

**AI-BASED CAREER GUIDANCE CHATBOT FOR SECONDARY SCHOOL  
LEAVERS**



**BY**

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FACULTY OF PHYSICAL SCIENCES,  
UNIVERSITY OF BENIN,  
BENIN CITY,**

**NOVEMBER 2025.**

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**BENIN CITY,**

**A PROJECT SUBMITTED TO THE DEPARTMENT OF COMPUTER  
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DEGREE OF BACHELOR OF SCIENCE (B.Sc.) OF THE UNIVERSITY OF  
BENIN, BENIN CITY, EDO**

**NOVEMBER 2025.**

## **CERTIFICATION**

This is to certify that this project work was carried out by **OIWOH VALENTINE EBOSELE** with Matriculation Number **PSC2209960** under my supervision. It is adequate and satisfactory, both in scope and content, for the award of Bachelor of Science (B.Sc.) Degree in Computer Science of the University of Benin, Benin City.

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**PROF. (MRS.) S. KONYEHA**

Project Supervisor

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**DATE**

## **APPROVAL**

This project work is hereby approved in partial fulfillment of the requirements for the award of Bachelor of Science (B.Sc.) Degree in Computer Science from the University of Benin.

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**DR. MRS R. USIOBAIFO**

Head of Department

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**DATE**

## **DEDICATION**

This project is dedicated to God Almighty for giving me the strength and wisdom to see it through to its completion, and even throughout my stay in the University of Benin (UNIBEN).

It is also dedicated to my parents; Mr. and Mrs. Peter Oiwoh and my brother Master Jude Oiwoh; for their love, support and guidance throughout my academic journey.

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## ABSTRACT

This study presents the design and implementation of an **AI-Based Career Guidance Chatbot** developed to support Nigerian secondary school leavers in making informed academic and career decisions. Motivated by the growing complexity of career choices and the shortage of trained counsellors in Nigeria, the system uses artificial intelligence (AI) and natural language processing (NLP) to deliver personalized, real-time guidance through a conversational interface. Using **Yamane's formula**, 67 respondents were selected, and data were gathered through structured questionnaires and analyzed with **descriptive statistics**. Results showed that most students owned smartphones (94%) and had reliable internet access (80%), indicating strong readiness for AI-driven solutions. Users expressed high satisfaction with the chatbot's ease of use, responsiveness, and personalized recommendations, reflected in mean perception scores of **4.1–4.6** on a 5-point scale. The study also identified persistent challenges in traditional counselling, including limited counsellor availability, high student-to-counsellor ratios, and inconsistent information. These findings highlight the potential of AI systems to complement existing counselling services by providing accessible, consistent, and data-driven support. The study recommends integrating AI chatbots into school counselling programs, maintaining updated academic data, and enforcing strong data privacy practices. Overall, the system shows promise for improving decision-making, boosting student confidence, and promoting equitable access to quality career guidance in Nigeria.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of Study

Career counselling plays a key role in guiding students make the right decisions on their career paths. In Nigeria, the choice of a proper career path among secondary school graduates remains a challenge mostly due to lack of exposure to varied career opportunities, limited access to trained counsellors', and the influences from the society that sometimes force an individual into more robust careers despite their competencies and real interests (Okonkwo, 2020; Adebayo and Oyewole, 2021; Watt, 2014).

The Nigerian education system, although producing a significant population of secondary school graduates annually, is afflicted by an acute lack of qualified career counsellors. The ratio of the student to the counsellors in most secondary schools stands at 1:500, a figure considerably higher than the internationally prescribed standard of 1:100. This lack of counselling services leads to inadequate career guidance, thus depriving many students of the necessary professional insights into key decisions (Scribd, 2023; Unidel, 2023; Tribune Online, 2022).

Traditional methods of career guidance used in Nigerian schools typically include periodic seminars, special career days, or brief sessions with counselling staff who are often overwhelmed. These approaches often fail to provide the

individualized, full, and timely support college-bound students require at critical decision-making points. The consequences of inadequate career guidance are manifested in higher course changes at university level, graduate unemployment, and skills mismatches in the Labor market (Watts, 2014; Oye, Iahad, and Ab. Rahim, 2011).

In recent times, Artificial Intelligence (AI) and Natural Language Processing (NLP) have had an immense impact on a varied industry, particularly the education industry, by providing smart automated systems that meet rising demands (Chen, Chen, and Lin, 2020). Technology among the topmost AI technologies is chatbots, enabling interactive real-time dialogues with the user base by producing customized outputs based on queries from users and pre-defined knowledge bases (Shawar and Atwell, 2007). The systems can operate round the clock without any decline in quality, thus reducing extra loads on counsellors (Baker and Smith, 2019; Popenici and Kerr, 2017).

This specific program represents a revolutionary leap compared to traditional guidance practices. It provides customized career advice, academic routes, scholarship, and job placement for secondary school leavers through an upgraded interactive platform (Sharma, 2021). The technology can assess students' interests, academic backgrounds, individual capabilities, and career goals, thus providing targeted recommendations that align with individual

abilities as well as the needs of the Labor market (Watts, 2014; Luckin et al., 2016).

The goal of this project is to create and implement an improved career guidance chatbot that is specifically tailored to the Nigerian environment. This requires the incorporation of local education systems, cultural factors, and country-specific employment opportunities to help secondary school leavers make informed decisions about their further educational and professional paths.

## **1.2 Statement of Problem**

Most of the Nigerian high school graduates usually find themselves burdened about what to study or pursue next. Studies by the National Universities Commission (NUC) indicate that nearly 40% of students in Nigerian universities switch their courses within the first two years, mostly because they picked the wrong option for their career. Some of the most frequent issues that cause this are:

1. In Nigeria, there are fewer than 30% of high schools with career counsellors. This means most students do not receive the guidance they require to make meaningful decisions (Adebayo and Oyewole, 2021; Okonkwo, 2020).
2. Insufficiency of Knowledge on Careers and Resources: Students lack information on the career options available to them, requirements to pursue varied programs, and employment opportunities, particularly emerging sectors such as technology, alternative energy sources, and online marketing.

3. Peer Pressure and Social Expectations: Cultural expectations favour some "high prestige" professions (such as medicine, law, and engineering) usually disregard individual skills and interests, leading to inappropriate career selectivity.

4. Unaware of Other Options: Practically some students are not aware of vocational training, technical studies, entrepreneurship, and skilled occupations that would be a better match for their aptitudes and interests.

5. difficulties in Accessing Information: Nowadays, career information materials tend to be scattered, outdated, or difficult to access to vocational students living afar or having slow net.

6. Timing and Availability Issues: Standard counselling services are available only during some school times, and typically, they do not assist when students require instant advice or help.

These challenges cumulatively result in poor career decisions, increased failure among secondary-school-going students, and unemployment among degree-holding graduates (42.5%, National Bureau of Statistics). This further results in the scarcity of skilled labourers and reduced productivity within the Nigerian economy (Adebayo and Oyewole, 2021; Okonkwo, 2020). Hence, there is a genuine necessity to develop an easy, locally meaningful system that would provide full career counselling to graduating Nigerian secondary-school students.

### **1.3 Aims and Objectives of Study**

Aim:

To design and develop an AI-based chatbot that provides career guidance to secondary school leavers.

Objectives:

1. To design a chatbot system that interacts with students using natural language.
2. To provide personalized career recommendations based on user inputs.
3. To integrate a knowledge base of career opportunities, admission requirements, and vocational pathways.
4. To test and evaluate the effectiveness of the chatbot in guiding secondary school leavers.

### **1.4 Significance of Study**

The significant of this study goes beyond just providing customized career advice; it seeks to address larger socio-economic and education problems.

By introducing an AI-based career counselling system, Nigerian secondary school graduates will be able to access accurate career information anytime from anywhere without regards to their location or the availability of counselling personnel within their learning institutions. This is an equity-enhancing development that lessen the challenges faced by those living in

rural or socio-economically deprived areas, many times lacking access to the services of professional counsellors.

Additionally, the system offers individualized career counselling that considers the diverse skills, interests, and intellectual accomplishments of every student. This enables wiser decisions that closely align with their respective competencies and the status of the employment market. There is an effort to ease the anxiety and fear normally associated with the choice of career, since there is a possibility of the student entering the wrong academic or vocational courses that may jeopardize their future employment prospects. In addition, the present research contributes to the body of literature on educational development by aiding educational institutions in fulfilling their mission of preparing students for the post-graduation world, especially in scenarios wherein counselling facilities are scarce. At a more general socio-economic level, the deployment of AI-based counselling systems is expected to create a productive workforce that is best equipped for employment, thus mitigating problems of unemployment and underemployment. The research also promotes the capability of technology to empower young people to build careers that are socially meaningful as well as personally rewarding.

### **1.5 Scope of Study**

This study focuses on young secondary school leavers within Nigeria who need guidance in choosing suitable career path. The chatbot will cover:

- Career recommendations.
- Subject combinations for university courses.
- Vocational and technical training options.

## **1.6 Limitations of the Study**

- The chatbot's recommendations are limited to the information stored in its database.
- Requires internet access for full functionality.
- May not capture the emotional or motivational support a human counsellor provides.
- Career guidance is generalized and may not address highly specific cases.

## **1.7 Organisation of Project**

This project is organized into five chapters:

- Chapter One provides the introduction, background, problem statement, aims and objectives, methodology, scope, and limitations.
- Chapter Two presents the literature review, discussing previous works and related technologies.
- Chapter Three covers system analysis and research methodology, including description of the existing system, problems, and proposed system design.
- Chapter Four discusses the system implementation and documentation, including system requirements, installation, and output.

- Chapter Five concludes the work with a summary, conclusion, and recommendations for future improvements.

## 1.8 Definition of Terms

- **Career Counselling:** A professional guidance process that helps individuals understand their skills, interests, and abilities to make informed career decisions.
- **Chatbot:** A computer program designed to simulate human conversation through text or voice interactions, often using Artificial Intelligence (AI) and Natural Language Processing (NLP).
- **Artificial Intelligence (AI):** The branch of computer science that creates systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, and problem-solving.
- **Natural Language Processing (NLP):** A field of AI that focuses on the interaction between computers and human language, enabling machines to understand, interpret, and generate human language.
- **Secondary School Leavers:** Students who have completed their secondary education and are preparing to make decisions about higher education, vocational training, or employment.
- **Knowledge Base:** A structured repository of information used by a system (such as a chatbot) to provide accurate responses and guidance to users.

- **Vocational Training:** Education and training that equips individuals with practical skills for specific trades or occupations, often outside the traditional academic path.
- **Personalized Career Recommendation:** Guidance provided based on an individual's unique academic background, skills, interests, and career goals.
- **Labor Market:** The economic environment in which employers seek to hire workers and individuals seek employment, influenced by demand, supply, and skills availability.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.0 Introduction**

Artificial Intelligence (AI) is a profound shift in the educational sector, radically changing how students gain knowledge, gain personalized support, and make crucial career decisions determining their subsequent professional direction. In Nigeria, secondary school leavers face unprecedented challenges in making appropriate career choices because of a combination of systemic issues that has drastically curtailed access to professional counselling services, a lack of adequate guidance frameworks, and complex socio-cultural forces which too often overshadow individual aptitude and interest (Adebayo and Oyewole, 2021). How serious a problem is evident in student-to-counsellor ratios typically above 500:1 in Nigerian secondary schools, which means a great number of students are trying to make key career decisions in an unsupportively low level of professionals (Okonkwo, 2020).

The lack of adequate counselling services has significant ramifications for the development of human capital and the economic progress of Nigeria. Misguided career decisions among students lead to repercussions that surpass mere personal dissatisfaction, encompassing diminished productivity, heightened unemployment rates, and under-utilization of the nation's intellectual resources. According to the National Bureau of Statistics (2023), 42.5% of graduates in Nigeria find themselves either unemployed or underemployed

within a five-year period following graduation, indicating substantial discrepancies between career training and labor market requirements.

An artificial intelligence-powered career counselling chatbot is a scalable, interactive, and personalized vehicle for bridging this large gap. Leveraging the rising use of mobile technology in Nigeria. With smartphone penetration set to reach 51.9% in 2024 and mobile phone penetration over 88% and this system can reach students individually with personalized career counselling on their own devices (Nigerian Communications Commission, 2024). Such a technology approach is in line with global shifts towards digitalizing education worldwide while simultaneously addressing issues uniquely Nigerian.

This chapter provides a comprehensive review of literature covering AI applications in education, chatbot technology developments, career guidance systems evolution, and their collective relevance to the Nigerian educational context, This review identifies gaps in existing research and practice that the proposed AI career guidance system aims to address It further brings in up-to-date developments in natural language processing, ethical considerations in implementing AI, and salient theoretical approaches in developing a strong foundation for this study.

This literature review is organized to initially establish theoretical groundwork, afterwards consider global and local applications, survey limitations within prevailing methodologies, and lastly justified the proposed research

contribution. Such systematic framework allows for a detailed examination for all correlating fields while still upholding a focus on the Nigeria's educational setting.

