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T-labio

"A medical application that works as a smart laboratory "

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Dedication

I am delighted to dedicate this achievement, which was the result of hard work and dedication, to:

To my mother, who has always been my role model, my inspiration and my source of strength, who enlightened our path and fought for us, for our education, for our success and for us to be in the highest ranks, thank you a thousand times. Even though she is not enough for you, we are proud that you are.

To my father, my guide in life and the source of my wishes, you are the one who taught me to be a different and strong girl and not to look like anyone else, and now the days are passing and proving that, and the result of today is your fatigue all these years and your support for us. Thank you for all your tremendous efforts for us.

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To my brothers, you are the ones we support; you are the males. I am the eldest, but you are the ones who will bear the responsibility when you grow up, so do not underestimate the path of knowledge like your generation, and build your strength with your knowledge so that you will be the pride of our family.

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To my country: I am grateful to have the chance to contribute to the development through my work; I intend to give this chance back to a country that has given me much more than Ideserved.

Abstract

Tlabio is an innovative contemporary solution based on transferring the experience of medical and analytical laboratories from the classical complex method to the wave of artificial intelligence with intelligent system to emerge in the market as a smart laboratory based on artificial intelligence systems to read and interpret the results of analyses in coordination with doctors and experts in a simple and safe way The system allows the user to enter data manually, then to click using the technology of recognition of letters and words so that the data is processed and compared with the given codes according to numerous factors, including age and sex, and provides a clear explanation of the indication and indicates whether it is normal, low or high, with advice and recommendations for the patient, then put them in touch with our medical team made up of doctors specialized in several specialties. The application also offers additional services to support patients after health checks or request a home-based medical follow-up in place with the nurses or provide information about medicines or know the side effects of certain over-the-counter medications to know their negative effects on the body with the creation of special services for specific patients and work to provide a section of medical content within the applications such as allergies and vitamins....

Résumé

Le projet est une solution contemporaine innovante basée sur le transfert de l'expérience des laboratoires médicaux et analytiques de la méthode classique complexe à la vague de l'intelligence artificielle avec le système intelligent pour émerger sur le marché comme un laboratoire intelligent basé sur l'intelligence artificielle systèmes pour lire et interpréter les résultats des analyses en coordination avec des médecins et des experts de manière simple et sûre Le système permet à l'utilisateur de saisir des données manuellement, puis de cliquer en utilisant la technologie de reconnaissance des lettres et des mots afin que les données soient traitées et comparées aux indicatifs données selon de nombreux facteurs, y compris l'âge et le sexe, et fournit une explication claire de l'indication et indique si elle est normale, faible ou élevée, avec des conseils et des recommandations pour le patient, puis le mettre en relation avec notre équipe médicale composée de médecins spécialisés dans plusieurs spécialités L'application propose également des services complémentaires pour accompagner les patients après des examens de santé ou demander un suivi médical à domicilemettre en place avec les infirmières ou fournir des informations sur les médicaments ou connaître les effets secondaires de certains médicaments pris sans ordonnance pour connaître leurs effets négatifs sur le corps avec la création de services spéciaux pour des patients spécifiques et travailler à fournir une section de contenu médical au sein du applications telles que les allergies et les vitamines...

ملخص

المشروع حل مبتكر معاصر يقوم على نقل تجربة المختبرات الطبية والتحليلية من الطريقة الكلاسيكية المعقدة إلى موجة الذكاء الاصطناعي بالنظام الذكي ليخرج للسوق على أنه مختبر ذكي معتمد على أنظمة الذكاء الاصطناعي في قراءة وتفسيرنتائج التحاليل بالتنسيق مع الأطباء والخبراء بشكل سهل وآمن، حيث يتيح النظام للمستخدم إدخال البيانات يدويًا وبعد ذلك يتم الضغط باستخدام تكنولوجيا التعرف على الحروف والكلمات بحيث يتم معالجة البيانات ومقارنتها مع البيانات الإرشادية وفق العديد من العوامل و منها العمر والجنس , و يقدم تفسيرا واضحا للمؤشروحالته هل عادية ام منخفضة او مرتفعة مع نصائح و توصيات للمريض ، ثم ربطه مع فريقنا الطبي المكون من أطباء مختصين في عدة تخصصات , كما يوفر التطبيق خدمات تكميلية لتوجيه المرضى بعد التحاليل من رعاية صحية او طلب متابعة طبية منزلية رفقة الممرضين اوتوفير معلومات عن الادوية اومعرفة الاثارالحانبية لبعض الادوية التي تؤخذ بدون وصفة لمعرفة تأثيرها السلبي على الجسم مع استحداث خدمات خاصة لمرضى محددين والعمل على توفير قسم محتوى طبي داخل التطبيق مثل الحساسيات و الفيتامينات

Table of contents

Chapter1: General introduction.....1

1.1. General context.....1

2.2. Problem Statement.....1

2.3. Project motivation.....1

2.4. Project objectives and goals.....2

2.5. Dissertation organization.....3

Chapter 2: Company.....5

2.1. Company presentation:.....5

2.2. The company's organisational structure.....5

2.3. The company's various services.....5

Chapter 3: Scientific and technological context.....8

3.1. Introduction.....9

3.2. Presentation of the medical and biological field.....10

3.3. Classification of Medical Analyses in Laboratory Medicine.....11

3.4. Clinical interpretation of Biomarkers:.....12

3.5. Biomedical Indicator Calculation Methods.....12

3.6. Factors Affecting Biological Parameters:.....13

3.7. Aspects of Biological Reference Values:.....14

3.8. Digitalisation of the healthcare sector:.....15

3.9. Role of Artificial Intelligence.....19

Chapter 4: Intelligent system for processing and interpreting medical biological.....21

4.1 Artificial intelligence in healthcare.....21

4.2. Data interpretation logic:.....21

4.3 .AI/Machine learning.....22

4.4. Cyber security in healthcare.....24

Chapter 5: General Conclusion.....26

5.1. General Summary:.....27

5.2 Main findings.....27

5.3. Scientific Contribution:.....28

5.4. Study Limitations.....28

5.5. Recomendations.....29

Chapter 6: Presentation of the project.....30

6.1. Problem statement:.....31

6.2. Project Idea.....31

6.3. Suggested values:.....32

6.4. The project team:.....33

6.5. Project objectives:.....43

6.6. Project implementation timeline:.....36

Chapter 7:Aspect and innovation.....38

7.1 . Nature of innovations:.....38

7.2. The field of innovation:.....38

Chapter 8: Strategic market analysis.....40

8.1.Target market:.....41

8.2 Marketing Plan:.....42

8.3.T-LABIO's SWOT Analysis.....44

8.4. The development process tlabio:.....45

8.5. Workforce.....46

8.6. key partenere....46
Chapter 9: Financial Plan....48
9.1. Establishment costs:....49
9.2. Operational costs:....50
9.3. Annual Equipment Consumption Schedule:....51
9.4. Revenue schedule:....52
9.5. Forecasted income statement:....54
9.6. Break-even point calculation (Break-Even Point)....55
Chapter 10: Prototype and BMC....56
10.1. logo....57
10.2. Branch of Explanation and interpretation of medical test results....60
10.3. Online Pharmacy Branch....63
10.4. Nursing and home care branch....65
10.5. Bassins model Canvas....71

Table of figures

Figure 1	The organization of the company	Page 6
Figure 2	Enterprise services	Page 7
Figure 3	Bibliometric map of the digital transformation healthcare	Page 18
Figure 4	Artificial intelligence infographiques	Page 19
Figure 5	The categories and scales of biomedical multimodal data	Page 21
Figure 6	An illustration of deep learning with two hidden layers	Page 23
Figure 7	current trend for deep learning (the data are generated through searching the deep learning in healthcare and disease categories on Pub Med)	Page 24
Figure 8	The data source for deep learning, the data are generated through searching deep learning in combination with the diagnosis techniques on Pub Med.	Page 24

List of table

Table 1	Main clinical purposes of biomedical analyses	Page 11
Table 2	Major classes of routine medical laboratory analyses	Page 12
Table 3	Explication how OCR works in healthcare	Page 18
Table 4	Key Algerian legal texts touching digital information	Page 25

Part 01 :

Theoretical

Part

Chapter 1: General introduction

1.1. General context

In recent years, the healthcare sector has witnessed rapid digital transformation thanks to the development of artificial intelligence and modern medical technology, which has contributed to improving the quality of healthcare and facilitating access to medical services. It has become possible to analyze health data more accurately, support medical decisions, and develop remote health follow-up services through smart applications and modern digital systems. Biomedical sciences have also played a fundamental role in integrating technology with medicine in order to develop diagnostic and treatment methods and improve the efficiency of health services (1)(15).

2.2. Problem Statement

Despite these developments, many patients still have difficulty understanding medical test results due to the complexity of biological indicators and the lack of simplified interpretation, which may lead to a misunderstanding of results or a delay in seeking appropriate care. In addition, the Algerian market lacks integrated digital health platforms that combine interpretation of medical tests, medical guidance, home care services, and health follow-up within a unified and secure system that takes into account the user's privacy and the protection of their medical data. Especially in light of the increasing challenges associated with population growth, and the difficulty of providing continuous and effective health care to all segments of society.

2.3. Project motivation

The idea for this project came from the real human suffering experienced by many patients during the medical analysis journey, starting with anxiety and difficulty understanding the results, all the way to the absence of health accompaniment after receiving the analysis. The limited integration between digital health services and the weakness of local solutions adapted to the specificity of Algerian society have also contributed to enhancing the need for a smart platform that accompanies the patient in a simplified and safe manner before, during, and after medical tests based on these rapid digital transformations, the need has emerged to develop a smart health solution capable of addressing the shortcomings in traditional health systems,

especially in countries that still face challenges in digitizing medical services, including Algeria.

Recent studies have shown that understanding medical test results is a real challenge for a wide range of patients. Published research in the field of health informatics has shown that patients with limited health literacy were less than half as able to distinguish between normal and abnormal results as others. Only 38% of them were able to understand laboratory results correctly, compared to 77% of people with high health literacy. These studies also included more than 1,800 patients between the ages of 40 and 70 years, and confirmed that most patients face difficulty in determining whether their condition requires immediate contact with a doctor or not.

This problem is further complicated by chronic disease patients and the elderly, who frequently undergo tests, as a large number of patients spend days or weeks waiting for a medical appointment to understand their results or search for unreliable explanations online and on social media, which increases psychological anxiety and the possibility of misinterpretation of health information. Recent studies have also shown that simply providing medical results digitally does not guarantee their understanding. In fact, many patients feel confused when reading laboratory values and tests without a simplified explanation or appropriate medical guidance

2.4. Project objectives and goals

This project aims to develop a smart healthcare platform called the Smart Lab “T-labio”, based on digitizing the entire medical analysis process in an integrated manner. This platform integrates artificial intelligence and OCR technologies to automatically analyze and interpret analysis results under medical supervision. Digital support services are also provided, including home sampling, patient guidance following results, appointment booking, and connecting users to home care services and electronic pharmacies.

The project's primary goal is to build a unified digital health solution that simplifies medical data processing, improves the speed and accuracy of interpreting results, reduces manual intervention in routine operations, and ensures effective communication between patients, physicians, and healthcare providers within a single system. It also seeks to bridge the gap between medical technology and humans by making health information clearer and easier to understand, while also alleviating the psychological and physical burdens on patients and their

families, particularly in chronic conditions and the elderly. This will contribute to improving quality of life and promoting the digital transformation of the Algerian health sector toward a more integrated and intelligent system.

2.5. Dissertation organization

This thesis is divided into two parts: a **theoretical part** structured in five chapters and a **practical part** which is also divided into 5 chapters.

Chapter 1 provided a general introduction of the project .

Chapter2 is dedicated to the presentation of the host company where we completed the internship.

Chapter3 presents a review of the key biological techniques related to our project

Chaper4 presents some intelligent system for processing and interpreting medical biological

Chapter5 presents a concusion and recommandatons

Chapter6 presents an overview of our project

Chapter7 presents aspect and innovation of our project

Chapter8 presents the strategic market analysis of our project

Chapter9 presents the financial plan

Chapter10 presents the prototype of our project and BMC

Chapter 2 : company

2.1. Company presentation :

EURL Fmds Proactive Engineering and Investment, accredited by ARPCE in 2025, is based in El Domrana, Beni Bachir municipality, Ramdane Djamale district, Sikka province, under the sole management of Mr Imed Boufedj. The premises cover a total area of 307 m², with a built-up area of 197 m².

