the results were recorded; then it was repeated under the same conditions three weeks later on 15% of the study sample, and the results were recorded.

The findings showed that the suggested efficiency measurement questionnaire had a reliability score of 0.94, which falls within the acceptable range based on the classification provided in the research paper published in reference No.[17], and is regarded as a very high level according to the

classification given in the research paper published in reference No.[18]

8.4 Data Analysis

Data analysis is the process of assessing the study's collected data using statistical and analytical tools to find the relevant information required. The data analysis method employed in the current study is a descriptive analysis and all analyses were performed using the latest version of IBM Statistical Package for Social Sciences Software (SPSS) for Windows.

9. PROPOSED SYSTEM

In order to understand the proposed system for early detection and treatment of drug abuse among Egyptian university students, it will be detailed into three parts: Overview, Development, and Implementation. Each of these parts will be explained in detail in the following discussions:

9.1 System Overview

Several previous surveys have shown high rates of illicit drug abuse among college students for various reasons[19], so the results of these studies served as the motivation for this study to propose a software system to detect and treat drug abuse among college students.

Generally, the process of drug detection and treatment depends on analyzing a urine sample of the college student. On the first try, if the college student passes the drug test, no problems will arise. While, if it is discovered that he was using drugs, he will receive treatment for a set period of time, and a follow-up drug test will be conducted.

If a new applicant student passes the second drug test, he will be admitted to the college; if he is a previously registered student, he will continue his studies as usual. On the other hand, if a new applicant student fails the second drug test, he will not be admitted to the college; if he is a previously registered student, he will be dismissed from the university, and the student's guardian and the competent authorities will be informed.

A block diagram for the steps involved in the proposed system can be outlined below in Figure.1.