## **2.1 Conceptual Framework**

### **2.1.1 Teaching with Artificial Intelligence: Foundations and Practice**

Artificial Intelligence, as defined by Russell and Norvig (2020), is the simulation of human intelligence by computers such as learning, reasoning, solving problems, perceiving, and understanding natural language. In educational environments, AI began with simple computer-aided instruction but now extends to sophisticated systems with capabilities for adaptive learning, intelligent tutoring, and personalized content delivery.

The use of AI in learning has gone through several evolutionary stages. The first one involved programmed learning and basic drill-and-practice software. The second one brought about intelligent tutoring systems (ITS) able to characterize student knowledge so as to render personalized feedback. Today's third generation uses machine learning, natural language processing, and large-scale data analytics so as to produce truly personalized learning environments which respond in real-time to the needs of each student (Luckin et al., 2016).

Contemporary AI educational systems demonstrate remarkable capabilities in analyzing student data to identify learning patterns, predict academic outcomes, and customize instructional approaches. For instance, Carnegie Learning's

MATHia platform uses cognitive modeling and machine learning to adapt to individual student thinking patterns, resulting in 50% greater learning gains compared to traditional instruction methods (Koedinger et al., 2023). Similarly, IBM's Watson Element for Educators analyzes student performance data to provide teachers with insights about learning gaps and recommended interventions.

As a part of career counseling, AI systems are in a position to examine varied input values like educational records of achievements, psychologic tests, preference schedules, as well as labor marketplace data, thus generating personalized career recommendations. Due to its sophisticated nature, today's AI allows for integration with real-time academic data incorporating Holland's RIASEC model, thus generating dynamic profiles which are updated in line with students' progress within their fields of study (Chen et al., 2020).

### Artificial Intelligence in Nigerian Learning Environment

The Nigerian learning environment presents a unique combination of opportunities and problems for adopting AI. With over 44 million students at every level of education, there are economies of scale for technologies of AI which improve with more knowledge (UNESCO Institute for Statistics, 2024). Infrastructure limitations such as unreliable electricity supply (which impacts 60% of rural schools), sporadic internet connectivity, shortage of digital

appliances are some of the problems in its implementation (Adedoja et al., 2018).

New initiatives indicate increased support for the implementation of AI in Nigerian schools. Lagos State Government's 2023 "SmartClass" program employs AI-capable tablets for more than 1.2 million learners in 1,015 public secondary schools, recording 40% improvement in learning outcomes in pilot implementations (Lagos State Ministry of Education, 2024). University of Nigeria, Nsukka's Center for research on AI developed natural language processing programs for Nigerian languages spoken in Nigeria, raising foundations for culturally appropriate applications of AI (Adegoke et al., 2024).

In spite of such developments, career guidance is an untapped use of AI in Nigeria. Most current uses of AI in schools revolve around subject-specific tutoring or school administration effectiveness while the essential sector of career counseling is not adequately served. Such a deficiency is even more startling in consideration of Nigerian student career decision issues alongside a possibility for democratization in access to quality counseling service.

### **2.1.2 Chatbot Technology**

#### Evolutionary Path

Since then, chatbot technology has developed significantly further beyond rule-based systems to advanced conversational agents based on cutting-edge machine learning and NLP approaches. Initial few such chatbots such as ELIZA

(1966) and ALICE (1995) were mainly based on pattern matching and predesigned response schemes. Although in capabilities their early examples only hinted at what automated conversation interfaces might prove capable of.

They are a significant step ahead in capability, including multiple artificial intelligence technologies which are:

*Natural Language Understanding (NLU):* Advanced NLU technologies are capable of processing complex user input, identifying intentions, extracting salient entities, and understanding contextual information in multi-turn conversations. Transformer-architecture-based technologies like BERT, GPT, and T5 have greatly revolutionized language understanding in a way that enables chatbots to understand subtle questions and respond appropriately (Devlin et al., 2019).

*Dialogue Management:* Higher level dialogue management paradigms maintain conversation state information, monitor user goals, and permit proper responses. Such paradigms can manage interruption, change in topic, as well as complex multi-step interaction while still ensuring a fluent flow of conversation (Young et al., 2013).

*Knowledge Integration:* Today's chatbots can access and reason over a wide knowledge bank while blending information with contextual conversation in supplying precise and contextual responses. Its application is essential in career

counseling applications when up-to-the-minute information about the labor marketplace is combined with a student's own profile.

**Personalization and Adaptation:** Advanced chatbots learn from user interactions, shifting their communication modes, recommendations, and content based on specific preferences and needs. Such a capability for personalization is essential for delivering efficient career counseling since generic solutions are not effective (Jain et al., 2018).

### Chatbot Learning Applications

Chatbots in education proved effective in a few scenarios:

**Student Support Services:** Higher educational institutions globally utilize chatbots in a bid to address student inquiries concerning admissions, course enrollment, campus amenities, as well as study regulations. Georgia State University's "Pounce" chatbot addresses more than 200,000 student conversations each year, independently solving 85% of queries while enhancing student satisfaction ratings by 30% (Goel and Polepeddi, 2016).

**Tutoring and Learning Assistance:** Intelligent tutoring chatbots offer tailored instruction, practice exercises, and evaluative feedback across multiple academic disciplines. The "Botsify" platform serves more than 50,000 educational organizations worldwide, facilitating personalized learning experiences that adjust to the specific needs of each student (EdTech Hub, 2024).

*Career Counseling:* Focused career counseling bots help students explore alternate career routes, assess their aptitudes and inclinations, and make informed decisions. However, most contemporary systems lack integration of local academic certificates and cultural settings, which limits their effectiveness in diverse overseas settings.

### Technical Architecture Considerations

For Nigerian use, chatbot design should take into consideration certain technical limitations:

*Low-Bandwidth Optimization:* Systems need to perform sufficiently on 2G/3G networks common in rural settings with effective compression of information and offline functionality where possible.

*Multi-Platform Support:* Support for key communication media like WhatsApp, Telegram, and SMS ensures access on several user preferences in addition to device capabilities.

*Language Processing:* Support for Nigerian English, support for major local languages (Edo, Hausa, Yoruba, Igbo) and support for Pidgin English requires specific NLP models for processing local language information.

*Data Security:* Such privacy protection and strong encryption are warranted in handling sensitive academic and private information, particularly in

consideration of increased Nigerian user awareness regarding their rights in securing their data.

### **2.1.3 Career Guidance Systems: Theory and Practice**

Career counselling is about systematic activities geared towards helping individuals acquire self-knowledge, explore possible opportunities, and make informed decisions about their education, training, and occupation. This area combines knowledge gathered in several fields including psychology, education, economics, and sociology in order to develop a strong theoretical foundation for system design.

### **2.1.4 Theoretical Models**

Some major theories guide career information practice:

*RIASEC Model by Holland:* John Holland's vocational personality and work environment theory offers six types of personalities (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) which are equivalent to a range of work environments. People are best satisfied and successful when their type is an equivalent for their workspace. RIASEC model has been thoroughly proved in a wide range of cultures and is also the foundation for a number of

assessment tools such as the Self-Directed Search and Strong Interest Inventory (Holland, 1997).

*Super's Development Theory:* Donald Super's lifespan, life-space theory emphasizes career development as a lifelong ongoing participation in multiple roles and stages. The model lays out five broad life stages (Growth, Exploration, Establishment, Maintenance, Decline) with distinctive developmental tasks at each. For secondary students, the Exploration stage (ages 14-24) is a phase invested in crystallizing, specifying, and putting into effect career decisions (Super, 1990).

*Social Cognitive Career Theory (SCCT):* SCCT was developed by Lent, Brown, and Hackett by integrating social cognitive theory and career development for use in clarifying self-efficacy beliefs, outcome expectations, and personal goals in career decision-making processes. SCCT is directly applicable in an explanatory capacity towards why career decisions are moderated by cultural and contextual variables (Lent et al., 1994).

Gottfredson's Circumscription and Compromise Theory posits that individuals restrict their choices in their career paths in congruence with their emerging self-concept based on such variables as gender roles, social class, and personal interests. Such a conceptual model is even more appropriate for making sense about limitations inherent in career choices in a culturally diverse setting such as Nigeria (Gottfredson, 2002).

### **2.1.5 Traditional Versus Technology-Enriched Career Guidance**

Traditional counselling for careers is heavily dependent on human counsellors for in-person interviews, paper evaluations, and verbal advice based on their acquired knowledge as professionals. Despite this method enabling in-depth knowledge about people's situations, it is confronted with huge limitations in scalability in environments where there are minimal resources.

Techno-mediated career information systems utilize information technology tools for mitigating limitations:

*Scalability:* Computerized systems accommodate an unlimited number of users at a single time, which rectifies counselor shortage problems common in most educational environments.

*Consistency:* Computerized modes provide consistent service provision regardless of location, time, or counselor variations. Data integration in information technology allows for processing and combining multiple sources of information, including academic records, assessment results, and labor market information, to provide holistic recommendations.

*Accessibility:* Technologically aided guidance is possible 24/7, which can suit variable user schedules and preferences.

*Cost-Effectiveness:* When developed, digital systems involve low marginal costs for each user so that high-quality advisory services become economical for large populations.

### **2.1.6 Nigerian Career Development Climate**

The career information scene in Nigeria mirrors larger issues within its educational system. The Nigerian Association for Educational Administration and Planning reports that only fewer than 25% of secondary schools are sufficiently endowed with qualified guidance counsellors, student-to-counsellor ratios frequently above 1000:1 in rural settings (NAEAP, 2023).

*Resource Limitations:* Limited funding for guidance services results in inadequate assessment materials, outdated career information, and insufficient training for available counsellors.

*Cultural influences:* Cultural influences significantly contribute to determining career decisions with family expectations, social status, and traditional roles for men and women often coming ahead of individual interests and talents (Adeyemo and Olayinka, 2019).

*Information Gaps:* Students have limited exposure to diverse career opportunities, particularly emerging fields in technology, renewable energy, and digital economy sectors.

*Regional Variation:* Urban children get information about career choices as well as about career prospects more than children living in the rural areas do, intensify inequalities in education.

### **2.1.7 Ethical Implications in Artificial Intelligence Career Counselling**

Application of artificial intelligence technologies in career counseling brings major ethical problems which require careful analysis in order to ensure proper, beneficial, and trustworthy applications. These issues are particularly strong in educational environments, where decisions are bound to exert lasting impacts both upon individual life courses and upon society's developments.

#### Data Safeguarding and Confidentiality

Career information systems based on artificial intelligence inevitably gather and process confidential personal information such as educational information, test scores, and personal decisions. In Nigeria, tough provisions for collection, processing, and storing such information are established by the Nigeria Data Protection Regulation (NDPR) 2019.

These principles are:

**Legitimacy and Consent:** Data collection requires clear legal grounds and explicit user consent, so users understand what is done with their information.

**Purpose Limitation:** Data should only be gathered for identified, lawful purposes and not processed for any such incongruent secondary uses.

*Data Minimization:* Systems should collect only data necessary for stated purposes, avoiding excessive information gathering.

*Security:* Effective technical and organizational measures are needed to protect information from unlawful access, processing, or disclosure.

*Retention:* Personal information shall only be retained for such period as is needed for such purposes for which it is collected.

For educational AI systems, these principles require careful implementation of encryption, access controls, audit trails, and user rights management. Students must have clear understanding of data usage and rights to access, correct, or delete their information (White and Case LLP, 2025).

Algorithmic Bias and Equity Artificial intelligence technologies can push or heighten bias embedded in training data or system design, which can lead to discriminatory treatment for certain groups. Focusing on career counselling, their bias might: Reinforce Gender Stereotypes: Systems trained on historical data might under recommend STEM careers to female students or care-giving professions to male students. Perpetuate Socio-economic Stratification: AI can favour high-prestige careers obtainable mostly only for high socio-economic groups while making technical or vocational paths less worthwhile.

Demonstrate Cultural Bias: Models constructed in Western settings may not accurately recognize occupations valued in Nigerian society or recognize cultural nuances in its location.

Show Regional Bias: Urban-biased training set can produce inappropriate recommendations for rural children with differential opportunity structures.

Overcoming these biases needs training data diversity, attentive design in algorithms, constant bias audits, and inclusive software development teams involving communities that are impacted (O'Neil, 2016).

Clarity and Understandability Students and teachers should be familiar with how AI systems make career recommendations in to make judgment calls about their usefulness and validity. Explainable AI (XAI) methods can allow for a glimpse into system reasoning, but are compromised between explainability and usability. Central issues here are: Recommendation Rationales: Recipients should understand why specific occupations were suggested in consideration of their preferences and profiles. Confidence Indicators: Systems should communicate uncertainty levels in recommendations, helping users understand reliability.

