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REPORT

Utilizing M-Technologies for AI-Driven Career Guidance in Morocco: An Innovative Mobile Approach

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ABSTRACT

In today's interconnected world, the significance of effective career guidance has been magnified. With the advent of mobile technologies, e-orientation and artificial intelligence (AI)-orientation systems offer a promising avenue for personalized career guidance. This paper delves into the potential of transitioning from traditional e-orientation to advanced AI-orientation systems in Morocco by employing large language models (LLMs) such as LLAMA2, GPT, and PaLM. These LLMs, renowned for their human-like text generation and contextual understanding, are proposed as the backbone for AI chatbots that can serve as virtual career counselors. Accessible via mobile platforms, these mobile chatbot interfaces can provide real-time insights on career paths, educational prerequisites, and job market dynamics and outlooks. Despite challenges such as Internet reliability, data privacy, and legislative regulations, the integration of AI-orientated systems into mobile platforms can revolutionize career guidance for Moroccan students. This paper presents a detailed roadmap and implementation for embedding these innovative technologies into Morocco's educational framework.

KEYWORDS

M-technologies, mobile learning, artificial intelligence (AI) orientated systems, e-orientation systems, career guidance, large language models, LLAMA2, GPT, PaLM, mobile career counseling

1 INTRODUCTION

Choosing a career is a pivotal moment in a student's journey, and the right guidance can set them on a path that resonates with their passions, skills, and goals. Traditional career guidance methods often fall short of offering the personalized touch needed for each student. In the age of mobile technology, innovative tools like e-orientation and artificial intelligence (AI)-orientated mobile systems are emerging as potential significant changes [1].

Career guidance is a well-established field with numerous theories and methods outlined within the literature, such as Holland's vocational choice theory, which

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could potentially be transformed through AI and mobile technology systems. A body of recent studies indicate a positive trend in using AI for e-orientation in career guidance [2]. Globally, countries such as the United States, Australia, Singapore, and many others have begun harnessing the immense potential technology offers within this sector [2].

Existing literature on AI used for career counseling has demonstrated its capability to provide personalized guidance powered by machine learning (ML) techniques [3]. However, these studies also point out potential challenges regarding data privacy and language compatibility [3].

In the context of Morocco and the larger MENA region, the specific socio-cultural and linguistic contexts require a customized, culturally sensitive approach to advancing technological innovation in career guidance [3]. Understanding the unique needs and barriers of students in the region is paramount.

However, despite the promising opportunities AI provides, the adoption of AI and e-orientation systems is far from straightforward.

From the perspective of the theoretical frameworks underpinning career counseling, technology stands to revolutionize the field significantly. For instance, Super's career development theory, which emphasizes the development of self-concept as a critical task for vocational maturity, could be supported by AI systems that can provide personalized feedback and interactive reflection opportunities for self-evaluation [4].

1.1 E-orientation system

E-orientation platforms, accessible via mobile devices, function as a digital compass, illuminating various career options, educational trajectories, and opportunities. However, their limitation lies in offering bespoke guidance, which is where AI-orientation systems, powered by large language models (LLMs) technologies, come into play.

E-orientation systems also refer to online platforms that provide students with organized information and guidance about different careers, learning paths, and future opportunities [5]. These systems offer the advantage of easy accessibility, enabling students to access critical information at their convenience [6]. However, the capabilities of e-orientation systems are limited in terms of providing personalized guidance, which is where AI-orientation systems can step in because many students are not fully aware of their needs and context [7].

E-orientation platforms serve as a digital scope for students to show different prospects. These online systems prove invaluable due to their easy accessibility, granting students the freedom to tap into crucial information whenever they wish [8]. However, are they aware of how to use this information and comprehend its usage to the benefit of their guidance?

Therefore, e-orientation m-platforms provide an informative overview of the opportunities available to students [9]. However, these e-orientation tools have constraints when it comes to offering tailor-made guidance; that's where AI orientation systems offer more value to students [9].