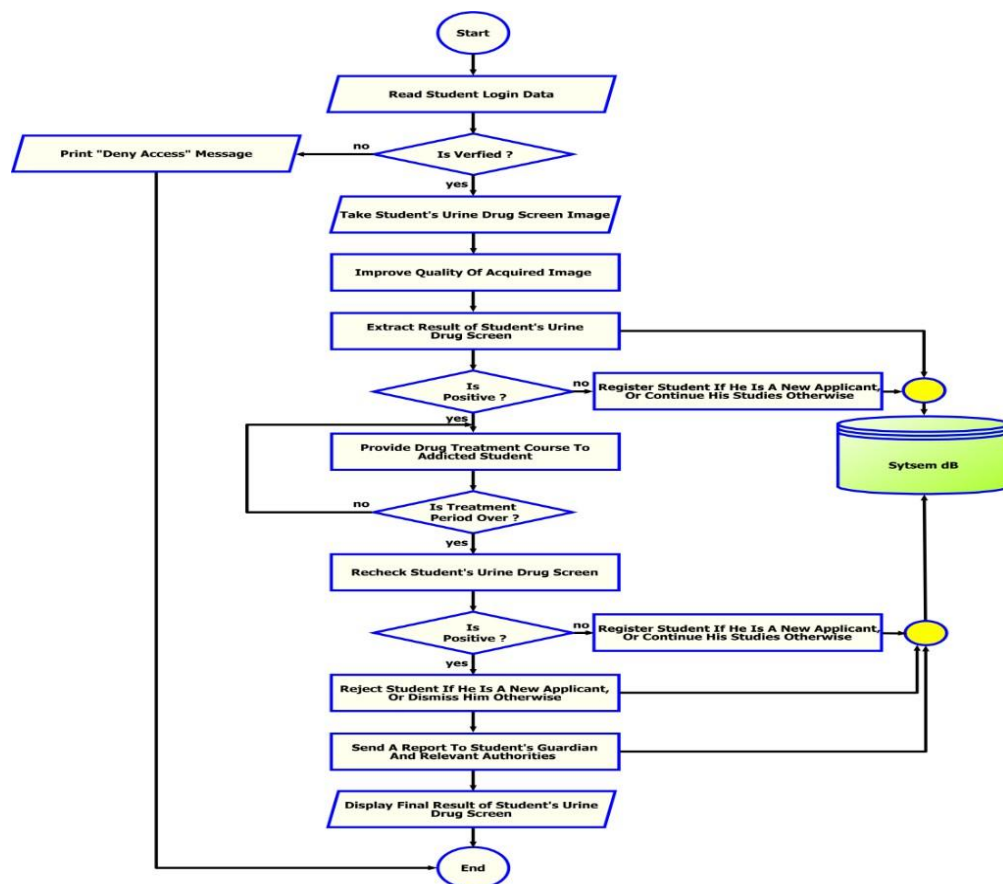


Figure 1. Steps of the Proposed System

9.2 System Methodology

The following suggested algorithm serves as the foundation for the proposed system for the early detection and treatment of drug abuse among Egyptian university students:

• The Proposed Algorithm

The input, output, and procedures of the proposed algorithm are as follows:

Input: An image of the student's urine drug screen.

Output: A report on actions taken based on the student's urine drug screen result.

Procedures:

The major procedures that occurred in the suggested algorithm are the following:

1. The image of the student's urine drug screen is acquired using any method of obtaining an image.
2. The acquired image of the student's urine drug screen is subjected to a number of digital image enhancement techniques to improve its quality and create a proper image for subsequent processing.
3. The drug screen result is extracted from the acquired student's urine drug screen image.
4. The appropriate actions are taken depending on whether the student's urine sample is positive or negative.
5. If the sample is negative, there is no problem for the student, whether a new applicant to the college or previously registered.
6. If the student's urine sample is positive, the student is given an addiction treatment course for a certain amount of time, depending on the type of drug used.
7. Following the treatment period has finished, the student is required to retake the urine drug screen.
8. Repeat steps one through four in order.
9. If the student's urine sample comes back negative the second time, the student will be admitted if he is a new applicant to the college, and if he has previously registered, he will continue his studies as usual at college.
10. If the student's urine sample is positive the second time, the student will be refused admission to the college if he is a new applicant to the college, and if he has previously registered, he will be dismissed from the college, and the student's guardian and the relevant authorities will be notified.

9.3 System Implementation

In practice, the proposed system includes a number of graphical screens. A sample of the proposed system implementation's screens is presented in the following:

Once the proposed system has been launched, the "Splash" window depicted in Figure.2 will appear for a specific period of time.



Figure 2. Screenshot for Splash Window

After the specified time for the "Splash" window has elapsed, the "Login" window depicted in Figure.3 will appear to verify the student's identity.

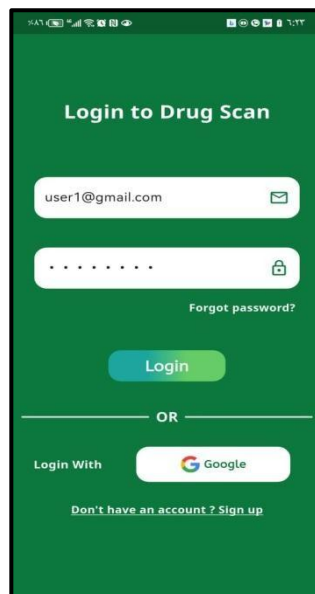


Figure 3. Screenshot for Login Window

From the above window, the student is asked to enter the necessary login data, which, if it is entered correctly, the "Image Acquisition" window depicted in Figure.4 will appear to display methods of acquiring images of the student's urine drug screen; if not, the access request will be rejected.



Figure 4. Screenshot for Drug Screen Image Acquisition Window

From the above window, the proposed system either uses the smartphone's camera to take a live image of the student's urine drug screen or downloads a previously saved image.

When uploading a negative urine drug sample image, the "Negative Urine Drug Image" window depicted in Figure.5 will appear to display the content of the negative uploaded image.