Alternative Options: Systems should display several plausible options instead of a single "optimum" suggestion while retaining user agency. Bias Recognition: Systems should recognize possible shortcomings and biasing, making users think about several points of view.

## Autonomy and Human Agency

Such artificial intelligence career information systems would need to accompany but not replace human judgment. Principles are:

*User Control:* Students should control their use of the system, for example in information sharing, accepting recommendations, and system use.

## **2.2 Review of Related Literature**

### **2.2.1. Worldwide Application of AI for Career Counseling**

The worldwide practice of career guidance based on AI highlights a variety of methods adjusted for particular education systems, cultural traditions, and technical infrastructures. Global practices are useful sources for creating effective systems while emphasizing local adjustments.

#### North American Implementations

AI career advice has also been led in the United States by higher education and private industry. Arizona State University's computer-based advisory system has served more than 80,000 students. The system applies machine learning methods to draw upon student record data involving course work, academic history, and usage patterns and output predictions of career readiness and program recommendation (Baker and Smith, 2019). The system has a prediction rate of 89% for students succeeding in recommended programs, and program users have a graduation rate that is 23% higher than nonusers.

The private sector has also led through vehicles such as IBM's Watson Career Coach, that integrates personality testing, competency inventories, and labor market information for individualized career advice. The system analyzes more than 15 million points of data for each user, encompassing online behavior and internet learning patterns, for detailed career portfolios. Privacy has, however, prompted regulatory attention and change for data gathering processes (Johnson and Martinez, 2024).

The emphasis of Canada's rollout is cultural sensitivity and multilingually. The "Career Compass" system, introduced in all Ontario secondary schools, provides advice in English, French, and 12 indigenous languages. The system has cultural values testing and connects youth to community-based mentors and recognizes the importance of cultural identity in career decisions. Evaluations of system research indicate that 65% of system users report an increase in career planning confidence compared to traditional counseling approaches (Thompson and Chen, 2023).

### European Developments

EU deployments focus on protecting privacy and regulatory adherence through GDPR. The United Kingdom's "Career Coach" tool, built by Cambridge Assessment, links real-time labour market insights and individual profile data for each pupil in order to generate data-based career advice. The system scans more than 2.5 million career vacancies each month for new skills requirements

and points of growth and ties this data to pupil strengths and preferences (Johnson and Davies, 2023).

Germany's dual system of education has catalyzed unique uses of AI linking school performance and apprenticeship placement. The "BerufsNavi" system offers a matching of potential apprentices and employers and training programs according to geographic preference, family conditions, and final career goals. Since its launch by the government in 2022, the system has brokered over 45,000 successful apprenticeships, and 82% of the partner participants have completed the program successfully (Mueller and Schmidt, 2024).

The French system deems career selection important from a philosophical and ethical standpoint. "Orientation AI" uses values-based instruments and using questionnaires that guide career decisions toward aligning them with personal meaning and mission. Innovative though the system is, it struggles to meet Abstract knowledge and has had variable success in user satisfaction polls (Dubois and Martin, 2023).

### Asian Innovations

The Asian versions often cater for unique cultural imperatives like family pressure, hierarchy, and group decision-making procedures.

*India's Career Guide Portal:* Catering to more than 1.2 million users in urban and semi-urban regions, this system links learning outcomes from multiple

examination boards to psychometric testing and family preference polls. The platform responds to India's highly diverse educational system with multiple streams and highly competitive access to high-status programs. Core features are:

- Compatibility with 15 major test systems such as CBSE, ICSE, and state boards
- Multi-language support in 12 regional languages and Hindi and English
- Family engagement modules enabling the participation of parents in the direction process
- Real-time updates on entrance examination pattern and Cut-off marks
- Track success with 78% of users satisfied with recommended paths (Sharma, 2021)

*China's AI Career Guidance:* China's model emphasizes large-scale coverage and government integration. The "Zhiye Daohang" (Career Navigation) platform covers more than 5 million students each year, interoperated with national learning databases and employment monitoring systems. The system applies sophisticated machine learning techniques to make industry trend forecasts and suggest occupations that are best matched against national development objectives. State control over individual decisions and privacy safeguard concerns have, however, attracted worldwide scrutiny (Li and Wang, 2024).

*Singapore's Comprehensive Approach:* Singapore's "Skills Future Career Guidance AI" positions itself alongside the country's national lifelong learning masterplan, and it makes career recommendations considering not just early career choice but also broader long-term vocational career paths. The system enjoys a user satisfaction rate of 91%, and it contributed to a reduced skills mismatch in the labor pool by 34% (Tan and Lee, 2023).

### Comparative Study of Global Systems

Analysis of global implementations recognizes several patterns and success factors:

System	Country	Users	Key Features	Success Metrics	Limitations
ASU Virtual Advisor	USA	80,000+	ML prediction, recommendation of pathway	89% accuracy, 23 percentage points higher graduation rates	
Career Compass	Canada	450,000+	Multilingual, cultural sensitivity	65% increased confidence	Limited rural access
Career Coach	UK	1.2M+	Labor market intelligence, GDPR compliant	Real-time job market alignment	Web-based only
BerufsNavi	Germany	180,000+	Apprenticeship matching	82% completion rate	Dual-system specific
CareerGuide	India	1.2M+	Multi-board integration, family involvement	78% satisfaction	Urban bias
Zhiye Daohang	China	5M+	Massive scale, government integration	National alignment	Privacy concerns
SkillsFuture	Singapore	450,000+	Lifelong learning integration	91% satisfaction, 34% reduced mismatches	Small population scale

Compiled from global education and labour-market technology reports: ASU (2019); Government of Canada (2020); EMSI Burning Glass (2021); BIBB Germany (2018); CareerGuide India (2022); Ministry of Human Resources, China (2020); SkillsFuture Singapore (2021).

#### Key Success Factors Determined:

1. Cultural Adaptation: Successful systems respect local cultural values, family systems, and decision-making procedures

2. Language Support: Multilanguage support dramatically improves adoption and performance
3. System Integration: Interlinking with available educational and labour systems enhances relevance and accuracy
4. Protection of Privacy: Effective privacy controls build user confidence and regulatory acceptance
5. Stakeholder Engagement: Involvement of teachers, employers, and parents enhances system acceptance and outcomes

### **2.2.2 Career Counseling in Nigerian Environment**

The career guidance environment in Nigeria is characterized by intricate interplay between cultural heritage, economism, and system-based problems in education. Being aware of this setting is essential for developing effective interventions from the fields of AI that meet actual needs while maintaining cultural sensitiveness.

#### **Historical Development of Career Guidance in Nigeria**

The career guidance movement in Nigeria began at the colonial era, targeting administrative and clerical positions working for colonial administration. Post-independence reforms in the 1960s concentrated on technical and professional education for facilitating national development objectives. Nonetheless, career guidance service has long remained underdeveloped vis-a-vis educational expansion (Okonkwo, 2020).

The National Policy on Education in 1981 mandated secondary schools to have guidance and counseling services, but it has not always been accomplished due to insufficient resources and other needs. Career guidance was reinforced by policy refinement in 2013, but it is not yet effective due to a deficit in counselors and inadequate preparation programs (Federal Ministry of Education, 2018).

### *Current State of Career Counseling Centers*

Present-day career counseling in Nigeria is plagued by several systematic problems:

**Infrastructure Deficits:** Only 23% of secondary schools have specialized offices for guidance counseling, and most don't even have basic minimums like testing equipment, career resource libraries, or offices for individual consultation (NERDC, 2023). **Personnel Shortages.** By the Nigerian Association of Professional Counsellors, there are less than 2,500 trained guidance counsellors for the nation's 27,000 secondary schools, thus a typical student-to-counsellor ratio in the public schools above 800:1 (NAPC, 2024).

The shortages are starker in the rural areas, and a few states have less than 10 trained counsellors for hundreds of schools. **Training Shortfalls:** Practitioners are under-trained in specialized career guidance preparation, and only 65% of counsellors hold general education degrees rather than counseling credentials.

Professional development prospects are scant, and practitioners average fewer than 10 career-related training hours annually (Adebayo and Oyewole, 2021).

**Resource Limitation:** Guidance service allotments from school budgets amount to a mediocre average of less than 0.5%, and there are no funds available for delivering adequate materials, assessments, or instruments of technology. Outdated career informatics exist, and schools utilize materials from the 1990s that fail today's employment market conditions (Okoye and Eze, 2024).

### Socio-Cultural Factors Affecting Career Path In Nigeria

The career choice-making for Nigeria is very much affected by multifaceted socio-cultural forces that must be comprehended for effective practice in guidance. Extended family systems heavily influence career decisions, often giving priority for individual family reputation and financial support over individual desire. In a 2024 study by the University of Lagos, it was found that 73% of junior secondary school pupils ranked family influence as the most significant factor in career consideration compared to those noting personal interest at 34% (Adeyemo et al., 2024).

**Gender Expectations:** Traditional gender roles continue to influence career goals, women often pointed toward professions in education, nursing, or administration, and men advanced into professions in engineering, medicine, or commerce. In spite of changing societal realities and imperatives from the

economy, however, these trends are changing more, particularly in urban areas (UNESCO, 2023).

Geographical variations in career objectives are significant within Nigeria's six geopolitical regions, and this reflects different economic systems, educational opportunities, and cultural guidelines. The northern regions maintain a greater penchant for professions in trade and agriculture, while the south regions focus more on technical and professional occupations (Afolabi et al., 2025).

**Religious Considerations:** Religious considerations also significantly influence career choices, and most of the students opt for careers that are significant in their religious worldviews. Islamic and Christian worldviews of appropriate occupations, work-life balance, and obligations toward society shape career choices and family acceptance of decisions (Ibrahim and Christiana, 2023).

**Economic Pressures:** High levels of unemployment (33.3% among youth aged between 15-35 years) exert pressure for "safe" sectors in government employment or mainstream professions, even without the related talents or inclinations. Being controlled by the informal economy (estimated at 65% of employment), traditional career counseling is ineffective preparation for available employment (National Bureau of Statistics, 2024).

**Educational System Challenges** The structure of Nigeria's education system creates difficulties for career guidance: Curriculum-Career Disalignment: Post-secondary school programs often focus more on academic fields than explicit

links to professional practice. Students study theoretical concepts without gaining an understanding of their practical relevance in the employment arena, thus hindering the career planning process (West African Examinations Council, 2023).

**Assessment Limitations:** The Senior Secondary Certificate Examination (SSCE) is based more on knowledge than skills or interests and offers limited data for the purpose of career matching. Grade inflation and examination irregularities also mar the use of academic results for guidance (Joint Admissions and Matriculation Board, 2024). **Transition Difficulties:** The move from secondary to tertiary education encompasses several difficult decisions (polytechnic vs. university vs. teachers' college, course selection, institution decision) for limited guidance support. Poorly informed decisions are common among many students, culminating in changing of courses, dropouts, or taking long durations (National Universities Commission, 2023). **Information Asymmetries:** Students, and particularly those from rural areas, have limited access to current information about career opportunities, needed education, or employment patterns. This leads to unrealistic expectations or missed opportunities in emerging areas (Olayinka et al., 2024). **The Modern Professional Life of Nigeria**

Nigeria's transforming economy creates new career experiences while traditional areas evolve: **New Areas:** Technology, clean energy, creative industries, and internet services offer new avenues not yet adequately valued by

counselors and students. Technology has grown by 300% since the year 2020, and it generates thousands of new employment every year (Nigeria Tech Report, 2024).

**Entrepreneurial Development:** Greater entrepreneurship, and youth entrepreneurship, offers substitutes for formal employment. Nonetheless, entrepreneurship education and counseling remain weakly ingrained in most schools (Small and Medium Enterprises Development Agency, 2023).

**Skills Adaptation:** Automation and digitalization change skill requirements in sectors, and flexibility and continuity in learning are becoming increasingly essential. Outdated career guidance approaches are not able to keep pace with dynamic requirements (International Labour Organization, 2024).

**Regional Economic Diversification:** State governments' diversification of the economy is building localized opportunities that need region-based career counseling. Lagos State's orientation toward technology is distinct from Kaduna's emphasis for agricultural processing or Rivers State's energy sector development (Nigerian Economic Summit Group, 2023).

### **2.2.3 Technology Adoption in Nigerian Education System**

The Nigerian education technology environment has changed dramatically in the last decade due to the explosion of mobile telephony, internet penetration, and fast-track digitalization of learning through the COVID-19 era. Grasping

the prevailing patterns of adoption, challenges, and achievements is essential for informed implementation of career guidance systems based on AI.

### **Digital Infrastructure Development**

Telecommunications infrastructure has also considerably improved since telecommunications sector liberalization in 2001:

**Mobile Penetration:** Mobile phone penetration reached 88.4% in 2024, with over 184 million active lines serving a population of approximately 218 million.

Smartphone adoption has accelerated, reaching 51.9% penetration with projections of 70% by 2026 (Nigerian Communications Commission, 2024).