1.2 AI-orientation system

AI-orientation systems, integrated into mobile platforms, leverage AI technologies, especially LLMs, to offer tailored guidance. These systems can mimic career

counselors, offering advice based on academic performance, interests, and aspirations. With the global trend of integrating AI into mobile platforms for career guidance, Morocco stands on the cusp of a transformative phase in its educational sector.

AI orientation systems take e-orientation a step further by incorporating AI technologies, such as multiple LLMs, and fine-tuned knowledge bases to offer personalized guidance to students [10]. LLMs, such as Facebook's LLAMA2, OpenAI's GPT4, and Google's PaLM, are trained on vast amounts of text data, enabling them to generate human-like text, understand context, and provide relevant responses. When integrated into orientation systems, these LLMs can effectively simulate the role of a career counselor, providing individualized advice based on each student's academic performance, interests, and career aspirations [11].

The use of AI and e-orientation in mobile systems for career guidance is not without precedent. Countries across the globe, especially in the developed world, have started harnessing these technologies to revolutionize their career guidance infrastructures [12]. Morocco, a North African country with a large young population, represents fertile ground for implementing these systems [13]. The Moroccan education system has been grappling with the challenge of providing effective and personalized career guidance to its vast student population [13]. The incorporation of AI and e-orientation systems could potentially transform this landscape, providing personalized and dynamic guidance to Moroccan students [14].

This paper aims to explore the potential application of AI-orientated systems for career guidance in the context of Morocco. We propose an implementation path, discuss the potential benefits, and highlight the challenges that might be encountered along the way in conceptualizing these AI tools. We hope that this research will contribute to the discourse on technological innovation in career guidance and lay the groundwork for future research in AI m-technologies and implementation efforts in Morocco and beyond [14].

2 RELATED WORK

A successful implementation of an AI orientation manifest as a chatbot in the educational sector can be seen in the case study of the Big Data and Data Science Master cycle in the Ben M'Sick Faculty of Sciences, Hassan II University in Casablanca, Morocco [15].

The chatbot was developed to assist students in integrating into the job market by finding jobs suited to their preferences. The chatbot was designed to be an e-orientation agent for students, not an AI agent, helping them understand their personality types based on professional psychometrics and the jobs best suited to their type, according to the theory of John Holland [16]. The results of this implementation were satisfactory, demonstrating the potential of such an approach in the educational sector.

This case study provides evidence of the feasibility and effectiveness of chatbots in guidance electronic systems, supporting the argument for the increased use of technology in education in general and in orientation in particular. However, the limited capacity of personalization and individualization reduces the implementation to the category of e-orientation, and it requires a vast language knowledge base such as the ones introduced in late 2022 and early 2023.

The success of this implementation suggests that AI-orientated chatbots can be beneficial in various educational contexts, providing personalized, instant support to students [17].

This case study illustrates paths on how AI orientation chatbots can be effectively implemented in the sector of guidance, providing valuable insights for future developments in this field [18].

3 METHODOLOGY

The paper proposes a structured four-step methodology for developing an AI-orientated system tailored for mobile platforms: data collection, model development, model training, and testing. This approach ensures the system is centered on the needs of Moroccan students, addressing unique cultural and logistical challenges.

In developing an appropriate AI-orientation system, a structured methodology is crucial. We propose a four-step process:

1. Data collection: Our primary data collection will be through hot surveys, interviews, and focus groups with stakeholders, such as students and career counselors. The aim is to ascertain the specific needs for an AI-orientation system and perspectives in the Moroccan context.
2. Model development: We plan to utilize No-Code platforms such as Flowise as a starting point for our AI-orientation system and work on it to customize the architecture to meet our specific needs. The fine-tuning would happen after the data collection phase, which would allow us to tailor the AI-orientated system to suit our demographic more efficiently.
3. Model training: For model training, we will use a dataset uniquely extracted from public platforms for this purpose. The dataset is to be annotated against a framework developed by seasoned experts and professionals in the field of career guidance. This approach allows us to train the model to cater to the specific cultural and linguistic context of Moroccan students.
4. Testing: We plan to establish rigorous evaluation protocols that include both qualitative and quantitative methods. We will measure user engagement, satisfaction, guidance accuracy, outcome tracking etc. Over time, we will be able to demonstrate the evolution and effectiveness of the AI-orientation system and identify any required adjustments.