The company's various services:

- Cybersecurity research and development laboratory

- Engineering and investment

- Industrial, electronic and IT engineering

- Data hosting and storage

Fmds PE.I stands out for its scientific and practical expertise in engineering and industrial scientific research, as demonstrated by scientific publications and articles, as well as its participation in numerous local and international scientific and industrial conferences and symposia, notably

Our primary objective is to earn the trust of our clients, and our aim is to support you in

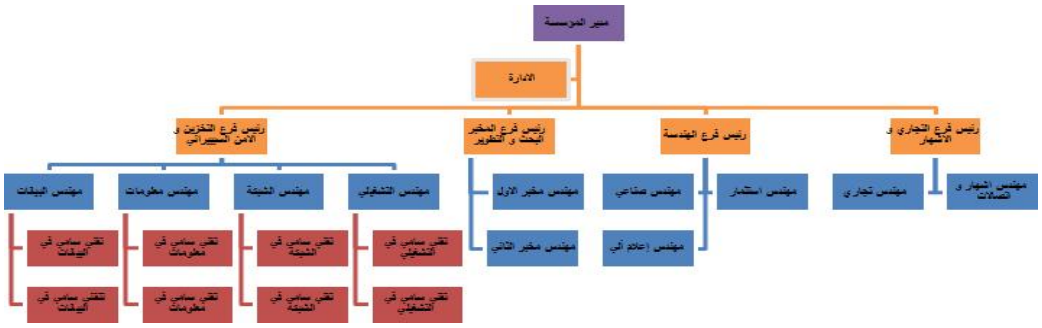


Figure1 : The organisation of the company

2.2. the company's organisationnel structure :

2.3. The company's various services

- Cybersecurity Research and Development Laboratory

- Engineering and Investment

- Industrial Engineering, Electronics and IT

- Data Hosting and Storage



Figure2 : The company's various services

Chapter 3:
Scientific and technological context

3.1. Introduction :

Biomedical analysis represents one of the fundamental pillars of modern healthcare systems, playing a crucial role in disease diagnosis, therapeutic monitoring, prognosis evaluation, and preventive medicine(1).

The role of biomedical testing does not stop at identifying the presence of pathology; they also serve public health surveillance, epidemiology, personalization of medicine, and predictive medicine. Based on the analysis of biological markers and physiological indicators, laboratory diagnostics helps in establishing metabolic disorders, infectious diseases, endocrinopathies, cardiovascular risk, and various other diseases. Laboratory data, therefore, represent an indispensable component of medical documents for patients' health.

Nowadays, laboratory tests significantly determine the course of clinical decision-making in the field of healthcare services. Based on laboratory results, doctors verify diagnoses, establish the severity of the disease, choose the appropriate treatment, and analyze patient reactions to therapy. Procedures such as complete blood count (FNS), glucose test, renal indicators, lipids, and inflammation are among the most common analyses ordered by doctors in both inpatient and outpatient facilities. Such tests make it possible to detect signs of pathology at the initial stages, even before the occurrence of clinical signs of diseases.

The recent advancements in digital medicine have contributed to the advancement of biomedical analytics by incorporating electronic health records, LIS, artificial intelligence, and diagnostic tools(1).

As a result, more biomedical data becomes available every day, which provides more possibilities for the application of intelligent techniques in analyzing this information, making predictions regarding patients’ diseases, and providing them with personalized treatment solutions. Nevertheless, this new paradigm comes with its own set of problems that need to be addressed, including the analysis and protection of medical information.

Thus, knowledge of biomedical analyses and their importance is critical when designing the modern intelligent healthcare (1).

3.2. Presentation of the medical and biological field

3.2.1. Components of modern digital health

Digital health consists of a wide range of technologies working together to bring about this transformation. The most prominent of these ingredients are:

a) Artificial Intelligence (AI) and Machine Learning (ML):

Artificial intelligence is used to analyze medical images with extreme accuracy, support clinical decisions, and identify hidden patterns in medical data that may be missed by the human eye. For example, artificial intelligence can speed up the diagnosis of diseases such as cancer and retinal diseases (2).

b) Electronic Health Records (EHRs):

These systems provide a unified patient data center, facilitating information exchange between caregivers, reducing medical errors, and improving care coordination. Electronic health records allow data to be transformed into informed clinical decisions through a digital knowledge architecture(2).

c) Telemedicine and Remote Patient Monitoring (RPM):

These technologies have made it possible to provide medical consultations and therapeutic services to patients regardless of their geographical location, increasing access to care, especially in remote areas. Wearable devices are used to collect physiological data of patients and monitor them continuously (3).

d) Transforming data into clinical decisions:

At the core of digital transformation is the ability to transform massive amounts of medical data into actionable insights. Through advanced data analytics, physicians and healthcare organizations can make more accurate and effective decisions, leading to personalized treatment plans and improved patient health outcomes (3).

3.2.2. Fundamentals of medical laboratory parameters:

Laboratory test results influence approximately **70% of clinical decisions**, playing a crucial role in diagnosis, prognosis, disease risk assessment, and treatment monitoring. However, the interpretation of these results requires caution, as reference ranges are typically established from healthy populations and include the central **95% of values**, meaning that about **5% of healthy individuals may present results outside the normal range**. In addition, laboratory values can vary according to age, sex, ethnicity, testing methods, seasonal factors, and

biological variability. Therefore, results slightly outside the reference interval are not always clinically significant and should be interpreted within the patient's overall clinical context (3).

3.2.3. Definitions of Biomedical / Medical Analysis and Laboratory Medicine

Clinical Laboratory Science is a healthcare discipline that analyzes biological samples using various analytical techniques to support disease screening, diagnosis, prognosis, and treatment monitoring. Biomedical analyses, particularly molecular diagnostics, are among the most widely used tools in modern medicine due to their ability to detect a broad range of biological and pathological abnormalities (4).

Purpose	Brief description
Screening	Detect disease or risk in asymptomatic people
Diagnosis	Establish /absence and type of disease
prognosis	Predict course, outcomes, mortality
Monitoring/follow -up	Track disease, treatment repone, safety

Table1: Main clinical purposes of biomedical analyses

3.2.4. Role of medical analysis in Diagnosis, Prediction, and Medical Follow-up:

Biomedical analyses play a key role in **diagnosis, prediction, and patient monitoring** by detecting disease-related biomarkers and supporting clinical decision-making. Artificial intelligence and data analytics enhance early diagnosis, risk assessment, prognosis, and treatment follow-up. The reliability of these analyses depends on proper sample collection and handling, validated analytical methods, calibrated equipment, qualified personnel, quality control procedures, and robust statistical evaluation to ensure accurate and clinically meaningful results (5).

3.3. Classification of Medical Analyses in Laboratory Medicine :

3.3.1. Diffrent types of laboratory analyses:

Class	Main focus	Typical example
Hematological	Blood cell /coagulation	Blood count, platelets ,coagulation tests .

Biochemical	Dissolved chemicals in blood /fluids	Glucose ,lipides, liver /kidney test ,enzymes .
Immunological	Immune cells, antibodies, complement	Medical laboratory testing is generally classified into major categories based on the type of analyte measured and the clinical purpose of the test, providing a structured framework for diagnosis and patient care
Hormonal (Endocrinology)	Hormones/endocrine function	Thyroid , reproductive hormones
Microbiological	Microbes causing infection	Bacteriology, virology,

Table 2 : Major classes of routine medical laboratory analyses

3.4. Clinical interpretation of Biomarkers :

Biomarkers are measurable biological indicators that reflect normal physiological processes, disease states, or responses to therapeutic interventions. They play a central role in modern medicine by supporting disease screening, diagnosis, prognosis, treatment monitoring, and early detection of recurrence. Biomarkers can be measured in various biological materials, including blood, urine, tissues, and other body fluids, providing valuable information for assessing disease progression and treatment effectiveness. Despite their clinical importance, variability between different tissues and biological fluids remains a challenge, highlighting the need for continued research and integrated analytical approaches (7).

3.5. Biomedical Indicator Calculation Methods:

Biomedical indicators can be broadly categorized into directly measured parameters and calculated parameters. Directly measured parameters are obtained through immediate observation or instrumentation, while calculated parameters are derived from one or more directly measured values using specific formulas or algorithms(8)

3.5.1. Direct Measured Parameters:

These are values obtained directly from a measurement device or observation without further computation ,BM (Body Mass): This is typically measured directly using a scale.
LDL (Low-Density Lipoprotein): While often calculated, direct measurement of LDL cholesterol is also possible through specific laboratory assays (8).

3.5.2. Calculated Parameters

Some biomedical indicators are not measured directly but are **derived from other measured values using mathematical formulas.** Examples include the **estimated Glomerular Filtration Rate (eGFR),** which is calculated from serum creatinine levels together with demographic variables such as age and sex, and the **Anion Gap**, which is calculated from serum electrolyte concentrations (sodium, chloride, and bicarbonate). Although **HbA1c** is generally determined through direct laboratory measurement, it can also be estimated using predictive models based on glucose-related parameters (8).

Technological advances in biomedical instrumentation have also enabled the direct determination of several **gait parameters**, including stride length, step length, cadence, single-support time, average forward velocity, and foot angle from force plate recordings. These measurements provide valuable information for the assessment of pathological gait and movement disorders (9).

Furthermore, specific analytical methods have been developed to derive these gait parameters directly from force plate data, improving the accuracy and efficiency of gait analysis in clinical and research settings . Therefore, distinguishing between **calculated** and **directly measured** indicators is essential for understanding biomedical methodologies and ensuring accurate interpretation of clinical results (10).

3.6. Factors Affecting Biological Parameters :

Biological parameters, particularly analytes assessed in clinical laboratories, are influenced by various factors across different phases of the testing process. Understanding these factors is crucial for ensuring the quality and accurate interpretation of laboratory information

a/ Physiological Factors : Biological parameters are influenced by predictable biological rhythms and demographic characteristics. Daily, monthly, and seasonal variations can significantly affect analyte concentrations, making appropriate specimen collection timing essential for accurate interpretation of laboratory results. In addition, factors such as age, sex,

and ethnicity may influence biomarker levels and should be considered when establishing and interpreting reference values (11).

b/Pre-analytical Factors : Laboratory results are influenced by multiple factors, including the **timing of sample collection**, pre-analytical conditions, analytical variability, and **within subject biological variation**. Pathological conditions, such as endocrine disorders, can significantly modify normal biomarker patterns, while physiological and environmental factors may also contribute to result fluctuations. Understanding these sources of variability is essential for accurate result interpretation, the establishment of reliable quality specifications, and the application of appropriate reference and monitoring values in clinical practice (11).

3.7. Aspects of Biological Reference Values :

a. Sample :Biological reference intervals (RIs) are established from a sample of healthy individuals and are used to define the range against which patient results are compared. Since they are derived from a specific sample, often selected through convenience sampling, they may be affected by selection bias and spectrum bias, which can limit their representativeness of the general healthy population. Therefore, the establishment of reliable reference intervals usually requires large sample sizes, often involving hundreds of subjects (12) .

b. Methodology :Reference intervals are determined using various statistical approaches, including rule-of-thumb methods, formal parametric and non-parametric calculations, and regression-based methods when influential covariates are present. RIs are used to assess whether a patient's result is consistent with values observed in a healthy population, whereas Clinical Decision Limits (CDLs) are directly associated with specific diseases and medical risks and are often more relevant for clinical decision-making. In addition, differences between analytical systems should be considered, as they may lead to variations in results and potentially affect clinical interpretation and medical decisions (13).