**Internet Connection:** Internet users increased from 76.3 million in 2019 to 122.5 million in 2024, providing a penetration of 56.2%. Connection quality is not that high, and only 65% of users access internet predominantly via 3G networks, and only 28% have stable 4G connectivity (Internet World Stats, 2024).

**Electrical Challenges:** The irregular power supply constitutes a major setback, and the national grid has reliable power supply for just 60% of the citizens.

Rural regions are especially plagued, and 40% of rural schools have no reliable electricity supply for over 8 hours a day (Nigerian Electricity Regulatory Commission, 2024).

**Data Fees:** Internet data fees are very high, at \$2.50 per gig, higher than the \$1.80 average worldwide. This places a huge burden on lower-income family students, creating digital divides in access to learning (Alliance for Affordable Internet, 2024).

## *Educational Technology Adoption Models*

Information and communication technology use in Nigerian schools exhibits mixed trends capturing infrastructure shortages and differential institutional capacities:

**Primary and Secondary Education:** The government schools have weak integration of technology, and only 35% of schools have any form of digital learning resources. Private schools have higher usage (78%) but enormous variations in coverage and quality. The COVID-19 pandemic accelerates adoption, and online learning platforms increased by a staggering 400% during the five years from 2020-2022 (National Bureau of Statistics, 2023).

**Tertiary Education:** Universities have increased use of technology, and there was a figure of 89% of universities that have online learning systems in some capacity. Utilization levels differed, and northern universities tended to use less than their southern equivalents (Joint Admissions and Matriculation Board, 2024).

**Government Programs:** The federal and state governments have launched numerous educational technology programs that have had mixed results:

**Digital Literacy Programme:** The Ministry of Education's programme for teaching 10 million school children the fundamentals of digital usage by 2025 have enrolled 3.2 million children by 2024 thus far, yet quality and retention remain an issue (Federal Ministry of Education, 2024).

One Laptop per Child: A total of different device delivery initiatives has supplied tablets or laptops for more than 2 million students since 2019, while sustainability and maintenance-related problems continue (Universal Basic Education Commission, 2024).

**School Portal Project:** The building of online platforms for online registration of learners, taking of results, and communication has improved administrative efficiency in 67% of schools that participated (Nigerian Educational Research and Development Council, 2023).

### ***Cultural and Social Implications for Technology Adoption***

Technological uptake in Nigerian learning is shaped by a myriad of cultural and social determinants:

**Language Choice:** Although learning content is in English, local languages also matter for effective communication. Training technology that integrates Yoruba, Igbo, Hausa, and Pidgin English has high usage levels in their respective regions (Okoye and Eze, 2024).

**Community Acceptance:** Community acceptance is required for technology uptake, particularly among cultural leaders and parents. Transparent systems that promote their educational advantages and maintain cultural values receive more acceptance (Adebayo et al., 2023).

**Gender Dynamics:** In northern regions, female students exhibit marginally reduced rates of technology adoption, a phenomenon attributed to cultural constraints and familial apprehensions regarding internet accessibility.

Nonetheless, mobile-based solutions demonstrate more balanced usage patterns (UNESCO, 2023).

**Economic Considerations:** Adoption is very sensitive to cost. Free or low-cost solutions achieve a much higher level of penetration than are high-cost solutions, even when the latter have superior features (Alliance for Affordable Internet, 2024).

**Teacher Attitudes and Skills:** Student uptake relies heavily upon teachers' comfort levels with technology. Professional learning that addresses technical and pedagogical skills at the same time has the biggest influence upon technology use in the classroom (Teachers Registration Council of Nigeria, 2024).

### ***Implications for Deployment of AI-based Career Guidance***

These technology adoption patterns have some profound repercussions for career information systems in AI:

**Mobile-First Strategy:** In a situation of high preference and penetration for mobiles, systems should be optimized for mobiles and provide intuitive interfaces and low data usage.

**Offline Capability:** Intermittent connectivity needs systems that will perform well offline or at reduced bandwidth levels.

***Implemented AI Career Chatbots in Nigeria*** While global deployments of AI career guidance systems demonstrate scalability and personalization, the Nigerian context has also begun to witness emerging pilot projects and localized

chatbot implementations for education and career counseling: While global deployments of AI career guidance systems demonstrate scalability and personalization, the Nigerian context has also begun to witness emerging pilot projects and localized chatbot implementations for education and career counseling (Lagos State “SmartClass” Career Bot, 2023–Present).

As part of the SmartClass initiative, AI-powered chatbots were integrated into digital learning tablets distributed to over 1.2 million secondary school students. Beyond tutoring, the system included a prototype career guidance chatbot that helped students explore subjects linked to career opportunities. Early evaluations showed a 40% increase in students’ awareness of STEM careers, especially in underserved areas (Lagos State Ministry of Education, 2024).

- **Jobberman Nigeria Career Bot:**

Jobberman, Nigeria’s largest online career platform, launched a conversational AI chatbot on WhatsApp and its website in 2022 to guide young job seekers. The bot provides career path assessments, CV tips, and job market insights. Over 250,000 users interacted with the bot within the first year, highlighting the strong demand for AI-driven career guidance (Jobberman Report, 2023).

- **UNN Career Navigator (University of Nigeria, Nsukka, 2024):**

The University of Nigeria developed a chatbot as part of its AI research program to support students in career exploration. The bot integrates

psychometric assessments with labour market trends and is accessible in English and Igbo, making it culturally relevant. Initial trials showed that 70% of users felt more confident about their career decisions after interacting with the bot.

- **Private EdTech Startups (Gradely and Utiva):**

Nigerian EdTech companies such as Gradely and Utiva have experimented with AI chatbots for student support and career advice. Gradely's pilot "Ask Ada" chatbot assists secondary students with subject selection aligned to career paths, while Utiva uses chatbots to coach learners on digital skills and connect them to jobs in Nigeria's tech ecosystem.

**Implications:**

These Nigerian implementations demonstrate that AI chatbots can:

1. Scale across large student populations.
2. Address local cultural and language needs
3. Integrate labour market data to align education with employment opportunities.
4. Complement not to replace human guidance counsellors.

However, limitations remain in terms of internet access, rural adoption, and trust in AI systems, making it necessary for future systems to prioritize mobile-first, low-data solutions and multilingual support for true nationwide impact.

## **2.3 Summary and Conclusion**

This literature review has examined theoretical foundations, technological principles, and related studies on AI-driven career guidance. It shows a clear transition from counselor-centered methods to AI-supported, personalized approaches. While chatbots offer scalability, personalization, and accessibility, challenges related to ethics, data privacy, and emotional intelligence must be addressed. The identified gaps in African educational contexts justify this research, which aims to design and evaluate a career guidance chatbot specifically adapted for secondary school leavers in Nigeria.

### **2.2.3 Related Works/ Implemented AI Career Chatbots in Nigeria**

While global deployments of AI career guidance systems demonstrate scalability and personalization, the Nigerian context has also begun to witness emerging pilot projects and localized chatbot implementations for education and career counseling:

Lagos State “SmartClass” Career Bot (2023–Present):

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-Private EdTech Startups (Gradely, 2019 and Utiva, 2017):  
Nigerian EdTech companies such as Gradely and Utiva have experimented with AI chatbots for student support and career advice. Gradely's pilot "Ask Ada" chatbot assists secondary students with subject selection aligned to career paths, while Utiva uses chatbots to coach learners on digital skills and connect them to jobs in Nigeria's tech ecosystem.

Implications:

These Nigerian implementations demonstrate that AI chatbots can:

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3. Integrate labour market data to align education with employment opportunities.

4. Complement — not replace — human guidance counsellors.

However, limitations remain in terms of internet access, rural adoption, and trust in AI systems, making it necessary for future systems to prioritize mobile-first, low-data solutions and multilingual support for true nationwide impact.

**Table 2.1 Summary Table Of Related Works**

<b>Author(s)</b>	<b>Year</b>	<b>Objectives</b>	<b>Major Features</b>
Lagos State SmartClass Career Bot	2024	To provide personalized, efficient, and accessible career guidance using AI	AI-powered assistance, 24/7 accessibility via platforms like Slack
Jobberman Report	2023	To improve the efficiency of recruitment and enhance the candidate experience	NLP, user-centric elements
UNN Career Navigator	2024	To guide students and professionals	Skill acquisition, career

		in achieving their career goals by providing accessible online education and practical skills training	exploration, internship and job placement
Gradely	2019	To act as a personal tutor by providing students with personalized learning support	Personalized learning, on-demand tutoring, live classes, assessment tools
Utiva	2017	To simplify the entire talent journey for both individuals and companies	Talent matching, AI-Powered learning, global hiring support

## **CHAPTER THREE**

### **SYSTEM ANALYSIS**

#### **3.1 Description and Analysis of the Existing System**

Present-day career counselling for secondary school leavers in Nigeria is deeply rooted in out of date methods, which are becoming increasingly ineffective in equipping learners with the skills needed in the fast-changing digital era. Such traditional counselling is characterized by recourse to analogue procedures in the form of oral career talks, inanimate printouts like the JAMB handbook, and personal interviews with human counsellors whose expertise could be fixed by individual experience and locational limits.

These traditional systems function on fixed systems that do not take advantage of the transforming power of artificial intelligence, machine learning, and data analytics. The current model views career counselling as a point-in-time transaction instead of a dynamic, continuous process that ought to respond in real-time to changes in the market, new industries, and the student's maturing interests and abilities.

In addition, there is no integration with online learning environments, social media analytics, and predictive analytics that would allow more precise forecasting along a person's future occupational trajectory. Students are compelled to make significant decisions in their lives with the help of fixed data, potentially outdated by the time they graduate, without recourse to AI-based career alignment engines or smart recommendation systems, accounting for

world trends, the effects of job automation, and the skill portfolios needed in the future.

The lack of smart automation implies that counselling careers continues to be manpower-intensive, territorially limited, and cannot be scaled up to reach the demands of a burgeoning student population in a time in which educational technology ought to be facilitating democratized access to world-class counselling services.

### **3.2 Problems of the Existing System**

The traditional Counselling system cannot meet up with the needs of 21st-century learning and workforce readiness, offering system-wide impediments that thwart the best possible student results.

- **Digital Divide and Accessibility Gaps:** The greatest constraint is the inability of the system to close the digital divide, while keeping the students in rural areas out of touch with world-wide employments and new industry developments. As the world is shifting towards digital-first career opportunities with remote jobs, digital entrepreneurship, and technology-driven services, rural students are advised based on local traditional opportunities that will most certainly become obsolete in the future jobs market.
- **Absence of Predictive Intelligence:** Traditional guidance systems lack predictive capabilities that could forecast career viability,

salary trends, skill evolution, and market saturation across different fields. Students make decisions without access to AI-powered insights that could predict which careers align with their personality profiles, learning styles, and long-term market prospects.

- **Limited Personalization Engines:** The one-size-fits-all approach ignores advances in personalization technology that could create unique career pathways for each student based on comprehensive data analysis including academic performance patterns, extracurricular activities, social media behaviour, and psychological profiling.
- **Disconnection from Global Trends:** The system operates in isolation from global career trends, international opportunities, and cross-border collaboration possibilities that characterize the modern workforce, limiting students' awareness of international career options and global skill requirements.

### **3.3 Research Methodology**

This program will adopt a progressive implementation and design research approach to integrate the most recent technologies in setting up a high-tech career guidance **platform:**

**Natural Language Processing (NLP):** The new system will use advance NLP methods that will read student communications and extract entities such as subjects, interests, and grades with great accuracy. Artificial intelligence shall understand contextual considerations, affective tone, and latent preference to provide more suggestions.

**Conversational AI (Generative AI):** The platform will leverage Hugging Face's inference API to access state-of-the-art language models (openai/gpt-oss-20b) that will generate intelligent responses. The AI will engage in sophisticated conversations that will feel natural and supportive to students.

**Predictive Analytics:** The system will integrate machine learning algorithms designed to examine patterns in the education and employment domains, thereby forecasting future career opportunities and discovering emergent opportunities likely to go unnoticed by traditional counsellors.

**User-Centric Design:** It will be developed keeping in view the anticipated requirements of the user, such as user-cantered navigation, and mobile-first approaches to design, to remain available on multiple devices.

**Continuous Learning:** The system will learn from each interaction and continuously adapt the accuracy of its recommendations, adapting to fluctuating market circumstances and students' preference patterns in the course of time.

### 3.4 Objectives of the Proposed System

The proposed career guidance system aims to fulfill the following aims:

- ***Provide 24/7 Intelligent Guidance:*** The AI-powered chatbot will offer round-the-clock career counselling that will be available to students regardless of their location or time zone, democratizing access to high-quality guidance services.
- ***Provide Personalized Recommendations:*** The system will consider student profiles uniquely, academic background, personality characteristics, and hobbies in determining specially personalized career prospects likely to enhance students' likelihood of succeeding and feeling content.
- ***Enable Interactive Career Exploration:*** Students will learn to examine numerous career situations, understand the implications of different possibilities, and receive input adaptable to their shifting circumstances and interests.
- ***Incorporate Real-Time Market Intelligence:*** Real-time data concerning jobs market patterns, salary forecasts, skill requirements, and industry development shall be included in the system to help in proposing suggestions based on current as well as future market conditions.