This comprehensive approach ensures that our AI-orientation system is designed and prioritized around the needs of Moroccan students and career counselors. We understand that it is significant to address cultural and logistic hurdles unique to Morocco, which involves meticulous and intensive labor, especially in data generation and model fine-tuning [19].

The advent of AI and ML has enabled the development of highly sophisticated models capable of processing and understanding large volumes of text data. Known as LLMs, these AI tools are key to our proposed implementation of AI orientation systems for career guidance in Morocco [20].

In the era of AI and ML, LLMs such as Generative Pre-trained Transformer (GPT), Pathways Language Model (PaLM), and Low-Latency Attentive Memory Architecture (LLAMA2) represent the bleeding edge of technology. However, it is important to note that these powerful tools are the product of Big Tech entities such as OpenAI, Google Alphabet Inc., and Facebook Meta Inc.

While theoretically feasible, the creation of a comparable model from scratch presents significant practical challenges, primarily due to the massive computational resources and specialized expertise required [21]. The process involves not

only the initial model training but also ongoing refinement and adaptation, requiring a significant investment of time, money, and skill.

Consequently, for the purpose of this manuscript, we have opted to leverage these pre-trained models, which offer both high performance and cost-effectiveness. Their use provides a sensible and efficient solution to gain the benefits of advanced language understanding and generation without the prohibitive overheads of creating a model from the ground up.

LLMs are trained on vast amounts of text data from the internet, learning from billions of sentences to understand the semantics and structure of human language. Notable LLMs include OpenAI's GPT, which is the most popular, and its debut on the tool called "ChatGPT" has opened the door to many applications and innovations not only in the educational or technological sectors but in aspects of the fabric of assistance services in other sectors. LLM models can generate human-like text, understand context, and provide relevant responses, making them well-suited for creating interactive AI-orientated chatbots.

3.1 Comparison of large language models

Each LLM offers some advantages and has some inconveniences. Furthermore, this comparison list offers recommendations that will guide the choice LLM used. Although there are a lot of open-source and commercial models, the focus on the following three models is justified by their integrability, accessibility, and availability in the mobile digital market in Morocco [21].

- **LLAMA2**
  - Model size: With a model size of 1.37 trillion parameters, LLAMA2 is significantly larger than GPT but smaller than Google's PaLM.
  - Training data: LLAMA2 is trained on publicly available Internet data, which questions the quality of responses in guiding students.
  - Accessibility: One of the key advantages of LLAMA2 is that it is open source. This makes it more accessible for developers and reduces the dependency on API access for use.
  - Languages support: LLAMA2 supports twenty languages, which is less than GPT and PaLM.
  - Strengths: LLAMA2 is noted for its ability to generate original creative text because of its large database of parameters used in its development.
  - Weaknesses: The model size compared to GPT and PaLM could limit its performance on complex tasks because of its creative use rather than its laser-focused development.

- **GPT**
  - Model size: GPT, first introduced by OpenAI, has a model size of 175 billion parameters, making it smaller than both LLAMA2 and PaLM.
  - Training data: GPT is trained on a private and efficiently cleaned dataset.
  - Accessibility: GPT is not open source, meaning API access is needed to use the model, potentially increasing the cost of deployment.
  - Languages support: GPT supports twenty-six languages, slightly more than LLAMA2 but significantly fewer than PaLM.
  - Strengths: GPT is particularly good at answering questions and can be used for chatbot applications, which is the case in ChatGPT.