3.7.1. Source of "Normal/Reference" Laboratory Values :

The population found suitable to donate blood is generally considered healthy and often specimens from this population are used to define "normal" values for laboratory tests results.6 Under ideal circumstances, each laboratory is expected to determine its own "normal/reference" ranges by testing at least 120 individuals without discernible disease, from each relevant age, gender, and ethnic groups in the population served by the laboratory. This

is essentially impractical. In practice, reference ranges or normal values are adopted from historic standards, textbooks and information provided by manufacturers of laboratory equipment and reagents. A source of variation is added by the different methods used for various tests. For example, there used to be up to 40-fold variation in the normal values for troponin I, depending on the instrument and method used. Even in 2024, results for troponin I vary by more than 4-fold among different methods. For 7 Only 3 analytes (a chemical or molecule) have undergone international standardization, harmonization, [In the context of Laboratory Medicine, harmonization of laboratory testing refers to our ability to achieve the same result (within clinically acceptable limits) and the same interpretation irrespective of the measurement procedure used, the unit or reference interval applied, and when and/or where a measurement is made.], to mitigate the variation engendered by different methods.8–12 The 3harmonized analytes being Cholesterol, Creatinine and Hemoglobin A1C. The coagulation test result, INR, is not an individual analyte and reflects a calculated value that has been nearly standardized. The logistics for harmonization of any analyte are overwhelming, expensive, and subject to objections by various vendors of the test equipment and reagents.13,14
It bears emphasizing that the historic normal values were ascertained in metabolic units of research hospitals where patients were admitted, maintained on a standard diet and physical activity and first morning (postabsorptive, basal) specimens were used to determine the normal/reference values. For many analytes these values are lower than the values that may be seen in an ambulatory patient coming to the laboratory. As examples, (a) blood levels of creatinine kinase, a muscle enzyme, go up with normal activities, similarly (b) blood levels of alkaline phosphatase are higher after a meal.15 until 17 (14).

3.7.2. Process for Determining “Normal/Reference” Range :

At the introduction of a new test for a new or old analyte, the regulations by the Centers for Medicare and Medicaid Services (CMS), Food and Drug Administration (FDA), and Centers for Disease Control (CDC) require following a prescribed process for validation of the test, including establishing a reference range.8 In its simplest form, 120 healthy individuals are tested. The specimen may be blood, a blood component, or another body fluid. The results from this group of people, referred to as a partition, are plotted. The lowest 2.5% and highest 2.5% of the values are excluded and the values comprising the central 95% are adopted as the reference range. This convention of using the central 95% as normal is an important cause of

"abnormal" laboratory results in healthy people.18 By definition, 5% of normal/healthy people will have an abnormal result. Thus, it is imperative that all laboratory results be interpreted in the clinical context to ensure that a person is not labeled with a diagnosis based solely on an "abnormal" laboratory value. As a corollary of the central 95% convention for normal range, if 20 tests are done on a normal/healthy person, one of the results is expected to fall outside the normal/reference range. Alternatively, the probability of no abnormal test result in a healthy subject, in a panel of 20 tests, is (0.95). 20 = 0.358. Thus, (1-0.358 = 0.642), 64.2% of "normal" patients will have at least one "abnormal" test result in a panel of 20 tests (15).

3.7.3. Exceptions to Sources and Processes for Determination of «Normal/Reference»

Age as a modifier: In an adult woman, a hemoglobin level of 12.0 g/dL is considered normal, however, a newborn girl with that level of hemoglobin is considered to have anemia.9 Blood levels of prostate-specific antigen (PSA) increase with increasing age without the presence of prostate carcinoma.22 Blood levels of alkaline phosphatase are higher in growing children than in adults (16).

The levels of some analytes found in healthy blood donors do not reflect the usual levels in older individuals without a relevant disease. For example, the normal ranges for serum free light chains noted in blood donors generate an abnormal value in 36% of adults presenting to a tertiary care hospital, without any evidence of a monoclonal gammopathy.23 It could be argued that normal/reference values should be derived from a "healthy" group of the same age and with similar co-morbidities as the ones affected by a relevant disease (23until –25)

Gender as a modifier: The lower limit of normal hemoglobin is 12.0 g/dL in adult women, and it is 14.0 g/dL in adult males. The lower level in women is not due to menstrual blood loss but due to the hormonal influence, improving the delivery of oxygen to tissues by affecting the levels of 2-3 DPG.26,27 Similarly, some hormone levels have gender specific normal values. Different reference ranges are adopted for HDL cholesterol, ferritin and creatinine etc. for men and women.(28 until –31) The reference ranges for non-binary/transgender people are still being worked out 32 ,Physiological state: As mentioned above, growing children have different values for some enzymes and hormones. Pregnant women have different normal levels for some laboratory tests than non-pregnant women 31 (16).

According to the International Organization for Standardization ISO 15189/5.5.5, the biological reference interval should be reviewed periodically. If the laboratory has reason to

believe that a particular reference interval is no longer applicable to the reference population, it should investigate and, if necessary, take corrective measures. When the laboratory changes the test procedure or the pre-test procedure, the biological reference interval should also be re-evaluated if applicable. Therefore, in actual clinical applications, in addition to determining the reference range for new test methods and test items, it is necessary to periodically review the test methods and items that have been applied to the clinic or verify them with appropriate procedures. If not applicable, it must be re-established. Therefore, the establishment of a reliable biological reference interval for upcoming and ongoing testing projects is one of the essential tasks that need to be accomplished in pre-clinical and clinical applications(16).

3.8. Digitalisation of the healthcare sector :

Digitalization of Biomedical Data: Key Components and Challenges
Biomedical data are rapidly shifting from paper and siloed systems to integrated, digital ecosystems. This transformation spans laboratory results, electronic records, OCR pipelines, and large-scale data platforms, but faces major issues of quality, standardization, and interoperability.

3.8.1. Concept of Health Data Digitalization / Lab Results :

Digital health transformation relies heavily on electronic health records (EHRs) that store numeric, categorical, text, image, and signal data, including laboratory results 123. Laboratory medicine is increasingly seen as a digital science, producing high-volume structured numerical and categorical test data, plus omics outputs and metadata, suitable for big data and AI if made FAIR (findable, accessible, interoperable, reusable) . Digitalization enables integrated data warehouses and comprehensive diagnostics across disciplines “imaging, histopathology, chemistry ”(17).

3.8.2. Digital Transformation in Clinical Laboratories :

Digital transformation in laboratory medicine enhances efficiency, decision-making, and quality control through the integration of Electronic Health Records (EHRs) and Laboratory Information Systems (LIS). In addition, OCR and NLP technologies enable the conversion of scanned laboratory reports into structured digital data with high accuracy, facilitating data extraction and analysis. However, challenges remain, including data standardization, interoperability, governance, and the quality of extracted information (18) .

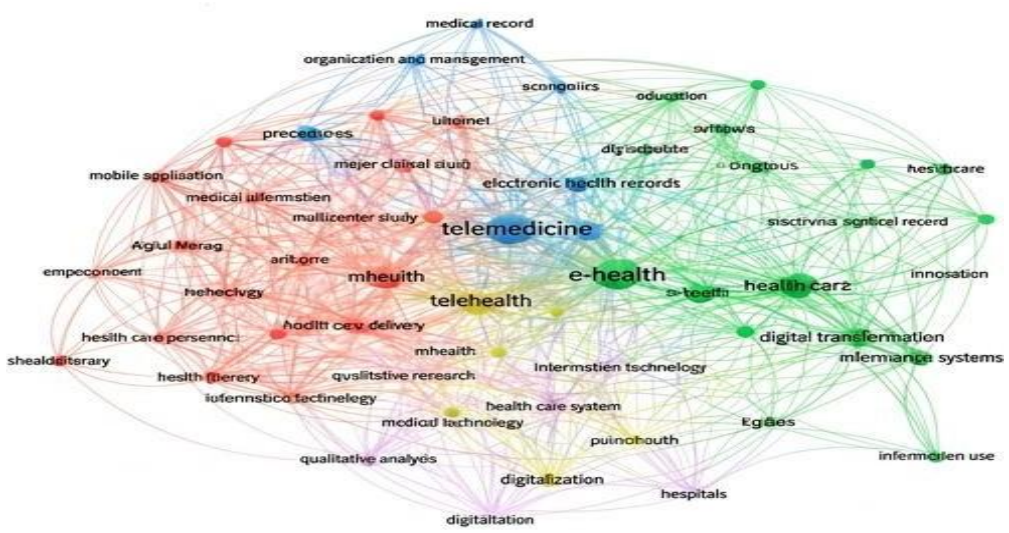


Figure 3: Bibliometric map of the digital transformation healthcare

3.8.3. OCR Technology in Medical Analysis:

Optical Character Recognition (OCR) is a technology that revolutionizes healthcare by converting various forms of medical documentation into a machine-readable, digital format. This process significantly enhances data accessibility, accuracy, and efficiency in medical analysis(18).

3.8.4. Key Applications in Medical Analysis :

OCR technology enables the digitization of laboratory reports, patient records, and prescriptions by converting paper-based or image-based documents into editable and structured digital data, thereby improving data management, accessibility, and accuracy in healthcare systems (18).

Step	Description
1.Document scanning	Paper records or physical documents are scanned to create digital images.
2.Character recognition	OCR technology identifies and extracts text from these images, converting it into machine-readable data.
3.Digitalisation /structuring	The extracted text is then converted into a searchable, structured dataset

Table 3 : explication how OCR works in healthcare

The healthcare industry faces an ongoing challenge with vast amounts of unstructured data locked within paper documents, handwritten notes, and legacy systems. This "paper trail"

often leads to inefficiencies, increased risk of errors, and significant time consumption in manual data entry and retrieval. Optical Character Recognition (OCR) technology emerges as a transformative solution, converting printed or handwritten text into machine-readable data, thus making medical information visible, usable, and trustworthy. This powerful tool is rapidly changing how healthcare organizations manage patient information, analyze laboratory reports, and convert traditional paper documents into accessible digital formats (18).

3.9. Role of Artificial Intelligence:

Artificial Intelligence (AI) in digital health leverages large-scale medical data to improve diagnosis, treatment selection, and prediction of clinical outcomes. Despite its significant potential, AI faces major challenges related to safety, fairness, transparency, and explain ability. Current AI models, particularly deep learning systems, often operate as “black boxes,” making their decisions difficult to interpret and raising concerns regarding trust, validation, and clinical implementation. Consequently, future AI applications in healthcare must be transparent, explainable, reliable, and compliant with regulations such as the GDPR to ensure safe and effective use in clinical practice (19).

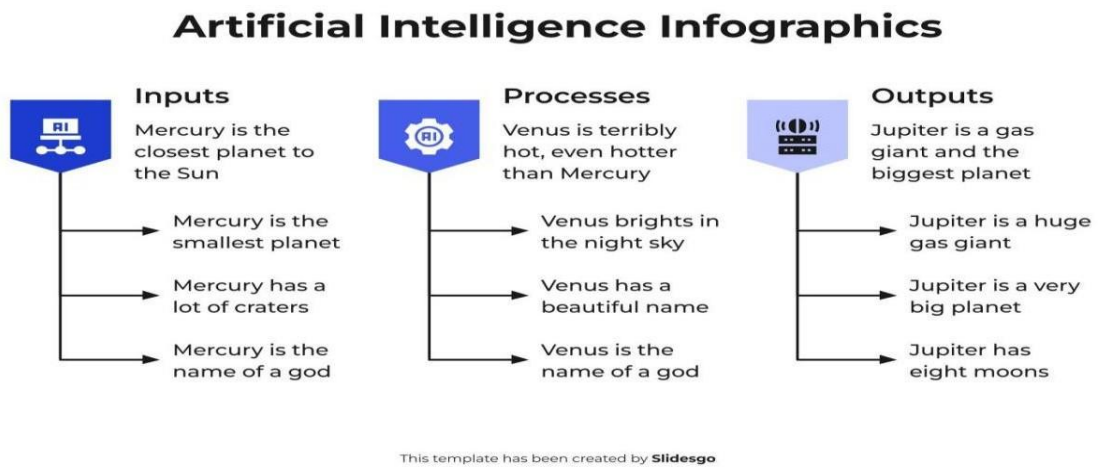


Figure4 : Artificiel intelligence infographiques

Chapter 4:
Intelligent system for processing and interpreting medical biological

4.1. Artificial intelligence in healthcare:

The integration of diverse biomedical data sources, including molecular, cellular, imaging, and electronic health record data, has enabled more precise diagnosis, biomarker discovery, and personalized treatment. Artificial intelligence, particularly deep learning, has significantly improved medical image analysis, disease diagnosis, drug discovery, genomic research, and single-cell data analysis. In addition, Natural Language Processing (NLP) techniques are widely used to extract valuable information from clinical reports and biological sequences. Despite these advances, challenges related to data privacy, multimodal data integration, and model interpretability remain important barriers to the broader adoption of AI in biomedical and clinical applications.