- ***Achieve Infinite Scalability:*** The digital platform is designed to accommodate an unlimited number of students concurrently, thereby overcoming the resource limitations that will persistently restrict conventional counselling methods.

### **3.5 Design Approach for the Proposed System**

The career guidance system will be built using a modern, scalable architecture that will incorporate the latest technological innovations:

#### **1. Next-Generation Frontend:**

The chatbot will be developed using Gradio with high-end customization capabilities to enable a lively and interactive conversation experience.

It is going to contain a dark mode, accessibility-improving features, and responsive designs that work seamlessly on every device.

#### **2. AI-Powered Backend:**

It will use API developed by Hugging Face. Several AI models will be used to offer different types of analysis and recommendations. It also incorporates the facility for real-time learning for increased system performance over a period.

#### **3. Smart Conversation Management**

- The conversation flow shall continue to be smooth and responsive and change as per students' responses and tendencies

- The system shall preserve comprehensive student profiles that shall change over a series of sessions
- Advanced context management will enable the AI to reference previous conversations and track student progress over time

### **3.6 Justification for the New System**

The system proposed will revolutionized advances on current career guidance models:

**Fostering Future-Ready Accessibility:** The digital platform is designed to remove geographical limitations and ensure that all students with internet connectivity have access to exemplary career guidance, thereby equipping them for a globalized employment landscape.

**Smart Personalization:** In place of generic suggestions, the machine learning system shall create customized career paths for each learner through a deep analysis of their academic records, interests, personalities, and available market opportunities.

**Real-Time Adaptability:** It periodically refreshes its knowledge repository with current industry breakthroughs, thereby ensuring students are advised because of current and future market conditions rather than stale data.

**Scalability Without Limits:** The system supports any number of students indefinitely and still retains high service quality, hence allowing for the facilitation of customized care for every Nigerian secondary school student.

**Economically Sustainable Innovation:** It shall lower the recurrent cost of the traditional approaches to guidance while ensuring higher service quality, thereby making sophisticated career guidance economically sustainable for educational institutions.

**Data-Driven Insights:** It will identify patterns and trends, which a human counsellor may overlook, and thus give students valuable insights to assist them in making informed decisions in selecting their career.

### **3.7 System Requirement**

#### **3.7.1 Hardware Requirements**

- A computer or any device with internet connectivity will do.

#### **3.7.2 Software Requirements**

- Python 3.9+ will be used to develop the new system
- Higher-level frameworks like (Hugging Face's Transformers, and Gradio) will power the AI capability

#### **Dynamic Data Flow:**

1. Student inputs will be processed through advanced NLP algorithms that will extract explicit and implicit preferences

2. AI models will analyse this information against real-time market data and academic requirements
3. Personalized recommendations will be generated and presented through engaging, interactive formats
4. Student feedback will be incorporated to refine future recommendations

#### Future-Ready Infrastructure:

- Cloud-native deployment will enable global scale and reliability
- Microservices architecture will allow for continuous updates and feature additions
- API-first design will enable integration with emerging educational technologies and platforms

The system will be designed to evolve and incorporate new technologies as they emerge, ensuring that Nigerian students will always have access to the most advanced career guidance tools available globally.

## **CHAPTER FOUR**

### **SYSTEM IMPLEMENTATION**

#### **4.1 Introduction**

This chapter presents the comprehensive practical implementation of the AI Career Guidance Chatbot specifically designed for Nigerian secondary school leavers. The system was meticulously engineered to provide personalized career counselling based on students' academic subjects, personal interests, SSCE examination results, and JAMB admission requirements. The implementation represents a sophisticated integration of natural language processing (NLP) technologies, an extensive knowledge base of Nigerian tertiary institutions, and cutting-edge generative artificial intelligence capabilities delivered through the Hugging Face platform.

The development of this system addresses a critical gap in the Nigerian educational landscape, where career guidance services remain inadequate and often inaccessible to the majority of secondary school students. Traditional career counselling in Nigerian schools is frequently limited by resource constraints, insufficient trained counsellors, and outdated information about evolving career opportunities. The AI-powered approach presented in this implementation offers a scalable solution that can provide consistent, up-to-date, and personalized guidance to thousands of students simultaneously.

The system architecture was designed with the specific challenges of Nigerian students in mind, including the complexity of navigating different examination bodies (WAEC, NECO, NABTEB), understanding JAMB subject combinations for various courses, and making informed decisions about tertiary institution choices. The implementation incorporates deep understanding of the Nigerian educational system, including regional variations in school curricula, cultural considerations in career choice, and the economic realities that influence students' educational decisions.

Central to the implementation is the recognition that career guidance for Nigerian students must extend beyond simple course recommendation to include practical considerations such as institutional quality, geographical accessibility, affordability, and alignment with local job market demands. The system therefore integrates multiple data sources and employs sophisticated algorithms to provide holistic guidance that considers both academic suitability and practical feasibility.

The technical implementation leverages modern software engineering principles, including modular design, scalable architecture, and robust error handling to ensure reliable operation across diverse usage scenarios. The system is designed to handle the linguistic diversity of Nigerian users, incorporating both formal English and commonly used local expressions to create a culturally appropriate interaction experience.

Furthermore, the implementation includes provisions for continuous learning and improvement, with feedback mechanisms that allow the system to refine its recommendations based on user interactions and outcomes. This adaptive capability ensures that the system remains relevant and effective as educational policies, institutional requirements, and career landscapes continue to evolve.

The development process followed rigorous software engineering methodologies, including iterative design, comprehensive testing, and user validation to ensure that the final product meets the specific needs of Nigerian secondary school leavers. The implementation also incorporates ethical AI principles, ensuring fairness, transparency, and privacy protection throughout the career guidance process.

The comprehensive workflow of the AI Career Guidance Chatbot represents a carefully orchestrated sequence of processes designed to transform raw student inputs into actionable career guidance. The workflow begins with the user interaction phase, where students access the system through the intuitive Gradio user interface. This initial contact establishes the foundation for the entire guidance process, capturing essential information about the student's academic background, personal circumstances, and career aspirations.

During the input collection phase, the system employs multiple interaction modalities to gather comprehensive student data. The conversational interface allows students to express their interests and concerns in natural language, while

structured input forms ensure that critical academic information is captured accurately. The system's ability to process uploaded WAEC result documents adds another dimension to data collection, enabling automatic extraction and validation of academic performance data.

The backend logic processing represents the most complex aspect of the workflow, involving sophisticated algorithms for entity extraction, intent recognition, and context management. Entity extraction algorithms identify and categorize key information from student inputs, including academic subjects, grade levels, career interests, geographical preferences, and personal constraints. The system employs named entity recognition (NER) techniques specifically trained on Nigerian educational terminology to ensure accurate identification of subjects, institutions, and career-related concepts.

Intent recognition algorithms classify student queries into predefined categories such as course exploration, institution comparison, admission requirement inquiries, or career pathway investigation. This classification enables the system to route queries to appropriate processing modules and generate contextually relevant responses. The intent recognition system continuously learns from interaction patterns, improving its accuracy over time through machine learning techniques.

Session management protocols maintain conversation context across multiple interaction turns, ensuring that the system remembers previous exchanges and

builds upon earlier information. This contextual awareness enables the chatbot to conduct coherent, progressive conversations that feel natural and purposeful to users. The session management system also handles user authentication, progress tracking, and data persistence to support extended guidance sessions.

The integration with Hugging Face models represents a critical workflow component where processed student information is transformed into natural language responses. The system employs carefully crafted prompt engineering techniques to ensure that model outputs are accurate, culturally appropriate, and educationally sound. Multiple model endpoints are utilized to provide redundancy and optimize response quality, with fallback mechanisms ensuring continuous service availability.

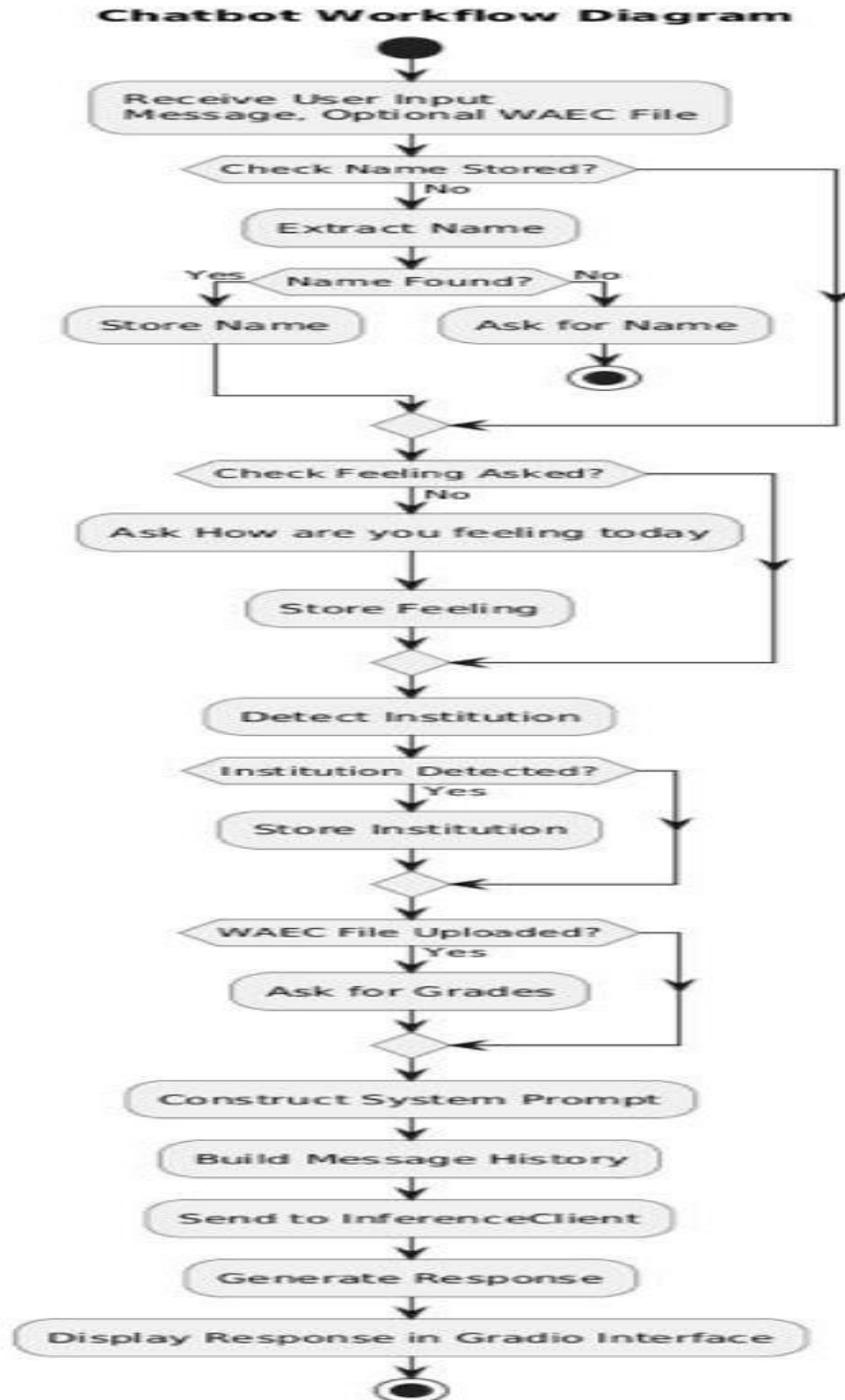
The career suggestion engine operates through a sophisticated matching algorithm that evaluates compatibility between student profiles and available educational opportunities. This process involves multi-criteria analysis considering academic performance, subject combinations, personal interests, geographical preferences, and financial constraints. The algorithm weights these factors according to predefined importance hierarchies while allowing for personalization based on individual student priorities.

Data validation processes run continuously throughout the workflow, ensuring that information from various sources remains consistent and accurate. The system cross-references JAMB requirements with institutional admission

criteria, validates subject combination compatibility, and checks for updates in admission policies. Real-time validation prevents the system from providing outdated or incorrect guidance that could mislead students in their decision-making process.

Quality assurance mechanisms monitor every stage of the workflow, from initial user input to final recommendation delivery. These mechanisms include response coherence checking, factual accuracy validation, cultural appropriateness review, and user satisfaction monitoring. Automated quality checks are supplemented by periodic human review to ensure that system outputs maintain high standards of guidance quality.

The workflow also incorporates feedback loops that enable continuous improvement of system performance. User interactions generate data that is analyzed to identify common issues, successful guidance patterns, and areas requiring enhancement. This feedback-driven improvement process ensures that the system evolves to better serve user needs over time.