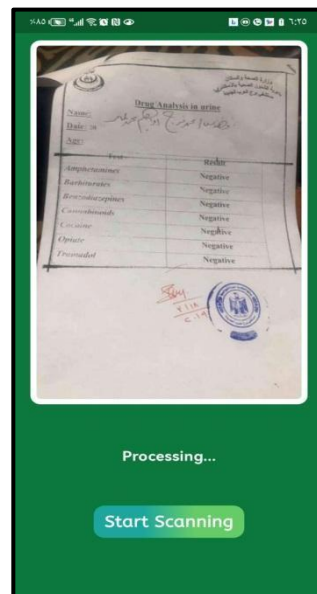


Figure 5. Screenshot for Uploading Negative Urine Drug Image Window

From the above window, when the button "Start Scanning" is pressed, the urine analysis image that was uploaded is checked, and the "Negative Drug Scanning Result" window depicted in Figure.6 will appear to display the negative scanning result and advise the student to go to the student affairs department to finish the registration process if he is a new applicant; if not, he proceeds with his studies as usual.



Figure 6. Screenshot for Negative Drug Scanning Result Window

On the other hand, when uploading a positive urine drug sample image, the "Positive Urine Drug Image" window depicted in Figure.7 will appear to display the content of the positive uploaded image.

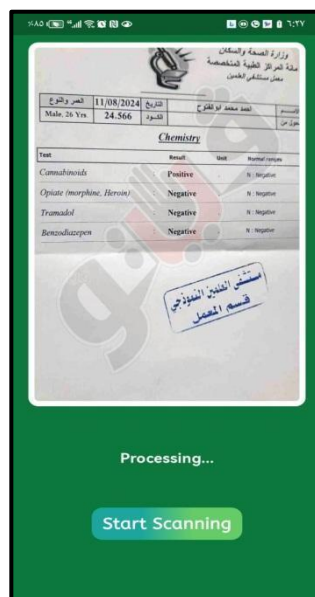


Figure 7. Screenshot for Uploading Positive Urine Drug Image Window

From the above window, when the button "Start Scanning" is pressed, the urine analysis image that was uploaded is examined, and the "Positive Drug Scanning Result" window depicted in Figure.8 will appear to display the positive scanning result and advise the student to take a 14-day drug treatment course and then retake the drug screen again. If the student fails a second time, he will either be dismissed if he is already enrolled or denied registration in the college if he is a new applicant.



Figure 8. Screenshot for Positive Drug Scanning Result Window

From the above window, when the button "Prescription" is pressed, the "Drug Treatment Plan" window depicted in Figure.9 will appear to send drug treatment instructions and a drug treatment course through the personal Email account that was previously registered on the system during the sign-up phase.



Figure 9. Screenshot for Drug Treatment Plan Window

10. RESULTS

In order to confirm the degree to which research findings align with theoretically derived hypotheses, two test levels were conducted. Both levels are explained in greater detail below.

10.1 Usability Test

To test the first hypothesis, which states that **"The proposed system is broadly usable in real-world settings,"** a copy of the proposed system was presented to a group of Mansoura

University software specialists along with the previously described usability questionnaire.

In order to gather precise expert feedback on the proposed system, the suggested usability questionnaire was divided into four main dimensions. The first dimension had several questions to gauge experts' satisfaction with the system interface, the second dimension had several questions to gauge experts' satisfaction with the system functionality, the third dimension had several questions to gauge experts' satisfaction with the system complexity, and the fourth dimension had several questions to gauge experts' satisfaction with the system timeliness.

Using the classifications given in reference [20], the experts' satisfaction levels for each evaluation dimension were categorized into seven levels based on the satisfaction score displayed in Table.2.