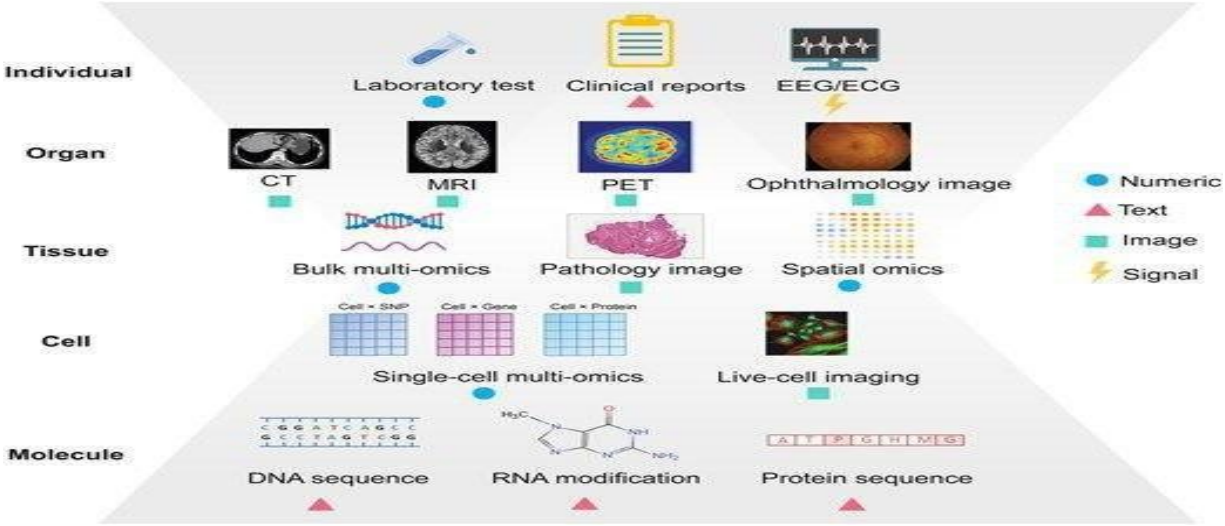


Figure 5: The categories and scales of biomedical multimodal data

4.2. Data interpretation logic :

The design and implementation of the data interpretation logic in the Smart Lab system are based on a modular and layered architecture that ensures scalability, reliability, and maintainability. The system is structured around a sequential data processing pipeline, beginning with data acquisition through either image-based inputs using Optical Character Recognition(OCR)or structured manual entry (21).

The data collected through acquisition undergoes pre-processing, which consists of cleaning, normalizing, and standardizing the data to minimize any extraneous information and provide consistency. The results of the processing are compared against a reference knowledge base that includes biological and clinical norms and values based on accepted medical standards or guidelines (21).

At the core of the application is an interpretation engine that compares the results to the norms to classify them using deterministic logic. A rules-based approach was employed during the interpretation phase of development to provide increased transparency to the entire process. The resulting output is presented in both a graphical format and a recommendation format, but no diagnostic assertions are made (21).

Overall, this architecture has provided an efficient implementation of software engineering processes for processing medical data (21).

ML enables computers to perform the tasks of medical professionals. ML has a widely used subfield in medical image recognition called deep learning (DL). DL is a method for designing the ML algorithm in which simple concepts are built on top of each other to form a deep structure with numerous processing layers. In other words, DL is the development of ML for analyzing massive data. It replaces the classical manual method of designing and extracting patterns used for classification with an automated strategy that allows a computer to decide which features are essential by training on a dataset. While DL is not a new concept, processing massive data and increased computing power have made DL successful and popular in recent years (22).

4.3 .AI/Machine learning :

Machine learning can be introduced as a scientific discipline that focuses on how computers learn from data and continuously improve themselves. It is mainly based on probability and statistics. But it is more powerful than the standard statistical methodologies when it comes to decision-making. Information gathered from a dataset which is being given to the algorithm is called features. The accuracy of the predictions made by the model is dependent on the quality of the features provided to the algorithm. It is the duty of a machine learning developer to detect the subset of features that could best fit the purpose, increasing the accuracy of the model. This is not an easy task. Continuous experiments should be carried out to identify the said feature subset for the algorithm. When considering putting a machine learning algorithm to applications, there are basically three steps to follow, which are training, testing, and validation. Training is important as the accuracy of the results will be depending on the

training dataset. Using the test dataset, the performance of the algorithm will be measured. When using the test data for measuring the performance, it is also important to lower the bias and to increase the variance in this testing period. A good machine learning algorithm must optimize the bias-variance trade-off. The evaluation of the final machine learning algorithm performance is done based on the validation dataset in the validation period . As a start, it would be better to have an idea about various approaches taken in machine learning along with several algorithms that are being used excessively for clustering and classification purposes in machine learning (23).

Several computations and operations on input data are performed through ML algorithms. Data preprocessing is the first and essential step to reducing false predictions or incorrect results, speeding up the data processing, and eventually improving overall data quality. After data preprocessing, crucial features are extracted and implemented according to the selected ML or DL model for image classification. Feature selection reduces dimension and boosts algorithm performance . Model training and parameter adjustment are also performed based on the chosen algorithm through data processing to make accurate decisions and obtain reasonable classifications or predictions in the last phase (23).

Deep learning is a modern extension of the classical neural network technique. One can view deep learning as a neural network with many layers (as in figure 6). Rapid development of modern computing enables deep learning to build up neural networks with a large number of layers, which is infeasible for classical neural networks. As such, deep learning can explore more complex non-linear patterns in the data. Another reason for the recent popularity of deep learning is due to the increase of the volume and complexity of data.37(Figure 7) shows that the application of deep learning in the field of medical research nearly doubled in 2016. In addition, (figure 8)shows that a clear majority of deep learning is used in imaging analysis, which makes sense given that images are naturally complex and high volum (23).

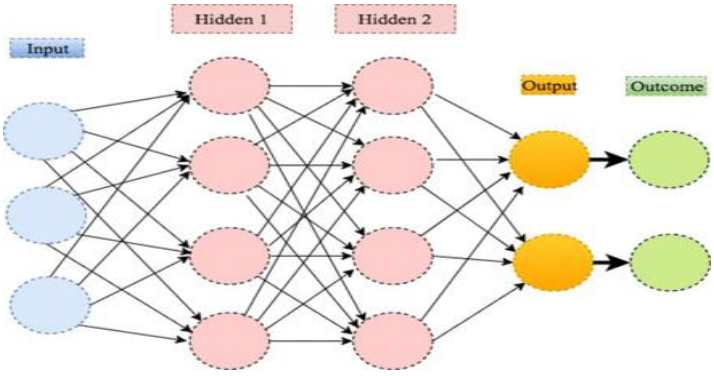


Figure 6 : An illustration of deep learning with two hidden layers

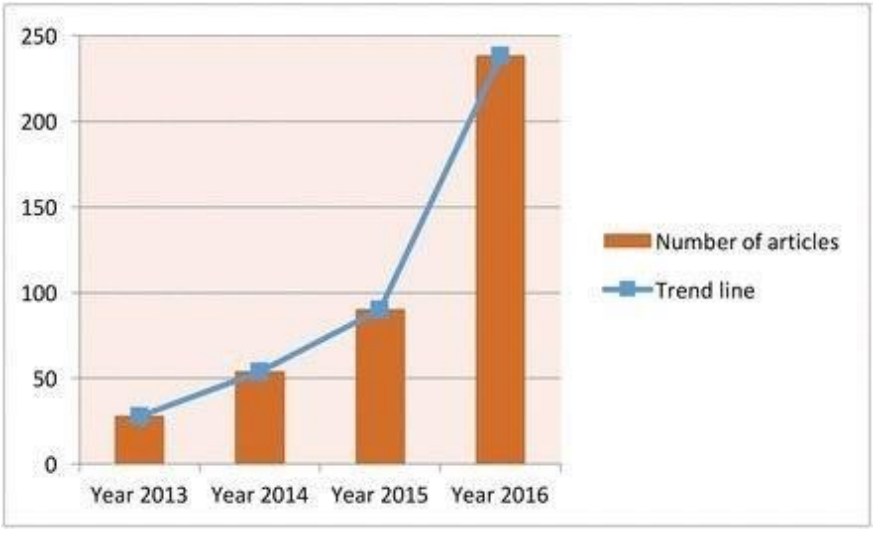


Figure 7 :current trend for deep learning (the data are generated through searching the deep learning in healthcare and disease categorie on Pub Med)

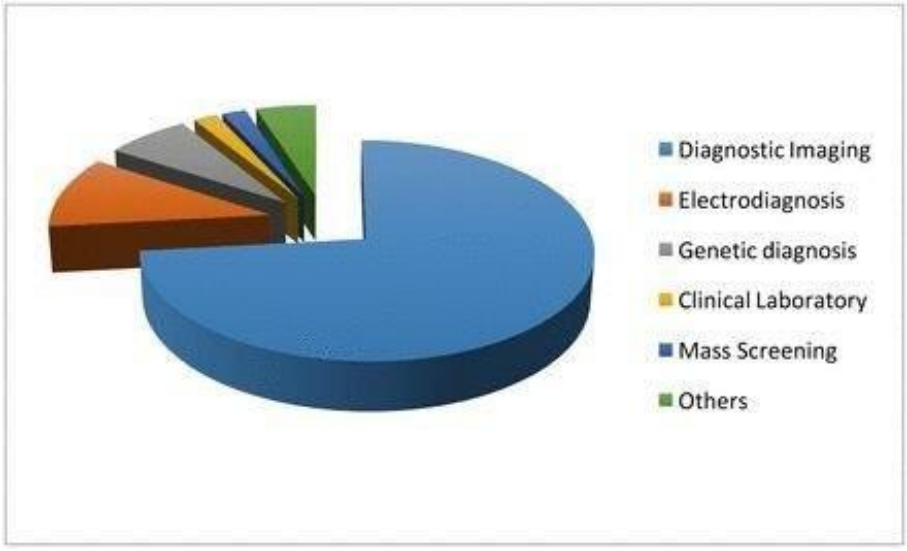


Figure 8 : The data source for deep learning ,the data are generated through searching

4.4. Cyber security in health car :

4.4.1. Cybersecurity Challenges in Healthcare:

Healthcare cybersecurity includes all the general actions listed and described in the previous paragraph tuned and specialized for the health-care sector; faces four main aspects in the cyber-system that can either be a complex medical device (e.g., wearable pumps; wearable stimulators; pacemakers; artificial pancreas) and/or a complex interoperable and

eterogeneous system (e.g., A Hospital Information System; a Radiology Information System; a dedicated medical network) comprehending several components of elaboration systems, informatics, biomechatronic, bioengineering, electronics, networks, eHealth, mHealth(24).

4.4.2. Four Main Aspects of Healthcare Cyber Systems:

Data preservation ensures that information remains accessible and functional over time through appropriate technical procedures and resources (25). **Data access and modification** involve the secure storage, retrieval, and updating of data using authentication and authorization mechanisms to regulate access (25).

Data exchange enables the secure transfer of information within and outside healthcare institutions while ensuring data protection and security requirements are met (25). **Interoperability and compliance** allow different healthcare systems to exchange and interpret data effectively, while adhering to applicable legal and regulatory standards (25).

4.3. Clinical Safety and Ethical Constraints :

Health applications in Algeria operate within a legal and regulatory framework designed to ensure patient safety, protect personal health data, and promote ethical medical practices. These regulations provide the foundation for the secure development and deployment of digital health solutions, particularly those involving the processing of medical information and clinical decision support systems.

Clinical studies and patient information	Health law 18-11, Articles 377-399-clinical studies /non faut liability
National data protection authority	law 18-07 duty to protect data of a personal nature

Table 4: Key Algerian legal texts touching digital information

Chapter 5:

Conclusion and recommendation

5.1. General Summary:

The rapid evolution of digital technologies and artificial intelligence has significantly transformed modern healthcare systems, particularly in the field of biomedical analysis and laboratory medicine. This study highlighted the importance of integrating biomedical sciences with intelligent digital technologies in order to improve the quality of healthcare services, facilitate medical follow-up, and enhance patient access to reliable medical information. Through this work, the role of biomedical analyses in disease diagnosis, health monitoring, and clinical decision-making was explored, in addition to the importance of biological indicators and reference values in evaluating physiological and pathological conditions. The study also emphasized the impact of digital transformation on healthcare systems through the adoption of electronic medical records, laboratory information systems, and intelligent data processing technologies.