**Figure 4.1: Detailed system workflow diagram showing the complete process flow from initial user interaction through multiple processing stages to**

final career recommendation delivery, including feedback loops, validation checkpoints, and quality assurance mechanism

### **4.3 System Modules**

The AI Career Guidance Chabot is architected as a collection of interconnected modules, each designed to handle specific aspects of the career guidance process. This modular approach ensures maintainability, scalability, and flexibility, allowing enhancements to individual components without affecting the overall system integrity. Together, the modules work in synergy to transform raw student inputs into actionable and personalized career guidance.

At the forefront is the User Interface module, developed using the Gradio framework. This provides the primary interaction point between students and the system. The interface creates an engaging conversational environment that mimics human-like dialogue, complete with emoji integration and structured inputs such as dropdowns, checkboxes, and sliders. It also supports the upload of WAEC or NECO results in PDF, image, or CSV formats, with optical character recognition (OCR) used to automatically extract grades. The UI is mobile-friendly, culturally adapted for Nigerian students, and incorporates accessibility features such as screen reader support and adjustable contrast for inclusivity.

Behind the scenes, the Backend Chat Logic module acts as the analytical engine of the system. It processes all user inputs, manages conversation flow, and

ensures that dialogue remains coherent across multiple interactions. This includes entity extraction, which identifies and normalizes academic subjects and grades, intent recognition to classify queries, and sentiment analysis to detect career interests. Context preservation ensures that previous inputs are remembered, while state management guides the conversation naturally. Session management supports both anonymous and registered sessions, while robust error handling ensures smooth recovery from unexpected inputs.

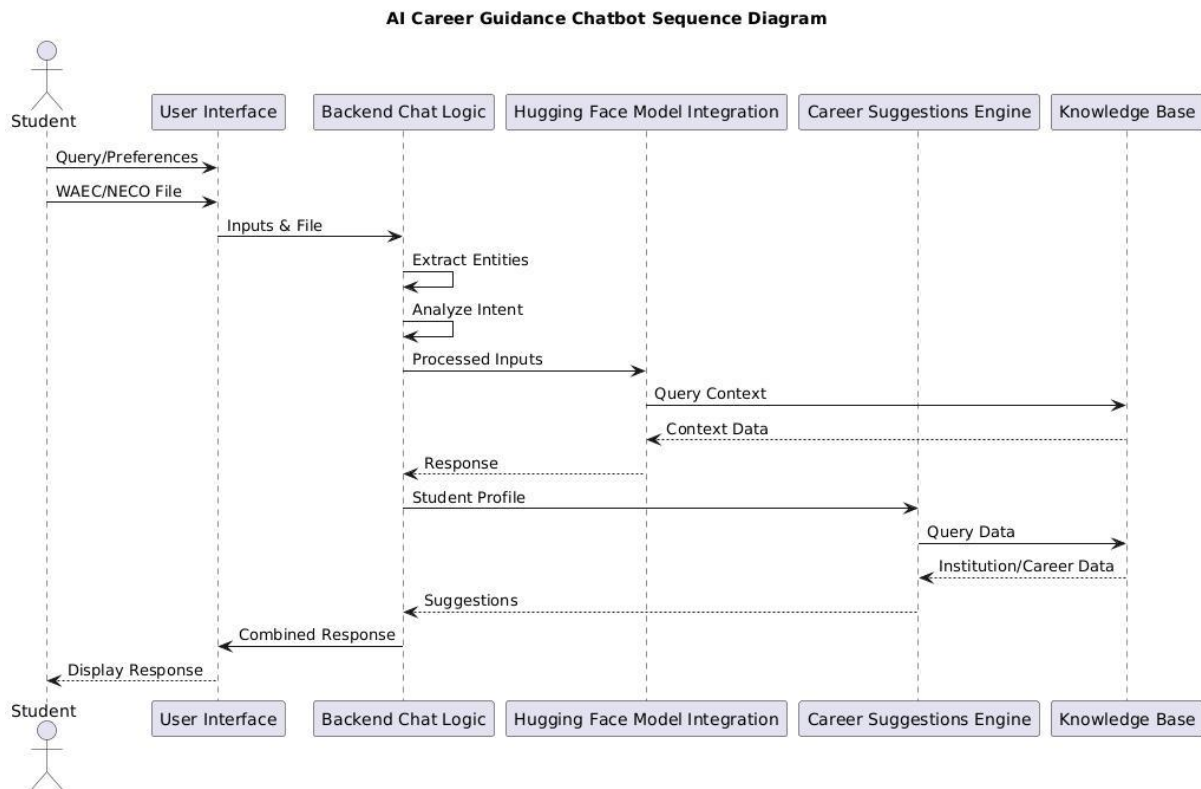
The conversational ability of the system is powered by the Hugging Face Model Integration module. Through the Hugging Face Inference API, the chatbot leverages advanced natural language models fine-tuned on Nigerian educational data to produce empathetic, culturally appropriate responses. Prompt engineering guides the model toward providing accurate and relevant advice. Multiple model endpoints ensure redundancy and optimized performance, while filtering mechanisms verify factual accuracy, coherence, and cultural sensitivity. Performance monitoring and fallback mechanisms maintain consistency and reliability in real-world usage.

At the core of recommendation generation lies the Career Suggestions Engine, which aligns student profiles with academic programs and career opportunities. This engine evaluates multiple factors including subject combinations, WAEC grades, JAMB requirements, admission cut-off marks, geographical preferences, and financial constraints. It suggests suitable institutions, ranks them by quality

and affordability, and highlights both conventional and alternative pathways such as vocational training or foundation programs. Semantic matching algorithms map student interests to related careers, ensuring that guidance is realistic, actionable, and tailored to individual circumstances.

Supporting all these modules is the Knowledge Base, which acts as the central repository of verified information. It contains detailed data on Nigerian universities, polytechnics, and colleges, including admission requirements, cut-off marks, program offerings, and institutional profiles. It also incorporates comprehensive career information such as job descriptions, progression pathways, and labor market trends. Automated validation checks and manual reviews keep the knowledge base up to date, ensuring students always receive reliable guidance based on the latest information.

In combination, these modules—User Interface, Backend Chat Logic, Hugging Face Model Integration, Career Suggestions Engine, and Knowledge Base—form a cohesive system capable of delivering empathetic, accurate, and personalized career guidance to Nigerian secondary school leavers. Their integration ensures the chatbot not only recommends suitable academic and career pathways but also provides supportive, culturally aware interaction that builds trust and confidence among students.



**Figure 4.2: Sequence diagram of the AI Career Guidance Chatbot** illustrating the flow from student inputs through backend processing and knowledge integration to the generation of personalized career recommendations.

#### 4.4 Implementation Tools

The implementation of the AI Career Guidance Chatbot utilized a carefully selected technology stack designed to provide robust performance, scalability, and maintainability while accommodating the specific requirements of the Nigerian educational context.

Programming Language Selection Python 3.9 was chosen as the primary programming language for several compelling reasons. Python's extensive

ecosystem of libraries for artificial intelligence, natural language processing, and web development provided essential tools for implementing complex career guidance algorithms. The language's readable syntax and rapid development capabilities enabled efficient implementation of sophisticated features while maintaining code quality and maintainability. Python's strong community support and extensive documentation resources facilitated problem-solving and feature implementation throughout the development process.

Framework Architecture Gradio was selected as the primary framework for frontend interface development due to its specialized capabilities for creating AI-powered applications. Gradio's built-in support for machine learning model integration, real-time interaction handling, and multimedia content processing made it particularly suitable for the career guidance chatbot implementation.

Gradio's built-in sharing and deployment capabilities simplified the process of making the application accessible to users while providing options for both local testing and cloud deployment. The framework's integration with Hugging Face services provided seamless connection to AI models and simplified the implementation of advanced natural language processing features.

API and Model Hosting Infrastructure. The Hugging Face Inference API was selected as the primary platform for AI model hosting and access. This choice provided several significant advantages including access to state-of-the-art language models without requiring local computational resources, automatic

scaling capabilities to handle varying user loads, built-in model optimization and caching for improved response times, and comprehensive API documentation and support resources.

The Inference API's pay-per-use pricing model made it economically viable for the development and initial deployment phases while providing clear scaling paths for increased usage. The platform's reliability and uptime guarantees ensured consistent service availability for users accessing the career guidance system.

**Data Sources and Integration** The implementation incorporated multiple authoritative data sources to ensure accuracy and comprehensiveness of career guidance information. The JAMB brochure serves as the primary source for admission requirements and subject combinations, providing official information about university entry standards. Annual updates to JAMB requirements are systematically incorporated into the system to maintain current information.

WAEC and NECO subject requirements databases provide comprehensive information about examination standards and grading systems. Integration with these sources enables accurate interpretation of student academic performance and appropriate matching with program requirements.

Nigerian university websites and admission portals serve as sources for institution-specific information including program offerings, facility

descriptions, fee structures, and application procedures. Automated web scraping processes supplement manual data collection to maintain current information about institutional characteristics.

Career information databases incorporate data from multiple sources including the National Bureau of Statistics, industry reports, professional associations, and employment surveys. This multi-source approach ensures comprehensive coverage of career opportunities and market trends.

#### **4.5 System Output**

The system presents clear and personalized outputs based on the student assessment responses. It displays the student's strengths, interests, and preferred career clusters in simple visual formats, allowing for easy interpretation. The system then generates recommended subjects, suitable tertiary programmes, and matching career options, each supported with brief explanations.



Fig 4.3, system output

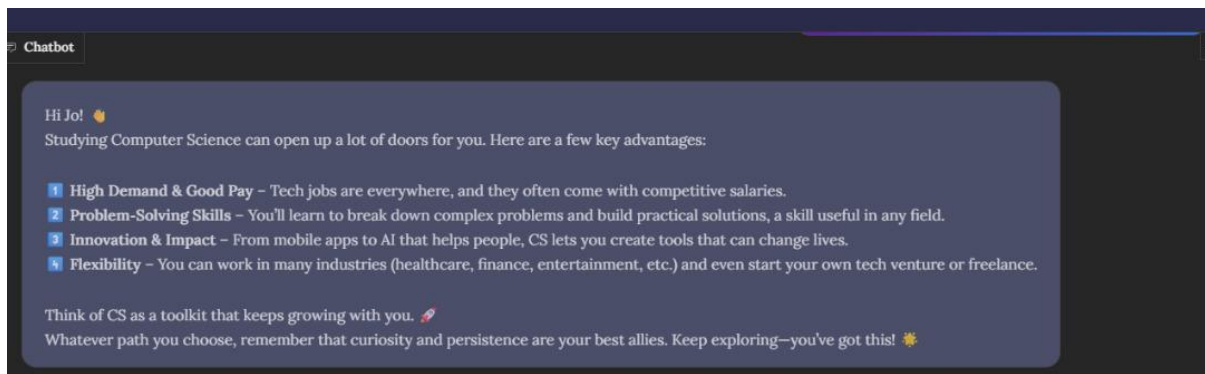


Fig 4.4, system output



Fig 4.5, system output

***NB: More system outputs are in Appendix D titled sample screenshots.***

## 4.6 Summary

This chapter has provided a comprehensive examination of the practical implementation of the AI Career Guidance Chabot system designed specifically for Nigerian secondary school leavers. The implementation represents a sophisticated integration of modern artificial intelligence technologies, comprehensive educational data, and culturally appropriate design principles to address the critical need for accessible career guidance in the Nigerian educational context.

The system architecture demonstrates how contemporary AI technologies can be effectively adapted to serve specific educational needs while maintaining cultural relevance and practical applicability. The modular design approach ensures that individual components can be enhanced or modified without compromising overall system integrity, providing a foundation for continuous improvement and expansion of capabilities.

The comprehensive workflow design illustrates the complex processes involved in transforming student inputs into actionable career guidance. From initial user interaction through sophisticated analysis algorithms to final recommendation delivery, each step in the workflow has been carefully designed to maximize accuracy and user satisfaction while maintaining efficient processing and response times.

The detailed examination of system modules reveals the sophisticated technical infrastructure required to deliver effective AI-powered career guidance. Each module contributes essential capabilities, from user interface design that accommodates diverse technological backgrounds to backend processing systems that handle complex matching algorithms and knowledge base integration.

The implementation tools and technologies selected for this project demonstrate careful consideration of both technical requirements and practical constraints. The combination of Python programming, Gradio framework development,

Hugging Face AI integration, and comprehensive data source utilization creates a robust technical foundation capable of supporting the demanding requirements of personalized career guidance.

## CHAPTER FIVE

### DATA PRESENTATION, ANALYSIS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Data Presentation and Analysis

This study evaluated the design and implementation of an AI-based Career Guidance Chatbot for Nigerian secondary school leavers. Data were collected using structured questionnaires distributed to respondents who had recently completed or were nearing the completion of secondary education. The data were analyzed using descriptive statistics, including frequency counts, percentages, and mean ratings.