Table 2: Classification of Experts' Satisfaction Level

Satisfaction Score	Satisfaction Level
Under 50	Bad
50-59	Limited
60-69	Fair
70-79	Good
80-89	Great
90-95	Excellent
96-100	Amazing

The usability evaluation questionnaires were gathered from evaluation experts, and invalid, incomplete, or damaged ones were excluded. Following that, descriptive statistical analysis was performed on the completed questionnaires, and the outcomes were documented in Table.3 and depicted in Figure.10.

Table 3: Outcomes of the Proposed System Usability Analysis

Exp.No	Expert Satisfaction Level				Average [%]
	Interface	Functionality	Complexity	Timeliness	
1	Great	Excellent	Amazing	Great	Excellent 91
2	Excellent	Amazing	Great	Amazing	Excellent 92
3	Amazing	Amazing	Excellent	Amazing	Excellent 95
4	Amazing	Excellent	Excellent	Great	Excellent 94
.....					
N	Amazing	Amazing	Amazing	Excellent	Excellent 93
Average %	95	94	91	92	93
Overall Average Satisfaction [%]					

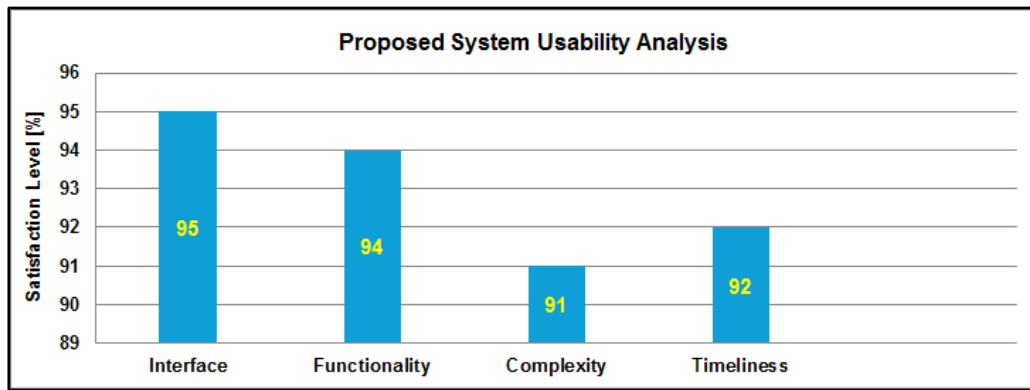


Figure 10. Statistical Analysis of Usability Findings

The aforementioned results demonstrated that, the viewpoints of the evaluation experts regarding the proposed system differed from one another, where the average satisfaction of the first expert in all dimensions of the proposed system was 91%, the average satisfaction of the second expert in all dimensions of the proposed system was 92%, the average satisfaction of the third expert in all dimensions of the proposed system was 95%, the average satisfaction of the fourth expert in all dimensions of the proposed system was 94%, and the average satisfaction of the last expert in all dimensions of the proposed system was 93%.

Also, the above results demonstrated that the viewpoints of evaluation experts toward the proposed system differed from one dimension to another, where the Interface dimension achieved an average satisfaction of 95%, the Functionality dimension achieved an average satisfaction of 94%, the Complexity dimension achieved an average satisfaction of 91%, and the Timeliness dimension achieved an average satisfaction of 92%.

The statistical analysis of the obtained results revealed that, on average, 93% of experts agreed on the usability of all dimensions of the proposed system, which means that the proposed system can be widely applicable to detect and treat drug abuse among students in various Egyptian universities.

Ultimately, according to the results achieved, we can conclude that the first hypothesis is acceptable.

10.2 Efficiency Test

After the usability test was successfully completed, the efficiency measurement process was conducted. Here, two dimensions were evaluated to measure the efficiency of the proposed system: the drug abuse detection dimension and the drug abuse treatment dimension.

The discussion that follows will go into greater detail about both levels:

10.2.1 Drug Abuse Detection Analysis

To test the second hypothesis, which states that "**The proposed system is able to detect drug abuse among university students,**" an experiment was conducted on 120 male and female students from Mansoura University who constitute the pre-specified study sample.