Furthermore, this project focused on the integration of artificial intelligence and OCR technologies within a proposed intelligent healthcare platform called “Smart Laboratory,” designed to support patients before, during, and after medical analyses. The proposed system aims to simplify the interpretation of laboratory results, facilitate communication between patients and healthcare professionals, and provide intelligent health guidance adapted to the Algerian healthcare context.

5.2. Main Findings:

The conducted study demonstrated that the digitalization of biomedical data can significantly improve the accessibility, organization, and interpretation of medical analyses. The integration of artificial intelligence into laboratory medicine offers promising opportunities for predictive healthcare, early disease detection, and intelligent clinical decision support.

The research also revealed that many patients experience difficulties understanding laboratory test results due to the complexity of medical terminology and the absence of simplified medical guidance. In addition, the lack of integrated digital healthcare platforms in the Algerian environment contributes to fragmented healthcare services and reduced continuity of patient monitoring.

The proposed intelligent system showed the possibility of combining OCR technologies, AI-based interpretation, and medical supervision within a unified healthcare platform capable of improving patient experience and supporting healthcare digitalization.

5.3. Scientific Contribution :

This work contributes to the growing field of digital health by combining biomedical sciences, health data digitalization, and artificial intelligence within a single intelligent healthcare framework. The proposed platform introduces an innovative approach for laboratory result interpretation and patient accompaniment through the integration of intelligent technologies adapted to real healthcare needs.

The study also provides a theoretical and practical overview of the mechanisms involved in biomedical data processing, intelligent analysis of laboratory results, and predictive healthcare systems. Moreover, it highlights the importance of secure and explainable artificial intelligence models in modern healthcare applications.

5.4. Study Limitations :

Despite the promising aspects of this project, several limitations were identified during the study. One of the main challenges concerns the limited availability of local biomedical datasets required for training and validating artificial intelligence models in the Algerian healthcare environment.

In addition, the implementation of intelligent healthcare systems requires strong digital infrastructure, secure medical databases, and continuous collaboration between developers, healthcare professionals, and regulatory institutions. Challenges related to medical data privacy, cybersecurity, and ethical responsibility also remain critical concerns in AI-based healthcare systems.

Furthermore, the current work focused mainly on the conceptual design and theoretical architecture of the platform, while full-scale clinical validation and real-world implementation require additional investigations and multidisciplinary collaboration.

Future developments of this project may include the integration of advanced predictive models capable of detecting health risks at early stages using machine learning and deep learning techniques. The platform could also evolve toward telemedicine services, real-time patient monitoring, wearable health device integration, and personalized healthcare recommendations.

Additionally, future research should focus on developing secure and explainable AI systems adapted to local healthcare regulations and ethical standards. Establishing national biomedical databases and improving interoperability between healthcare institutions may further enhance the effectiveness of intelligent healthcare platforms in Algeria.

Ultimately, the Smart Laboratory project represents a promising step toward the development of an integrated digital healthcare ecosystem capable of improving healthcare accessibility, supporting medical professionals, and enhancing patient-centered care through intelligent technologies.

5.5 Recommendations

5.5.1. Scientific Recommendations : Encourage further scientific research in biomedical artificial intelligence and digital health systems.

Develop local biomedical databases adapted to the Algerian healthcare environment.

Promote interdisciplinary collaboration between biomedical scientists, clinicians, and software engineers.

Support academic research focused on predictive healthcare and intelligent laboratory systems.

5.5.2. Technical Recommendations : Improve OCR accuracy for medical document extraction and laboratory report processing.

Develop explainable artificial intelligence models to enhance transparency and medical trust.

Strengthen cybersecurity mechanisms and data encryption systems for medical data protection.Improve interoperability between laboratory information systems and electronic health records.

5.5.3. Healthcare Recommendations : Encourage healthcare institutions to adopt digital healthcare solutions and intelligent medical platforms ,train healthcare professionals in the use of artificial intelligence technologies in clinical practice .Improve patient awareness regarding digital health services and secure medical data usage.Promote home healthcare and remote patient monitoring services, especially for elderly and chronic patients

5.5.4. Future Development Recommendations: Integrate telemedicine and online medical consultation services within the platform.

Develop intelligent chatbot systems for basic medical assistance and patient guidance.

Add predictive health scoring systems for early disease detection.

Expand the platform to include multilingual support and personalized healthcare services.

Establish partnerships with laboratories, clinics, and healthcare organizations to ensure practical implementation and scalability of the proposed system.

Part 02 :

APPLIED

PART

Chapter 6: Presentation of the project

6.1. Problem statement :

Difficulty in understanding medical test results the absence of a semi-automatic system linking artificial intelligence with doctors for interpreting and reading medical analyses, and the lack of a unified platform for digital health services represent major challenges. In addition, there is poor access to prompt medical consultations with specialist doctors, along with a lack of Arabic health content aimed at spreading medical awareness outside professional circles. Furthermore, there is no reliable platform dedicated to home care and nursing services, and local health solutions adapted to the Algerian environment remain insufficient. Another critical issue is the absence of a comprehensive system that accompanies the patient from pre-test to post-test, guiding them toward the appropriate treating physician or providing continuous care.

6.2. Project Idea

The project was initiated following a study indicating that 7 out of 10 patients do not understand their medical test results without the assistance of a doctor. This observation led to the creation of the “Smart Laboratory” project, which addresses the needs of a large segment of patients seeking an easy and reliable digital solution to understand their medical analyses and access healthcare services without the burden of physical movement. Studies have also shown that more than half of users prefer smart health solutions. The project is based on the development of an integrated digital application that leverages the latest artificial intelligence technologies along with OCR systems. It is structured into three main components: pre-analysis support through home blood collection services, analysis-stage assistance via automated reading and interpretation of results, and post-analysis guidance by directing patients to the appropriate specialist doctor, facilitating appointment booking, and connecting them with nursing services for continued home care. Additionally, the application provides access to necessary medical equipment that patients may require. The main objective of this project It is the transfer of the classical laboratory experience to a modern experience and the digitization of the oral reading of medical test results ,and to bring healthcare services close to citizens, improve the quality of medical care, and ensure continuous guidance supported by qualified medical professionals.

6.3. Suggested values:

6.3.1. Hybrid AI–Doctor Interpretation System (Semi-Automated Analysis):

The project introduces a hybrid interpretation model that combines artificial intelligence with medical supervision. Instead of replacing the doctor, the system assists in pre-analyzing medical test results and highlighting abnormal values, allowing faster and more accurate decision-making while maintaining clinical reliability.

6.3.2. End-to-End Patient Journey Integration :

Unlike existing solutions that focus on a single stage, the platform provides a complete healthcare pathway, covering pre-test preparation, in-test analysis, and post-test medical orientation. This continuous support system ensures that the patient is never left without guidance.

6.3.3. OCR-Based Medical Test Digitization :

The integration of Optical Character Recognition (OCR) enables automatic extraction and structuring of data from medical test reports, eliminating manual input and reducing human error while accelerating the analysis process.

6.3.4. Context-Aware Health Recommendations:

The system delivers personalized recommendations based on test results while adapting them to the Algerian socio-cultural and nutritional context, which is often ignored in global health platforms.

6.3.5. Intelligent Medical Orientation Engine (Non-Diagnostic) :

A smart routing system directs patients toward the appropriate specialist based on their test results, reducing unnecessary consultations and optimizing healthcare pathways without performing medical diagnosis.

6.3.6. Integrated Home Healthcare Ecosystem :

The platform connects patients with home blood collection services, nursing care, and medical equipment providers, creating a unified digital ecosystem instead of fragmented services.

6.4. The project team:

6.4.1. Management team

Lead supervisor 1: Dr. Boulnmour Imen	Doctor (MCA) in Computation and Cognition of Information Systems.
Lead supervisor 2 : Dr. Ghannam Maya	Doctor (MCA) in applied microbiology .

6.4.2. Project team :

Project team	Faculty	Specialty
Larkem Amina	Science	Applied Biochemistry

CEO (Chief Executive Officer)

Second-year Master's student, specialising in Applied BiochemistryMarketing consultant at Laya Travel (international tourism, hospitality and travel), and former employee at Brezina Voyage ,marketing trainer with a marketing certificate from the Malaysian company Qadasi Biz; has participated in major conferences as a speaker at GBB and as a course presenter at the Money Language' Institute,Member of the 'i-Tech Skikda' club for programming, robotics and artificial intelligence, and also a member of the 'Medsoul' medical club

Participated with this application idea at the 'Rosicada up' event

Organiser of several international forums in the field of artificial intelligence: 'DIC' + 'International Week of Intelligence''Artificielle' + 'International Day of Arduino'

Participated in several online hackathons with the "labalab" group, "The Internet of Agents Hackathon": most recently and Class representative for four years.

Speaks four languages and holds more than 10 certificates in various fields: English, design, financial management, critical thinking, and 21st-century skills.

She has completed internships at several locations: Sonatrach, the 'Abu al-Qasim' private clinic, Dr Meziani's pharmacy, and the Skikda Provincial Laboratory.

Have followed training in the CDE of entrepreneurship and BMC (Business Model Canvas).

Lead roles:

. Project management and relationship and marketing management.

.Studies of market needs.

.Research and development of products.

In addition to the team of developers from FMDS, a company specialising in cybersecurity, cloud storage and cybersecurity services, who worked on developing and maintaining the prototype and ensuring it was protected against security vulnerabilities and breaches, the company also developed an artificial intelligence model, which was integrated into the analysis interpretation and reading section .

6.5. Project objectives :

6.5.1. Principal objectives

a/Facilitating the understanding and explanation of medical test results to users in a simplified and reliable manner.
b/Providing a unified and comprehensive digital platform that combines medical analysis, home nursing, pharmacy and medical awareness services
c/ Improving the quality of health care and bringing it closer to citizens, especially in remote areas.
d/Leveraging artificial intelligence and OCR technologies to speed up and accurately analyze medical data.
e/ Promoting health awareness and empowering patients to make sound health decisions.
f/ Facilitate access to and reservations for doctors and nurses directly from the app
Supporting digital transformation in the healthcare sector and stimulating medical technological innovation.
g/ Contributing to the development of smart health services that facilitate patients' lives and improve medical follow-up by providing medical awareness content about diseases and encyclopedias for effective psychological tests and examinations.

h/ Providing a virtual paramedic to learn how to intervene in critical cases .
i/ Allocating special services to a specific group

6.5.2. Long term vision

.To bridge the gap in understanding test results and enable patients to understand their medical condition easily and accurately whilst maintaining their privacy, and to facilitate the ongoing management of their medical condition by creating a patient medical history and analysing their data to help them manage their condition with ease, supported by notifications, reminders and consultations from the entire medical team.

.Raise health awareness by providing an educational and awareness-raising laboratory specifically aimed at medical students to train them in the field of medical analysis.

.Transform test results from complex numbers into understandable and actionable health information.

.Providing a smart medical assistant dedicated solely to the medical field, which does not respond to other topics.

.Providing immediate and personalised explanations to each user.

.Developing more accurate models over time.

.Monitoring chronic conditions and health indicators.

.Integration with the healthcare system

Facilitating the sharing of results between patients and doctors.

Building a smart health database

Supporting research and healthcare decision-making.

National and geographical expansion of the app and access to global markets

.Providing the service in Arabic and then other languages.

6.6. Project implementation timeline :

	Monthly	1	2	3	4	5	6	7	8
1	Market research and needs analysis	√	√						
2	Prototype design			√	√				
3	UI/UX Design and system architecture					√			
4	Development of the mobile and web platform						√		
5	Medical database creation and OCR system integration							√	
6	Internal testing and cyber Security audit								√

Chapter 7: Aspect and innovation

7.1. Nature of innovations:

Tlabio isn't just a healthcare app , it's an integrated digital healthcare ecosystem that combines in vitro medicine, artificial intelligence, telemedicine, home healthcare, and pharmaceutical services within a single smart application .

The project offers several types of innovation:

7.1.1. Market innovation:

Tlabio is one of the first platforms in Algeria that works to unify laboratory services, interpret medical tests, and provide home blood collection services, telemedicine, and electronic pharmacy services.

7.1.2. Technological innovation:

The platform integrates artificial intelligence technologies capable of reading, digitizing, analyzing and interpreting medical analysis results while transforming complex medical data into health insights that are understandable to users.