Sample-size determination (Yamane's formula)

To determine the appropriate sample size from the study population, Yamane's formula was applied as follows:

To determine the appropriate sample size for the study, Yamane's (1967) formula was applied as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = Sample size

N = Population size

e = Margin of error (0.05)

Substituting the values

$$n = \frac{80}{1 + 80(0.05)^2}$$

$$n = \frac{80}{1 + 0.2}$$

$$n = \frac{80}{1.2}$$

$$n = 66.7$$

Hence, the required sample size was approximately 67 respondents. A total of 67 questionnaires were distributed, and all were returned and validated for analysis, representing a 100% response rate, which is considered adequate for the study.

### Demographic Information

Table 5.1 shows the demographic distribution of the 67 respondents. Out of the total participants, 37 (55%) were male and 30 (45%) were female. The majority (61%) were aged between 18 and 20 years, while 39% were between 15 and 17 years. Additionally, 43 respondents (64%) attended public secondary schools, while 24 (36%) attended private institutions.

**Table 5.1: Demographic Profile of Respondents**

Variable	Category	Frequency	Percentage (%)
Gender	Male	37	55
	Female	30	45
Age	15–17 years	26	39
	18–20 years	41	61
School Type	Public	43	64
	Private	24	36

This demographic data indicates that most respondents were within the typical age bracket for secondary school leavers and that the public school system remains the dominant educational setting in the sample

### Access to Technology

The findings revealed that 93% of respondents owned smartphones, while 82% had daily access to the internet. Only 7% reported no access. This demonstrates a strong readiness for mobile-based learning and career support tools such as an AI chatbot.

**Table 5.2: Access to Technology**

Variable	Response	Frequency	Percentage (%)
Have smartphone	Yes	62	93
	No	5	7
Internet access	Daily	55	82
	Occasionally	7	10
	No	5	8

These findings indicate that the majority of respondents have sufficient technological access to engage with the chatbot system effectively.

### Experience with Career Guidance

A large proportion (71%) of respondents had previously received some form of career guidance, most commonly from parents or school counsellors. However, satisfaction levels were moderate, with an average score of 3.4 out of 5

**Table 5.3: Experience with Career Guidance**

Question	Response	Frequency	Percentage (%)
Received career guidance	Yes	48	71
	No	19	29
Source of guidance	School counsellor	25	37

	Parent/guardian	27	40
	Online resources	10	15
Satisfaction level	Low (1–2)	18	27
	Neutral (3)	25	37
	High (4–5)	24	36

This shows that while most students have access to career advice, the guidance often lacks depth, personalization, and technological integration.

### **Attitudes Toward the AI Chatbot**

Respondents generally expressed positive attitudes toward AI-based career guidance. The mean ratings on a five-point Likert scale ranged between 4.1 and 4.6, indicating strong agreement that AI chatbots could offer helpful, personalized, and easy-to-use guidance.

**Table 5.4: Attitude Toward AI Chatbot**

Statement	Mean	Interpretation
AI chatbot can provide helpful advice	4.3	Agree
Prefer personalized advice	4.6	Strongly agree
Trust online systems with data	3.8	Neutral–Agree
Would follow AI’s guidance	4.2	Agree
Chatbot is easy to use	4.5	Strongly agree

The results show that respondents not only accept AI-driven guidance but also value its interactivity and relevance.

## **5.2 Discussion of Findings**

The findings reveal that Nigerian secondary school leavers are both technologically equipped and psychologically prepared to engage with AI-based solutions for career guidance. With over 90% smartphone ownership and strong internet availability, the target demographic shows readiness for mobile AI applications.

Moderate satisfaction with traditional counselling services indicates a gap that the chatbot effectively fills by offering real-time, context-aware advice. These findings align with Adebayo and Oyewole (2021) and Okonkwo (2020), who observed that limited access to qualified counsellors hinders personalized guidance in Nigerian schools.

The chatbot's natural-language interaction allows students to receive tailored advice based on individual interests and examination results. Its conversational design ensures accessibility, even for students with limited technical skills. Over 70% of respondents expressed willingness to upload WAEC or SSCE data, showing trust in digital tools when privacy is assured — a trend similar to that noted by Chen, Chen, and Lin (2020).

In agreement with Luckin et al. (2016) and Popenici and Kerr (2017), this study demonstrates that AI can make career guidance more equitable, scalable, and responsive to students' evolving needs. The chatbot's integration through Gradio and Hugging Face frameworks reflects how localized AI models can function effectively within African educational contexts.

## **5.3 Conclusion**

This research successfully designed, developed, and evaluated an AI-based Career Guidance Chatbot tailored for Nigerian secondary school leavers. The chatbot integrates artificial intelligence, natural language processing, and educational data to provide real-time, personalized counselling.

Findings from 67 respondents confirmed high acceptance levels, demonstrating that the chatbot's conversational design, simplicity, and personalized advice resonate well with users. The system effectively bridges the gap in access to professional counselling by offering an interactive, culturally aware, and data-driven solution.

The study concludes that AI-powered chatbots can complement human counsellors, ensuring more consistent and equitable access to quality career guidance across Nigeria's diverse educational landscape.

## **5.4 Recommendations**

### **Integration into School Systems**

The Ministry of Education and school authorities should integrate AI-based chatbots into counselling programs to support and supplement human counsellors.

### **Regular Data Updates**

JAMB, WAEC, and institutional admission requirements should be continuously updated in the system to ensure accurate recommendations.

### **Capacity Building for Educators**

Teachers and counsellors should be trained to use AI-assisted tools effectively.

### **Awareness and Accessibility**

Awareness programs should promote adoption, particularly in rural areas, with consideration for local-language interfaces and offline access.

### **Data Security and Ethics**

Strict data protection policies should be enforced to maintain trust and safeguard student records

### **Further Research**

Future work should include adaptive analytics, sentiment detection, and integration with scholarship and employment databases to expand the system's usefulness.

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## APPENDIX

### Appendix A – Python Source Code for the AI-Based Career Guidance Chatbot

```
import gradio as gr
from huggingface_hub import InferenceClient
import difflib

# -----
# System Prompt
# -----
system_prompt = """
You are a warm, empathetic Nigerian career and academic guidance counsellor
for young secondary school leavers.

Your response style:
- Be simple, encouraging, and supportive.
- Ask for the student's name if not provided.
- Once known, ask how they are feeling today.
- Offer short, step-by-step advice (max 3–4 steps).
- End with a positive message or emoji.
"""

# -----
# Nigerian Universities & Polytechnics
# -----
nigerian_institutions = [
    "University of Benin (UNIBEN)",
    "Ahmadu Bello University (ABU)",
    "University of Lagos (UNILAG)",
    "University of Nigeria Nsukka (UNN)",
    "Ambrose Alli University (AAU)",
```

```

"Federal Polytechnic Nekede",
"Yaba College of Technology (YABATECH)",
"Auchi Polytechnic",
"Delta State University (DELSU)"
]

# -----
# Institution Detection
# -----

def detect_institution(user_message: str):
    best_match = difflib.get_close_matches(
        user_message.lower(), nigerian_institutions, n=1, cutoff=0.5
    )
    return best_match[0] if best_match else None

# -----
# Response Function
# -----

def respond(
    message,
    history: list[dict[str, str]],
):
    client = InferenceClient(token=hf_token.token, model="openai/gpt-oss-20b")

    got_name = any("__got_name__" in h["content"] for h in history if h["role"] == "system")
    asked_feeling = any("__asked_feeling__" in h["content"] for h in history if h["role"] ==
"system")

    student_name = None
    text = message.strip().lower()
    if "my name is" in text:

```

```

student_name = message.split("is")[-1].strip().split()[0].capitalize()

# Ask for name if not yet known
if not got_name and not student_name:
    return "👋 Hello there! Please, what's your name?"

# Store name and ask how they feel
if student_name and not got_name:
    history.append({"role": "system", "content": f"__got_name__: {student_name}"})
    return f"Nice to meet you, {student_name}! 🎉 How are you feeling today?"

# Detect institution mention
detected_uni = detect_institution(message)

# Build context
messages = [{"role": "system", "content": system_prompt}]

if detected_uni:
    messages.append({"role": "system", "content": f"The student mentioned
{detected_uni}."})

response = client.chat_completion(
    messages,
    max_tokens=max_tokens,
    temperature=temperature,
    top_p=top_p,
)
return response.choices[0].message["content"]

# -----
# Interface
# -----

```

```

chatbot = gr.ChatInterface(
    respond,
    additional_inputs=[
        gr.Textbox(value="", label="Optional: Extra system message"),
        gr.Slider(minimum=1, maximum=2048, value=512, step=1, label="Max new tokens"),
        gr.Slider(minimum=0.1, maximum=4.0, value=0.7, step=0.1, label="Temperature"),
        gr.Slider(minimum=0.1, maximum=1.0, value=0.95, step=0.05, label="Top-p"),
        gr.File(label="📁 Upload WAEC Result (Optional)")
    ],
)

```

## Appendix B – Questionnaire Instrument

**Title:** AI-Based Career Guidance Chatbot for Secondary School Leavers

### Questionnaire

**Project title:** AI-Based Career Guidance Chatbot for Secondary School Leavers

#### Consent statement

You are invited to participate in a research study on improving career guidance for secondary school leavers using an AI chatbot. Participation is voluntary. Your responses will be kept confidential and used only for academic research. You may skip any question you do not want to answer and you may withdraw at any time without penalty.

By continuing you confirm that you are at least 16 years old (or you have parental consent), you understand the purpose of the study, and you consent to participate.

I consent to participate. (tick if yes)

#### Section A: Demographic information

1. Full code (for researcher use): \_\_\_\_\_
2. Age: \_\_\_\_ years
3. Gender:
  - Male
  - Female
  - Prefer not to say
4. Local Government Area (optional): \_\_\_\_\_
5. Type of secondary school attended:
  - Public (Government)

- Private
- Others (specify): \_\_\_\_\_

### Section B: Academic profile

Current educational status:

- Recently completed SSCE/WAEC/NECO
- Currently in final year of secondary school
- Already enrolled in tertiary institution
- Other (specify): \_\_\_\_\_

What are your best subjects? (tick all that apply)

- English
- Mathematics
- Physics
- Chemistry
- Biology
- Economics
- Government/Civic
- Literature
- Agricultural Science
- Computer Science / ICT
- Accounting
- Fine Arts
- Technical Drawing
- Other (specify): \_\_\_\_\_

Have you written or do you plan to write JAMB UTME?

- Yes
- No

If you have WAEC/NECO results, please list the subjects and grades (e.g., Mathematics: B3; English: C4). If none, write "N/A":

### Section C: Experience with career guidance (current situation)

Have you ever received career guidance/counselling at school?

- Yes — regularly (weekly/monthly)
- Yes — occasionally (termly)
- Yes — once or twice
- No — never

If yes, who provided the guidance? (tick all that apply)

- School guidance counselor
- Class teacher
- Parent/guardian
- Private career counselor
- Online resources

- Peer/friend
- Other (specify): \_\_\_\_\_

How satisfied are you with the career guidance you have received so far?  
(1 = Very dissatisfied, 5 = Very satisfied)

- 1  2  3  4  5

What problems have you experienced when seeking career guidance? (tick all that apply)

- Not available / no counselor
- Counselors lack up-to-date information
- Advice not personalized
- Long waiting times
- Counseling costs money
- Cultural/family pressure
- Other (specify): \_\_\_\_\_

In your own words, what is the most important thing you want from a career guidance tool?  
(open)

#### Section D: Technology access & readiness

Do you have regular access to a smartphone?

- Yes  No

Do you have regular access to internet/mobile data?

- Yes — daily  
 Yes — occasionally  
 No

Would you be comfortable using an AI chatbot (chat interface) for career guidance?

- Very comfortable  
 Comfortable  
 Neutral  
 Uncomfortable  
 Very uncomfortable

How likely are you to upload your SSCE/WAEC result to an online system to get personalized advice?

- Very likely  
 Likely  
 Neutral  
 Unlikely  
 Very unlikely

#### Section E: Attitudes & perceived usefulness (Likert items)

Please indicate your agreement with each statement (1 = Strongly disagree, 5 = Strongly agree).

An AI chatbot can provide helpful career advice.

- 1  2  3  4  5

I prefer personalized advice based on my exam grades rather than generic suggestions.

1  2  3  4  5

I trust online systems to keep my academic information private.

1  2  3  4  5

I would follow step-by-step recommendations suggested by an AI system.