Before the experiment started, two students were excluded because they refused to provide a urine sample, and three others were not included because their parents did not allow their children to participate in the experiment.

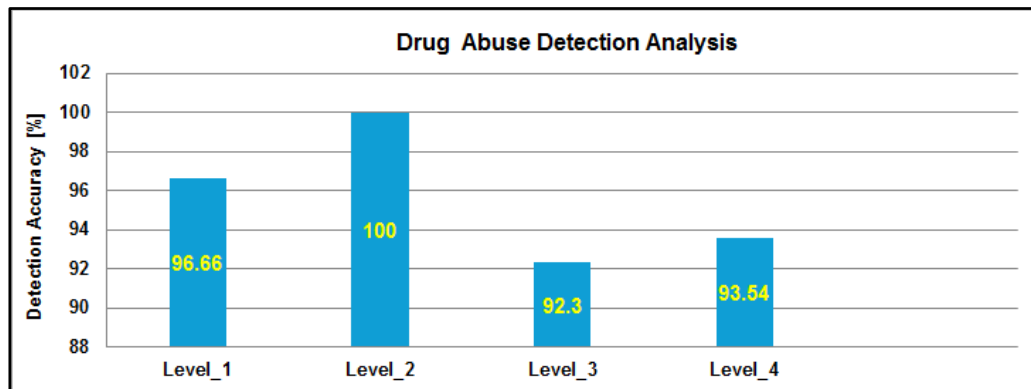
At the beginning of the experiment, each student participating in the experiment was asked to provide a urine sample in complete confidentiality and in the presence of a member of the nursing staff accompanying the student, according to the student's gender to prevent tampering with the content of the urine sample in any way. The proposed system acquired the drug screening result through the smartphone's camera or downloaded it from the device. The urine sample was examined through a rapid multi-drug test by a medical analysis device located at the drug screening room.

The proposed system analyzed the drug screen result to determine whether the student's urine sample was positive or negative for the most common types of illicit drugs.

The accuracy of drug abuse detection for each study level was computed, documented in Table.4 and the correctly classified instances depicted in Figure.11.

Table 4: Accuracy of Drug Abuse Detection

Study Level	Correctly Classified Instances	Incorrectly Classified Instances
First	96.66	3.34
Second	100	0
Third	92.30	7.70
Fourth	93.54	6.46
Average	95.63	4.37

**Figure 11.** Accuracy of Correctly Detected Instances

The aforementioned results demonstrated that the correct detection for the first study level was 96.66% (29 students among 30), for the second study level was 100% (33 students among 33 students), for the third study level was 92.30% (24 students among 26) and for the fourth study level was 93.54% (29 students among 31).

Also, the statistical analysis of the obtained results showed that the average correct drug detection was 95.63%, which is classified as a high level of drug abuse detection.

Ultimately, according to the results achieved, we can conclude that the second hypothesis is acceptable.

10.2.2 Drug Abuse Treatment Analysis

To test the third hypothesis, which states that "**The proposed system is able to treat drug abuse among university students,**" an experiment was carried out on a sample of students who had previously been identified as drug users by the drug detection screen described in the above section. Different numbers of students from each of the four study levels were included in the test sample, which was distributed as indicated in Table.5.

Table 5: Distribution of Drug Abuse Treatment Analysis Sample

Study Level	Total Number of Pupils
First	7
Second	10
Third	5
Fourth	8

At the start of the test, each addicted student was instructed to access the proposed system on his own smartphone in order to receive the proper treatment plan according to the level of addiction via his personal Gmail account registered on the system.

Once the student had received the treatment course, the application began remotely monitoring the student's adherence to the prescribed treatment and the specified behaviors.

With the end of the treatment period, the proposed system asked the addicted student to retake the drug screen, and the result was passed to the proposed system, which analyzed it and determined whether the student had recovered or not.