7.1.3. Service innovation:

Tlabio is transforming traditional laboratory services into on-demand digital services, allowing patients to access laboratory expertise, home healthcare, and remote medical guidance.

7.1.4 Business model innovation:

The platform operates through a multifaceted digital model that connects patients, laboratories, pharmacists, nurses, physicians, and healthcare organizations while generating value for all stakeholders.

7.2. The field of innovation :

TLABIO creates an integrated digital ecosystem connecting patients, laboratories, pharmacists, paramedical professionals and home care providers.

The main innovation areas of the project are:

7.21. Artificial Intelligence applied to Medical Biology

Development of intelligent algorithms capable of interpreting biological results, detecting potential anomalies and generating simplified medical explanations adapted to the patient.

7.2.2. Intelligent digitization of medical analyses

Use of OCR technology and artificial intelligence to automatically convert paper biological reports into structured, actionable medical data.

7.2.3. Digital Health Twin

Creation of an intelligent medical profile gathering the history of analyses, treatments, consultations and biological indicators in order to ensure continuous and personalized monitoring.

7.2.4. Data-Based Preventive Medicine

Analysis of the evolution of biological parameters over time in order to identify early health risks and issue preventive warnings before the appearance of complications.

7.2.5. National Marketplace for Medical Biology Services

First Algerian platform allowing laboratories, pharmacists, nurses and health professionals to offer their services within a unified digital environment.

7.2.6. Intelligent Medical Referral System

Automated recommendation of complementary examinations, specialists or adapted care services according to digital platform.

7.2.7. Digital Home Care Network

Direct connection between patients and home healthcare professionals for specimen collection, nursing care, and medical support via a centralized platform.

7.2.8. Interactive Medical Library

Creation of an intelligent medical knowledge base containing test results, prevention guides, and scientifically validated educational content.

7.2.9. Interoperability and Centralization of Health Data

Integration of multiple healthcare system stakeholders within a single infrastructure facilitating the secure exchange of medical data and continuity of care.

7.2.10. Large-Scale Accessible Digital Health

Democratization of access to clinical laboratory services and medical decision-support tools, particularly in remote regions with limited healthcare infrastructure.

Chapter 8: Strategic market analysis

8.1. Target market :

The app serves two main customer segments ;

The first segment is business-to-consumer (B2C)

Users include all of these age groups :

Newborns and children: Parents can open an account for their child and monitor their results through the app

.Ages 18–29: This segment represents young adults who frequently use digital solutions to streamline their interactions with medical tests, avoiding the need to visit the lab to review test results and consult with specialists or nurses

.Ages 30–55: This large group includes several subcategories

Workers who are constantly tied to their jobs, leaving them with little time to monitor their health

Patients who require frequent laboratory tests, especially individuals with chronic diseases such as diabetes, cardiovascular disease, anemia, kidney disorders, and hormonal conditions.

patients and people with limited mobility who require blood drawing and nursing services at home.

.Residents of remote or deprived areas where quick access to specialists and healthcare facilities remains difficult.

.Doctors with an accredited medical diploma can work online freely by booking appointments or medical consultations

.Pregnant women

.Ages 55 and up constitute the largest target group for the app, as they rely heavily on doctors to monitor their results—they trust doctors above all else. This is the app's goal: not to replace the doctor's role in interpreting test results, but to ensure their presence and streamline their work through artificial intelligence.

T**he second group includes partners of the company(B2B), such as:**

.Private laboratories and clinics are looking for digital tools to improve communication with

.General and private doctor's

.Nurses, physical therapy centers, and home care providers

.Medical supply centers

.Pharmacies and healthcare unions

8.2. marketing plan :

Before	1.**My target market:**	**1. My message to my target market :**	**3.The media i will use to reach my target market:**
	.B2C (Patients - Individuals) .Parents and children. Young adults. Busy professionals. Chronic disease patients. Elderly and pregnant women. Home healthcare users. Residents of remote areas. Licensed doctors. **B2B (Healthcare Partners)** Laboratories and clinics. /Doctors and specialists./Nurses, physiotherapy, and home	We will create a sentence explaining the smart lab, "where the results speak for themselves"	We will use different way like: **.**Instagram .fakebook .LinkedIn .blogger .YouTube

	care providers. Pharmacies and medical supply centers./Healthcare Organizations		
During	**4.My lead capture system :**	**5.my lead nurturing system :**	**6. my sales convarsion strategy :**
	Talabio Kampas Feature: Every student and medical staff member receives a free in-app account to recruit as many specialists as possible and turn them into ambassadors. .The app is promoted by the app's partners or by doctors active within the app.	Each report includes the results as well as a link to the app that is integrated with the results; when you share the app with others and doctors, it spreads automatically.	The app is available through a two-month free trial, after which it becomes a paid service, with the option to purchase certain features separately from the subscription, such as the private bag service.
After	**7.how i deliver a world class experience**	**8.how i increase customer lifetime value :**	**9.how i orchestrate and stimulate referrals :**
	Every result issued to the user is automatically saved in their medical record under their own ID, and we then convert it into a QR code that serves as a smart health passport displaying all	Implementing a lab evaluation and rating system that is controlled by the user, allowing them to freely express their opinions when interacting with labs, will enhance the	The "Talabio Ambassador" feature allows app ambassadors to earn points; once they reach a certain threshold, they can redeem a paid feature

	your test results. This allows you to show it to any doctor and use the paperless system.	value of the customer relationship with partners. This system will create competition that naturally motivates labs to partner with the application ..	for free or receive a free one-month subscription Within the medical analysis education platform, the ambassador can invite an expert to host online workshops or seminars for students directly within the app, which will help the app gradually spread across the country

8.3.T-LABIO's SWOT Analysis

•Strengths – Internal :

1. Professional expertise (applied biochemistry): Unlike purely computational applications, the algorithm was designed by healthcare specialists, ensuring the scientific accuracy of reference parameters (gender, age, physiological status).

2. Dual value proposition: Simultaneously addresses the challenges of understanding test results, home care, and at-home blood collection.

3. Integration of artificial intelligence into the field of laboratory testing and the creation of a scalable digital health database.

4. Creation of additional job opportunities for medical staff who prefer remote work and meet the necessary requirements.

5. National scalability and diversification of revenue streams

.**Weaknesses – Internal :**

1. Initial technological dependence: The need to hire or outsource specialized IT expertise (OCR/NLP) for the founding team, coupled with high development and application security costs.

2. Newness of the startup: The brand is still unknown in the Algerian e-health market at launch.

3. Complexity of document digitization: Risk of reading errors if the image of the paper report is of very poor quality (low lighting, handwritten notes by the doctor on the report).

The need to update the database in line with any changes to ensure information is always accurate.

.Opportunities – External :

1. Favorable regulatory framework (Decree No. 1275): State support for obtaining "startup" status, which facilitates access to tax exemptions and financing (Algerian Startup Fund – A2. Digital transformation in Algeria's healthcare sector: Widespread deployment of networks and use of digital solutions

mobile broadband (4G/5G) and citizens' desire to manage their health remotely.

3. A dynamic private sector: A growing number of private medical testing laboratories in Algeria seeking to differentiate themselves through innovation.

Utilization of health data, after securing it, to provide data-driven health statistics and reports

.**Threats – External :**

1. Health Data Regulation (Law 18-11): Strict requirements for hosting citizens' medical data on Algerian soil, which increases infrastructure costs compared to hosting abroad (Firebase/AWS).

2. Resistance to change: Potential reluctance among some biologists or traditional doctors toward using artificial intelligence to interpret test results.

3. Cybersecurity: Risks of cyberattacks or leaks of sensitive data that require ongoing investments in security.

Entry into the market by foreign companies with greater funding and more technical expertise

8.4. the developement process tlabio:

Market research and requirements analysis.

Collection of database information from vital signs and pharmaceutical analytics.

Prototype development.

Software architecture design.

Medical database modelling.

User experience/user interface design.

Development and maintenance of the prototype to achieve a minimum viable product (MVP).

Integration of artificial intelligence and optical character recognition (OCR) technologies

Compliance with standards and cybersecurity.

Functional, technical and security testing.

Recruiting medical staff to join and trial the application

8.5. Workforce :

The start-up will need a qualified team to ensure the platform is developed, managed and marketed:

• Project manager and founder.

• Software and mobile app developer.

• AI and data engineer.

• Cybersecurity and cloud infrastructure manager.

• Digital marketing and communications manager.

• Administrative assistant and accountant (part-time).

8.6. key partenere :

1. Healthcare Sector

•Clinical laboratories: (private and public networks in Algeria) to consolidate test results.

• Healthcare professionals: general practitioners and specialists to provide care/collect samples at home.

•Nursing and physical therapy centers

•Pharmacies

•Medical equipment centers

•Healthcare sector unions

2. Technology sector

• FMDs: to provide certified cloud hosting services; the company has implemented the prototype and will protect it from all security and software threats.

• Universities/business incubators: to provide scientific support ASF).

Chapter 9 : financial plan

9.1.Financial plan :

9.1. Establishment costs : with (DA)

item	Year 0 (Before starting)
protype design	20000
Legal licenses and registration	20000
Identify and brand establishment	3000
AI integration	100000
Application /platform development: . UI/UX Design . Databases /Scanning System	100000
Cyber security: . Secure login . Two-factor authentication . User permissions management	400000
Domain name reservation	5000
Copyright (ONDA)	5000
3 laptops for programming development	300000
Network	15000
Electrical protection stabilizer	18000
Nass for data Storage	35000
External for backup	19000
Printing press for documents and contracts	50000
4 Chairs	30000
4 Desk	32000
Total	1152000

Total operating costs for each year. The sum of all operating cost items for that year

Total costs =Total start-up costs + Total operating costs for the four yea

9.2. Operational costs : with (DA)

item	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries and wages : .Biological doctor .Developer .Manager (Extern)	1344000	1344000	1344000	1344000	1344000
Advertising and marketing campaigns	300000	315000	345000	362250	3803625
Technical support and operations ; .Technical maintenance .Hosting and servers	240000	252000	264600	258930	2718765
Management fees	360000	360000	360000	360000	36000
Internet and communication Facture	108000	108000	108000	108000	108000
Electricity	96000	96000	96000	96000	96000
Legal licenses	60000	60000	60000	60000	60000
Equipment depreciation	225600	225600	225600	225600	225600
Operational risk reserve	253500	253500	257760	258918	26202385
Total	2761500	2788500	2835360	2484098	288226235

Operating Cost Calculation Method

The salaries and wages continue: the doctor 48000.00 for the month, the developer 40000.00, and the manager 24000.00 for the month in the beginning

The annual operating costs were estimated based on monthly recurring expenses required for the normal operation of the TLABIO application. For recurring expenditures, the annual value was obtained by multiplying the monthly cost by twelve months according to the following formula:

9.3. Annual Equipment Consumption Schedule: with (DA)

Equipment	Original value (purchase Price)	Servic life	Depreciation rate	Annual depreciation
Development application	600000	5year	20.00%	120000
Software development computers	300000	5year	20.00 %	60000
Communication network	45000	5yaer	20.00 %	9000
Stabilizer Electricity Protection	48000	5year	20.00%	9600
NAS Storage	35000	5year	20.00 %	7000
External Hard Drive	19000	5yrar	20.00 %	3800
Document and contract equipment	50000	5year	20.00%	10000.0
4 office	30000	10year	10.00%	3200
4 chair	8000	10year	10.00%	3000
Total				225600

9.4. Revenue schedule : with (DA)

S	N	N+1	N+2	N+3	N+4
Commission income					
Number of telemedicine (20 % growth)	100	120	140	160	180
Price of telemedicine;	500	500	500	500	500
Number of doctors for person reservation (20% growth)	120	140	160	180	200
Price of reservation	200	200	200	200	200
Number of nurses (25% growth)	200	250	300	350	400
Price of nurses service	1000	1000	1000	1000	1000
Total of commission	3288000	4056000	4824000	5592000	6360000
sEnterprise subscription revenues					
Number of laboratory subscription (20% growth)	10	12	14	16	18
Price of laboratory subscription	6000	6000	6000	6000	6000
Physical therapy centers subscription (40% growth)	5	7	9	11	13
Price of physical subscription (20% growth)	6000	6000	6000	6000	6000
Pharmacy subscription (10% growth)	5	6	7	8	9
Price of pharmacy subscription	3000	3000	3000	3000	3000
Paramedical subscription (40 o growth)	2	4	6	8	10
Price of paramedical subscription	7200	7200	7200	7200	7200