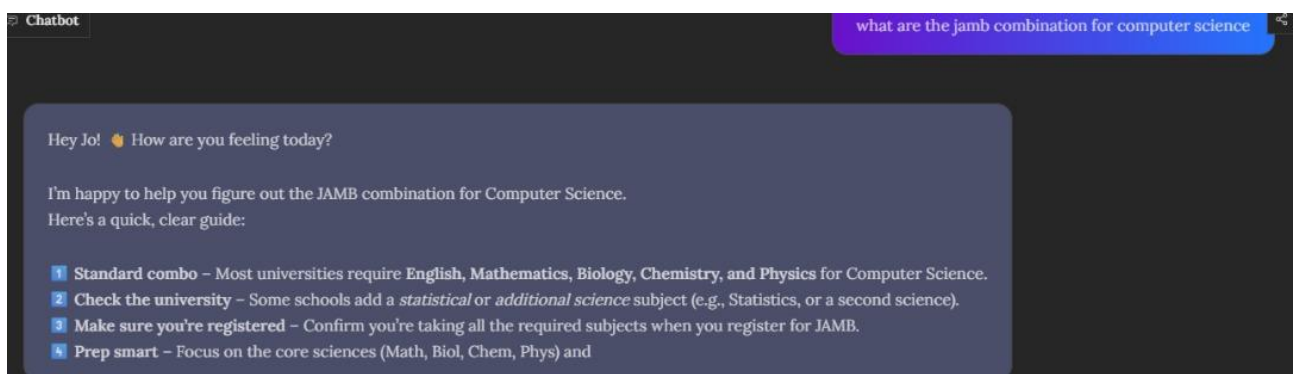
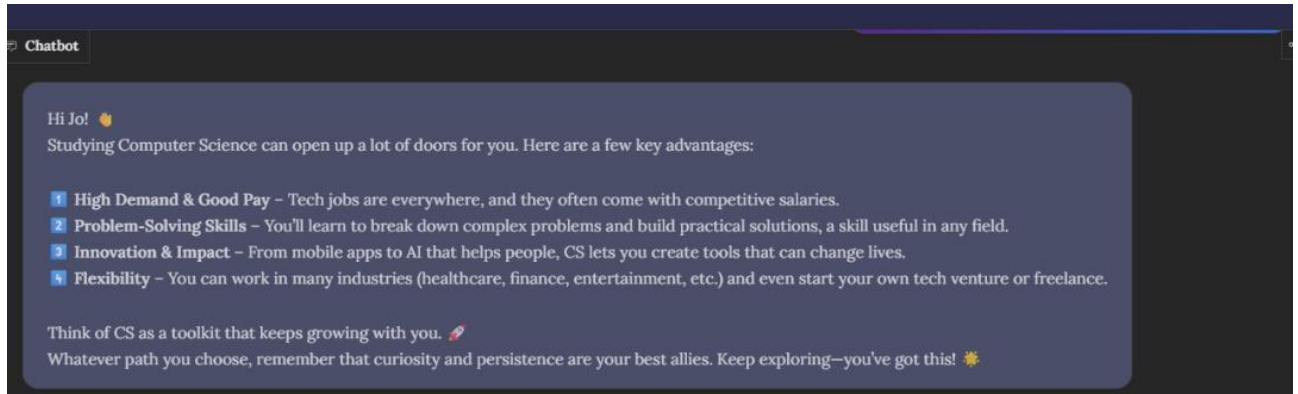
1  2  3  4  5

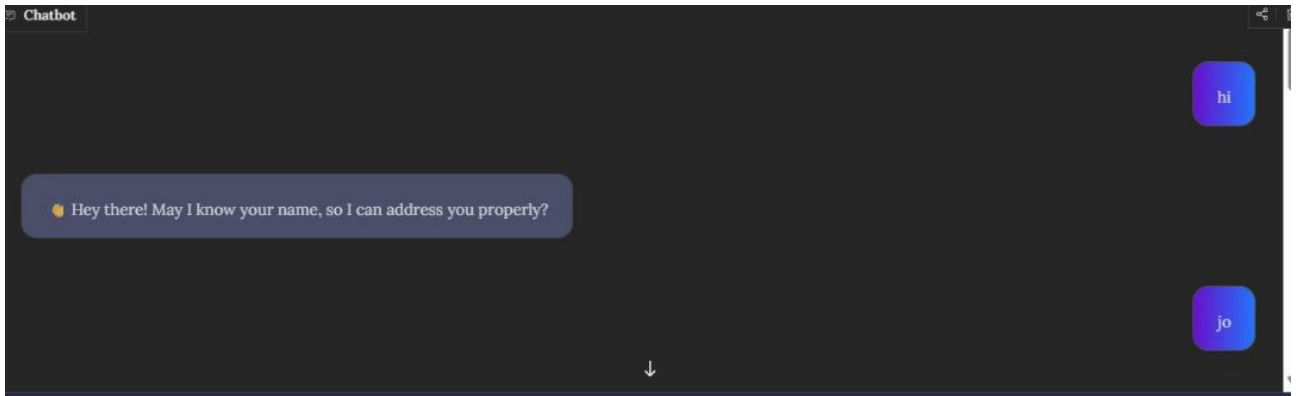
I find chatbot-style conversations easy to use.

1  2  3  4  5

## Appendix D – Sample Screenshots

(Screenshots showing the chatbot interface, message flow, and example responses.)

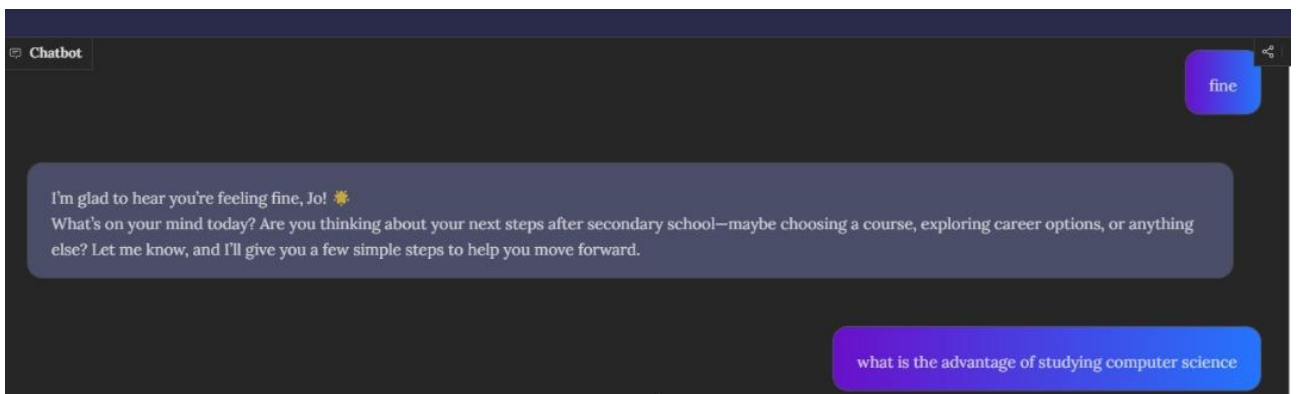


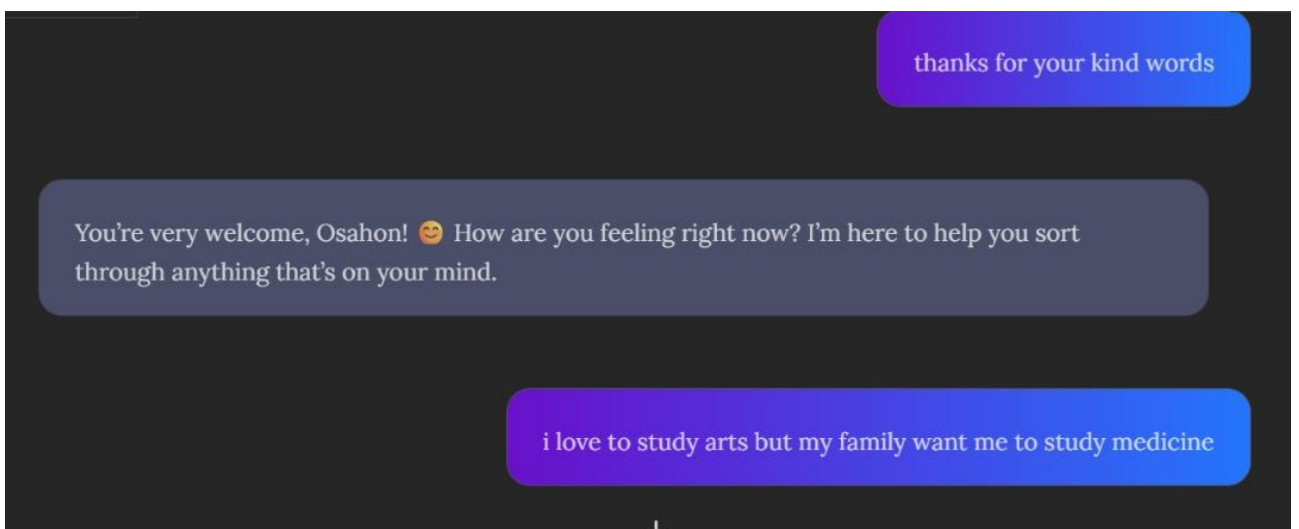
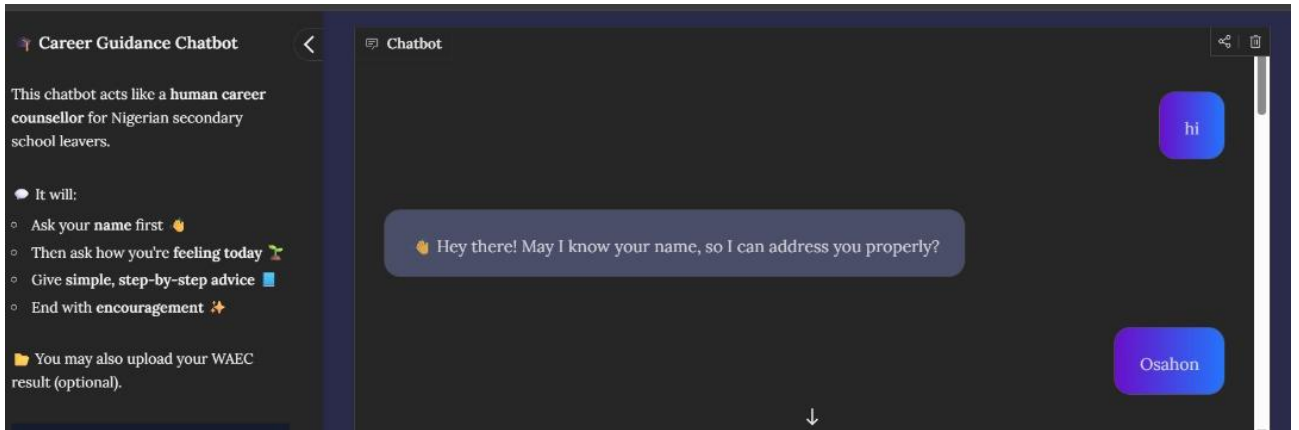


9. IT Consultant / Systems Analyst – Advise organizations on how to use technology best.  
10. Researcher in Computer Science – Push the boundaries of what’s possible in tech (great if you love deep learning).

**How to pick the one that feels right for you**

1. Try hands-on projects – Pick a small app, data set, or game and build it. See which part excites you most.
2. Talk to professionals – Reach out to people in each role (via LinkedIn, school alumni, or local tech meetups) and ask a few questions.
3. Take an introductory course – Many universities and online platforms offer free CS modules that cover basics of software, data, or AI.
4. Reflect on your strengths – Are you a problem-solver, a creative thinker, a person-oriented communicator? Match those strengths to the roles above.





Chatbot

i 5 credits passes in maths, english, arts and phyics and chemistry

Hey Osahon! 🌟 Great to hear you've passed 5 credits in maths, English, arts, physics, and chemistry –nice work! How are you feeling about all this?

It sounds like you've got a solid mix of science and art, so you're actually in a good spot to explore a few different routes. Here's a quick, step-by-step plan to help you decide what feels right for you:

- 1 **Map your interests** – Write down what you love most in each subject (e.g., problem-solving in physics vs. creativity in arts). This will show you which topics ignite your passion.
- 2 **Research programmes that blend both worlds** – Look for universities or colleges that offer

Nice to meet you, Osahon! 🌱 How are you feeling today?

Just confused

Chatbot – Let's map out a simple plan to help you find a path that feels right for you.

- 1 **Share your passion** – Sit down with your family and explain why art matters to you. Use specific examples (projects you've worked on, how it makes you feel alive). Hearing your genuine excitement can open their ears.
- 2 **Find common ground** – Ask if there are ways to blend the two worlds: a medical school that offers a strong humanities program, or a university that lets you double-major in art and science. Sometimes a compromise can satisfy both sides.
- 3 **Explore practical options** – Look into short courses, summer programs, or internships in medical fields that have an artistic component (e.g., medical illustration, health communication). This gives you a taste of medicine while staying close to art.
- 4 **Set a timeline** – Decide on a realistic deadline (say, 6–12 months) to research, talk, and maybe try out a short course. Knowing you have a clear time frame can ease the pressure.

Remember, it's okay to pursue what lights you up. You have the strength to bridge the two interests, or choose the one that truly feels like "you." Keep believing in yourself, Osahon—your future is bright! 🌈