The drug recovery level was classified into three categories. The full recovery, which means refraining from all drug use. The partial recovery, which means only refraining from some drug use. The poor recovery, which means not refraining from all drug use.

The accuracy of drug abuse treatment for each study level was computed, documented in Table.6 and the correctly treated instances were depicted in Figure.12.

Table 6: Accuracy of Drug Abuse Treatment

Study Level	Correctly Treated Instances	Incorrectly Treated Instances
First	85.71	14.29
Second	100.0	0
Third	80.0	20
Fourth	100.0	0
Average	91.43	8.57

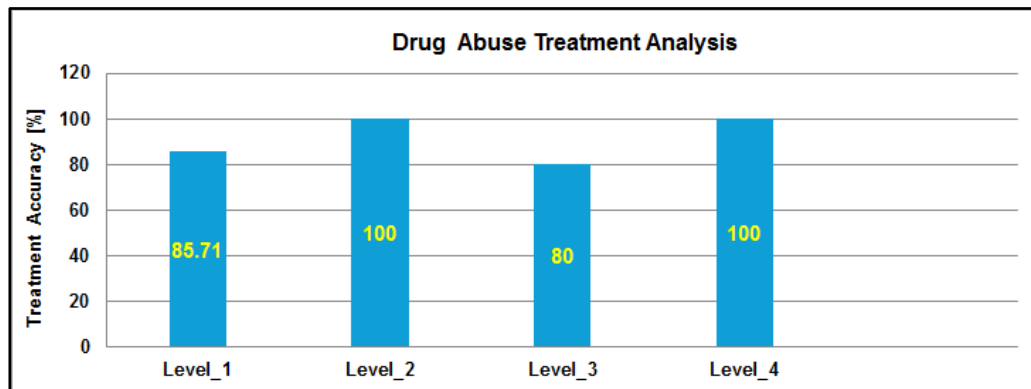


Figure 12. Accuracy of Correctly Treated Instances

The aforementioned results demonstrated that the correct treatment for the first study level was 85.71% (6 students among 7), for the second study level was 100% (10 students among 10 students), for the third study level was 80.0% (4 students among 5), and for the fourth study level was 100% (8 students among 8).

Also, the statistical analysis of the obtained results showed that the average correct drug treatment was 91.43%, which is classified as a high level of drug abuse treatment.

Ultimately, according to the results achieved, we can conclude that the third hypothesis is acceptable.

11. CONCLUSION AND FUTURE WORK

Drug addiction has become a frightening issue in the university community, where estimates indicate its widespread prevalence among students of various colleges. Therefore, this study presented a smartphone-based system for early detection of drug abuse among Egyptian university students and provided the support procedures for drug abuse treatment.

The evaluation plan focused on testing three dimensions: usability, drug detection efficacy, and drug treatment efficacy. Analyzing the study's findings demonstrated that the experts largely agreed on the suitability of the proposed system for use in actual university settings, supporting the first hypothesis. Moreover, the testing procedure proved the effectiveness of the proposed system in identifying and treating drug addicted students, supporting the second and third hypotheses, respectively.

The research recommendations concluded on the necessity of expanding the scope of using the proposed system for early detection and treatment of drug abuse among Egyptian university students.

In the future, the proposed system will be developed to be able to gather urine samples from university students, analyze them, and provide the results without human intervention.

ETHICAL APPROVAL

Institutional approval was obtained from the Ethical Committee at the Faculty of Specific Education, Mansoura University, Mansoura, Egypt.

AUTHORS CONTRIBUTION

All authors contributed equally in all phases of the study, where they participated in the study's design, data collection, statistical analysis, data interpretation, and writing the manuscript. Also, they participated in correcting the preliminary version and preparing the final version for publication.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interests.

CONSENT

Written informed consents were obtained from all individuals and students included in this study. Also, the consent of the parents of the students participating in the experiment was obtained.

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