Total subscription	119400	160800	202200	243600	285000
Advertising revenue					
Expected number of ads per month (20% growth)	5	6	7	8	9
Price od's with month	5000	5000	5000	5000	5000
Total advertising Revenue	25000	30000	35000	40000	54000
Special service fees					
Number of subscribers to private services (20% growth)	200	240	280	320	360
Monthly subscription price	500	500	500	500	500
Total subscription	100000	120000	140000	160000	180000
Premium Membership subscription revenues					
Number of patient subscribers (25% growth)	1000	1250	1563	1953	2441
Monthly subscription price	500	500	500	500	500
Total annual subscription	500000	625000	781500	976500	1220500
Total revenue	**4007400**	**4961800**	**5947700**	**6972100**	**8045500**

9.5. forcasted income statement : with (DA)

statement	N	N+1	N+2	N+3	N+4
equity	500000	0	0	0	0
Sales/Subscriptions	55807200	71713000	88666500	106693000	128735000
Total receipts	56307200	71713000	88666500	106693000	128735000
primary investment	1128000	0	0	0	0
operating expenses	3660000	3660000	3660000	3660000	3660000
total payments	4788000	3660000	3660000	3660000	3660000
net cash flow	51519200	68053000	85006000	103033000	125075000

Statement	Year 1	Year 2	Year 3	Year 4	Yer 5
	1.revenues / products				
turnover	4032400	4991800	5982700	7012100	8099500
	2.expenses /charges				
Salaries and wages	1344000	1344,000	1344000	36000,000	40000000
Advertising camping	3000000	315000	345000	36000000	36000000
Hosting and servers	240000	252000	264000	258830	271765
Management fees	360000	360000	360000	360000	360000
Internet and communication	180000	180000	108000	108000	108000
Electricity	96000	96000	96000	96000	96000
Legal licenses	60000	60000	60000	60000	60000
Equipment depreciation	225600	225600	225600	225600	225600
Operational risk reserve	253500	253500	257760	258918	262 535

Total expenses	2733600	3014100	3061960	3073598	3108263
Net profit before tax	1298800	1977700	2920740	3938502	4991237

9.6. Break-even point calculation (Break-Even Point)

1. Determine total costs

Costs approved in the calculation include:

Establishment costs: 3660000 DA

Annual operating costs for the first year: 2508000 DA

So:

Total costs = establishment costs + annual operating costs

= 3,660,000 + 2,508,000

= 6,168,000 DA

2. Determine the annual business number

The expected business figure for the first year was:

24,607,000 DA

3. Calculate the break-even point ratio

The break-even point ratio represents the portion of turnover needed to cover all costs:

Output:

That is, the organization needs to achieve 25.06% of its annual turnover to cover all costs.

4. Calculate the date the break-even point was reached

Assuming that revenues are generated regularly throughout the year:

According to available financial data, the institution reaches break-even approximately three months after the start of operations. This means it reclaims all establishment and operating costs during the first quarter of the first year, then begins to achieve a financial surplus and net profits during the rest of the year.

Chapter 10 :Prototype

.Tlabio application :

10.1. logo :







Login phase :

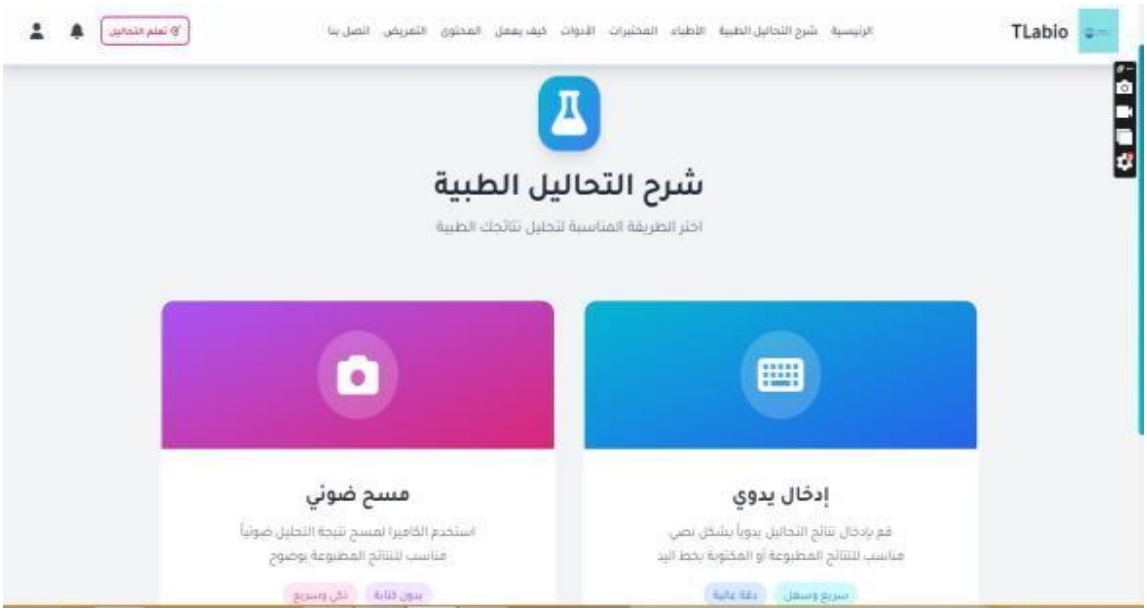


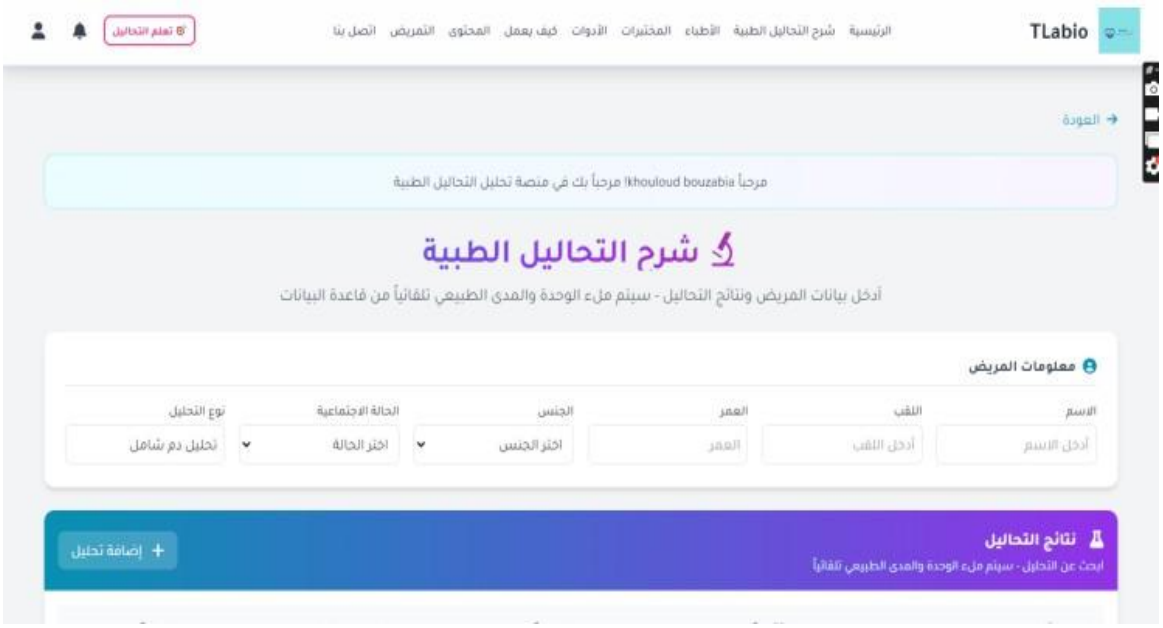


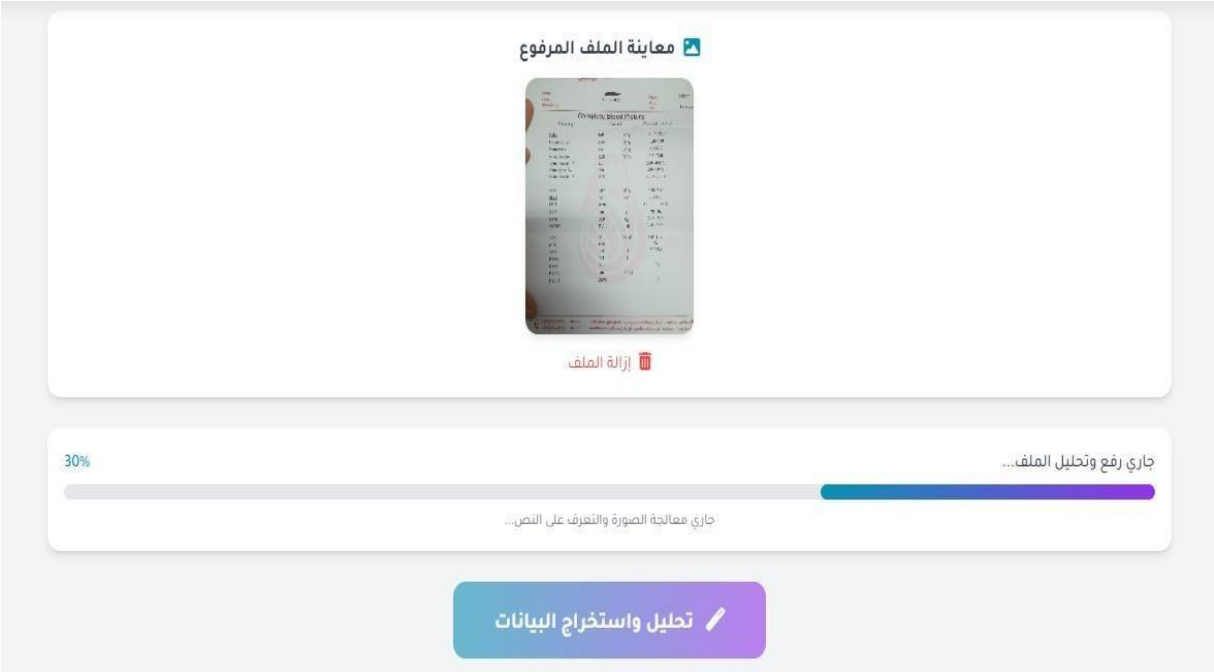
Branch of Explanation andinterpretation of medical test results :


العنوان (إجباري)
العنوان الكامل *
العنوان بالكامل: الشارع، المدينة، الرمز البريدي...
معلومات الأمان (جميع الحقول إجبارية)
كلمة المرور *
كلمة المرور يجب أن تكون 6 أحرف على الأقل
تأكيد كلمة المرور *
أوافق على شروط الاستخدام و سياسة الخصوصية *
إنشاء حساب جديد
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10.2. Branch of Explanation and interpretation of medical test results :






معاينة الملف المرفوع
إزالة الملف
جاري رفع وتحليل الملف...
30%
جاري معالجة الصورة والتعرف على النص...
تحليل واستخراج البيانات


تقرير التحليل الطبي
تم التحليل بواسطة الذكاء الاصطناعي مع مطابقة قاعدة البيانات
نتائج مطابقة من قاعدة البيانات: 17 / 0
طبيعي: 6
مرتفع: 4
منخفض: 4
نتائج تحتاج متابعة
تم العثور على 4 نتيجة مرتفعة و 4 نتيجة منخفضة من أصل 17 تحليل. يوصى بمراجعة الطبيب.
جدول نتائج التحاليل
التحاليل المطابقة من قاعدة البيانات معروضة بالنطاقات الدقيقة
اسم التحليل
النتيجة
الوحدة
المدى الطبيعي
الحالة
التفسير
WBC
4.6
x10³/µL
5 - 11 x10³/µL
منخفض
Valeur basse: 4.6 x10³/µL (Normale: 5 - 11 x10³/µL)
Lymphocytes
1.98
%
1.3 - 4 %
طبيعي
Valeur normale: 1.98 % (Normale: 1.3 - 4 %)


6
نتائج طبيعية
4
نتائج مرتفعة
4
نتائج منخفضة
17
إجمالي التحاليل
توصيات عامة
الحفاظ على نظام غذائي متوازن
ممارسة الرياضة بانتظام (30 دقيقة يومياً)
شرب كمية كافية من الماء (8 أكواب يومياً)
النوم الجيد لمدة 7-8 ساعات يومياً
إجراء فحوصات دورية منتظمة
نصائح إضافية
تجنب التدخين والكحول
تقليل التوتر والضغط النفسي
تناول الخضروات والفواكه الطازجة يومياً
مراقبة الوزن والحفاظ على مؤشر كتلة جسم صحي
استشارة الطبيب قبل تناول أي مكملات غذائية
متابعة تحليل WBC بعد 3 أشهر لتقييم التحسن
هذا التقرير تم إنشاؤه بواسطة الذكاء الاصطناعي لأغراض تعليمية فقط. النطاقات الطبيعية مأخوذة من قاعدة البيانات الطبية. يرجى استشارة الطبيب المختص.
تحميل كـ PDF
مشاركة مع الطبيب
حفظ في حسابي
تحليل جديد


تقرير التحليل الطبي
تم التحليل بواسطة الذكاء الاصطناعي مع مطابقة قاعدة البيانات
نتائج مطابقة من قاعدة البيانات: 17 / 0
طبيعي: 6
مرتفع: 4
منخفض: 4
نتائج تحتاج متابعة
تم العثور على 4 نتيجة مرتفعة و 4 نتيجة منخفضة من أصل 17 تحليل. يوصى بمراجعة الطبيب.
جدول نتائج التحاليل
التحاليل المطابقة من قاعدة البيانات معروضة بالنطاقات الدقيقة
اسم التحليل
النتيجة
الوحدة
المدى الطبيعي
الحالة
التفسير
WBC OCR
4.6
x10³/µL
5 - 11 x10³/µL
منخفض
Valeur basse: 4.6 x10³/µL (Normale: 5 - 11 x10³/µL)
Lymphocytes OCR
1.98
%
1.3 - 4 %
طبيعي
Valeur normale: 1.98 % (Normale: 1.3 - 4 %)

This section is the core of the TLABIO platform, aiming to support patients in the post-reception phase of medical test results, a phase that is often a source of concern and uncertainty for many patients. Although test results are easy to obtain, understanding biological indicators and their clinical meanings remains complex for non-specialists, prompting many patients to search for unreliable information online or interpret results incorrectly.

This section relies on integrating optical character recognition (OCR) and medical artificial intelligence technologies to transform paper or digital analysis results into processable and analyzable data. The system then extracts important biological indicators such as blood sugar, cholesterol, kidney function, liver function, blood cell counts, etc., and then compares them with internationally approved reference values, taking into account influencing factors such as age, gender, and physiological condition of the patient.

The system also provides a simplified explanation of each biological indicator, explaining its role within the body, and the extent to which its value matches normal levels, in addition to highlighting indicators that require attention or medical follow-up. The system's role is not limited to displaying results only, but extends to providing initial health recommendations and awareness-raising guidelines that help users better understand their health condition without replacing specialized medical diagnosis.

In the long term, this section could serve as a foundation for building predictive systems capable of detecting potential health risks early and contributing to improved prevention and personalized health monitoring.

10.3. Online Pharmacy Branch :

The e-pharmacy department aims to create an effective digital link between the patient and partner pharmacies. After receiving results from medical tests or consultations, patients often need to research appropriate medications or health products, a process that can be stressful, especially for the elderly or patients with limited mobility.

This section provides an electronic platform that allows the display of medicines, medical supplies, and semi-pharmaceutical products available at contracted pharmacies, with the possibility of viewing reliable scientific information about each product, such as indications for use.

In addition, the system can support services to know the side effects of frequently used medications with self-treatment by the patient, with the possibility of integrating confirmation of the availability of medications into the pharmacy in the future, which contributes to

enhancing the concept of digital health and facilitating access to health care, especially in remote areas or among patients with special needs.

This department also represents an important economic resource for the project by building partnerships with pharmacies and local health institutions within a sustainable economic model that serves all parties.

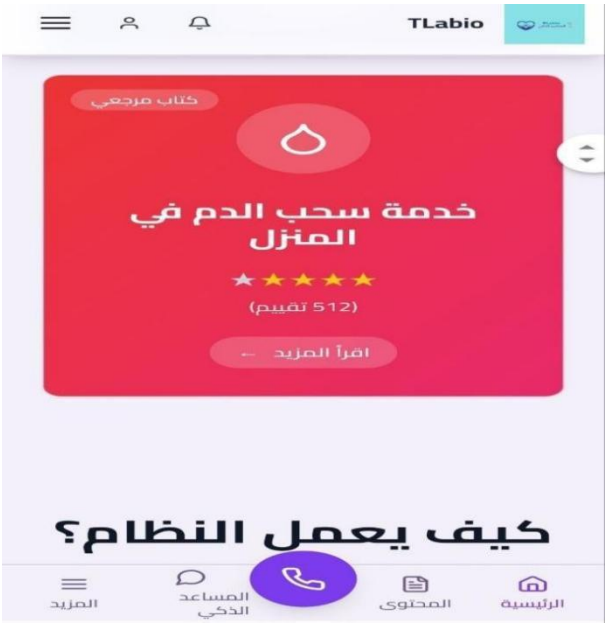




10.4. Nursing and Home Care branch :







This section provides a network of home health care providers, including nurses, health care assistants, and sampling technicians, where the user can request the appropriate service directly via the application. These services include drawing biological samples at home, following up on patients with chronic diseases, providing basic nursing care, monitoring vital signs, helping to take medications, in addition to following up on the elderly and people with special needs.

This section is of particular importance in Algerian society due to the pivotal role the family plays in patient care. It provides healthcare solutions that are compatible with the specificity of the local social environment and allow patients to receive the necessary care within their family environment without the need for constant movement.

This department also contributes to improving the quality of life for patients and reducing healthcare. By integrating these services with the smart analysis system and electronic pharmacy, the TLABIO platform becomes an integrated digital health system that accompanies the patient at various stages of his treatment journey, from diagnosis and follow-up to continuous care and support.

reassure on healthcare institutions, while promoting the concept of patient-centered

Section on Medical Analysais :







The Encyclopedia of Medical Analysis represents one of the most important educational components within the TLABIO platform, as it aims to spread digital health culture and provide a reliable scientific source of information related to medical tests and biological indicators. The importance of this section stems from the widespread dissemination of inaccurate medical information online and on social media, making it essential to provide simplified health content based on proven scientific foundations.

The encyclopedia includes a database containing the most important types of medical tests used in daily clinical practice, such as blood tests, biochemistry, hormones, immunology, and microbiology. For each analysis, an explanation is provided that includes the purpose of the analysis, the method of conducting it, its medical importance, normal reference values, factors that affect its results, in addition to diseases or health conditions associated with high or low values.

The encyclopedia also allows users to understand medical and laboratory terms in a simplified and easy-to-understand manner, helping them participate more effectively in monitoring their health status and making more informed health decisions in collaboration with specialist physicians.

The role of this department is not limited to patients only, but it can constitute a knowledge reference for students and those interested in the field of biomedical sciences and digital health, which enhances its scientific and educational value within the application .

Other part :


TLabio
متوفر الآن
خدمات خاصة
معدات وإكسسوارات شبه طبية
وحقائب متخصصة لتسهيل
توفيرها للمريض
حقيبة الحمل
حقيبة السكري
تصفح الحقائب الآن
المزيد
المساعد الذكي
المحتوى
الرئيسية


متوفر
حقيبة رعاية الحمل الشاملة
(تقييم 312)
حمل ووضع
مجموعة متكاملة لدعم الحامل طوال فترة الحمل مع محتوى تعليمي شامل
محتويات الحقيبة:
كتب طبية شاملة 3:
- أداة متخصصة تغطي جميع جوانب الحمل والولادة
- أدلة طبية معتمدة
- نظام تتبع متطور


الفيتامينات الخاصة بالمرأة الحامل
تعرفي على أهم الفيتامينات والمكملات الغذائية الضرورية لصحتك وصحة جنينك
حمض الفوليك
ضروري لنمو الجهاز العصبي للجنين ويمنع التشوهات الخلقية


الفيتامينات الخاصة
دليل شامل للفيتامينات والمكملات الضرورية للحمل
استكشف الآن
التحاليل المطلوبة
دليل شامل للتحاليل والفحوصات الطبية في كل مرحلة من الحمل
استكشف الآن


TLabio
تواصل مع الأطباء واحجز موعدك
تواصل مباشرة مع نخبة من الأطباء عبر الواتساب لحجز موعدك والاستفسار عن حالتك الصحية. ⏰ ساعات العمل: من 9:00 صباحاً إلى 16:00 مساءً.
استشارة طبية عامة
تواصل مع طبيب عام لحجز موعد للفحص والاستشارة


TLabio
استشارة متخصصة
تواصل مع أطباء متخصصين لحجز موعد في مختلف المجالات
الدكتورة شبل .ا حرم حجامي
أخصائية أمراض الغدد وداء السكري / أمراض الأيض والتغذية
ش
الغدد
السكري
التغذية
تواصل
الدكتور معزيز عبد الباقي
جراحة الكلى والمسالك البولية
م
جراحة الكلى
المسالك البولية
تواصل


TLabio
عرض جميع الأطباء الجزائريين
تواصل مع أفضل المختبرات الطبية
اختر من بين أفضل المختبرات المعتمدة في الجزائر لإجراء تحاليلك الطبية أو الاستفسار عن النتائج

10.5. Bassins model Canvas

<table>
<tr>
<td>KEY PARTNERS

• Clinical laboratories (public & private)
• General practitioners /specialists
• Nursing and physiotherapy centers
• Pharmacies /medical equipment centers
• Healthcare unions
• FMDS cloud & cybersecurity partner
• Universities and business incubators
• Ministry of Health</td>
<td>KEY ACTIVITIES

• Medical test result interpretation
• Patient support from pre-test to post-test
• Home sample collection coordination
• App maintenance and improvement
• OCR/NLP data extraction
• Clinical database updates
• Verification of healthcare professionals</td>
<td rowspan="2">VALUE PROPOSITION

• Easy access to healthcare services
• Home-based specimen collection
• AI-assisted interpretation of medical results
• Integrated digital health ecosystem
• Online access to doctors, nurses and pharmacies
• Improved healthcare access in remote areas
• Personalized follow-up and emergency support
• Better patient understanding of test results</td>
<td>CUSTOMER RELATIONSHIPS

• Medical confidentiality
• Personalized patient assistance
• Email, LinkedIn and WhatsApp support
• Continuous communication and follow-up
• Health awareness and education</td>
<td>CUSTOMER SEGMENTS

• Patients and families
• People in remote areas
• Clinical laboratories
• Doctors and specialists
• Physiotherapy centers
• Pharmacies
• Healthcare organizations</td>
</tr>
<tr>
<td>KEY RESOURCES

• Medical and laboratory databases
• Drug information repository
• AI algorithms and OCR/NLP engine
• Secure cloud infrastructure
• Physicians and healthcare experts
• Development and support team</td>
<td>CHANNELS

• Social media platforms
• Health blog and educational content
• Conferences, forums and workshops
• Innovation fairs and startup events</td>
<td></td>
<td></td>
</tr>
<tr>
<td colspan="2">COST STRUCTURE

• Platform design and development
• AI integration and software maintenance
• Hardware and equipment purchases
• Hosting, servers and cybersecurity
• Salaries (management, developers, biologist)
• Marketing and advertising campaigns
• Internet, communications and utilities
• Legal licenses and IP protection
• Equipment depreciation and risk reserve</td>
<td colspan="3">REVENUE STREAMS

• Commissions from telemedicine services
• Commissions from doctor appointments
• Commissions from home nursing services
• Enterprise suscriptions (l'abs, pharmacies, centers)
• Advertising revenue within the platform
• Premium patient memberships
• Special service packages and advanced options</td>
</tr>
</table>

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-Autorisation de dépôt du mémoire de Master-

Je soussigné ...Dr. Ghanam Maya...
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Présenté et soutenu publiquement par les étudiants :

1-Larkem AMINA.
2-.....
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4-.....

Spécialité : Biochemie Appliquée

Certifie par la présente que les étudiants ont pris en considération l'ensemble des remarques, modifications et corrections formulées par les membres du jury lors de la soutenance qui s'est déroulée le 06/07/2026.

En conséquence, le manuscrit final étant désormais conforme aux exigences scientifiques et académiques requises, j'autorise les étudiants suscités à procéder au dépôt officiel du mémoire auprès de la bibliothèque.

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