- Weaknesses: Its primary weakness is that it is not open source, which limits its accessibility and can incur additional costs for use. And because of the nature of the closed, less updated data, it is less likely to offer current information in guidance.

- **PaLM**
  - Model size: Google's PaLM is a robust model with a size of 540 billion parameters. It is smaller than LLAMA2, but significantly larger than GPT. Furthermore, PaLM has access to current published information on the web.
  - Training data: Like GPT, PaLM is trained on a private dataset.
  - Accessibility: PaLM is not open source and is closed to third parties, meaning API access is needed to use the model.
  - Languages support: PaLM supports more than one hundred languages, significantly more than both GPT and LLAMA2.
  - Strengths: PaLM excels at a wide range of tasks, including coding, translation, and laser-focused productive tasks in the Google ecosystem of applications.
  - Weaknesses: Despite its strengths, PaLM is not open source, limiting its accessibility for third-party use.

Table 1. Comparison table of popular LLMs used for AI-Orientation

Properties	LLAMA2	GPT	PaLM
Size	+	–/+	–/+
Knowledge base	–	–/+	+
Accessibility	+	–/+	–
Languages	–	–/+	+
APIs	+	–/+	–
Usefulness**	–/+	+	–/+

Notes: "+" stands for positive characteristics and "–" stands for negative ones; **Stands for its capability to be deployed and implemented in the context of the paper.

While all these models have their own unique strengths and weaknesses, GPT was the first of its kind and has proven its worth in various applications. Google's PaLM, although powerful, is closed to third parties while authoring this article. Facebook's LLAMA2, despite being open source, remains another option, but due to its relative weaknesses in focusing on creative text compared to the others, slows the decision to use it for AI-orientation is slow.

The decision on which model to use would depend on the specific requirements of the chatbot application, taking into consideration factors such as cost, language compatibility, and the model's strengths in relation to the chatbot's intended functions.

In the development phase of these chatbots, the fine-tuned personalized knowledge base challenge will be encountered. Therefore, it is important to address the lack of an appropriate knowledge base for fine-tuning the LLM models for the needs to build AI-Orientation chatbot. The creation of a comprehensive, locally relevant, and up-to-date knowledge base is a critical aspect that needs to be addressed in the implementation plan.

Moreover, to effectively guide students, these chatbots need to be more than simple response generators; they need to emulate the characteristics of a good career counselor. This necessitates the collection of relevant information from the students,

including their academic performance, interests, and career aspirations. By processing this information, the AI model can provide personalized guidance and suggestions to the students.

3.2 Progressive implementation strategy of AI orientation systems

A progressive strategy of AI orientation system refers to a methodical approach to rolling out changes or new initiatives in stages, rather than all at once. This approach is often used to manage risk, to make the implementation process more manageable, and to allow for adjustments to be made based on feedback or early results from the initial stages.

The general outline of implementation includes six steps: conceptualizing, testing, evaluation, partial implementation, re-evaluation, and full implementation. This progressive approach allows for better management of potential risks and problems that can occur when making significant changes or implementing new initiatives [22].

In the context of our manuscript, this strategy has been adapted in a multi-step approach that focuses on faster implementation for testing and evaluating the usefulness of the AI-orientation tools for the benefit of Moroccan students.

1. **Developing a functional AI Orientation Chatbot (Conceptualizing):** The first step is to choose an appropriate LLM for developing the chatbot and use a pre-developed chat UI to create an MVP ready for usage and testing. The choice of LLM would depend on numerous factors, including the specific capabilities of the model, cost considerations, and the model's compatibility with the intended platform.
2. **Integrating the Chatbot into a web platform (Integration):** To ensure accessibility, the chatbot should be integrated into a web-based platform that students can access at their convenience. This integration involves developing a user-friendly interface and ensuring the smooth functioning of the chatbot on the platform. However, the need for web services servers and API access could incur substantial costs, which is a factor to be considered.
3. **Data collection and personalization (Testing and Evaluating):** To provide personalized guidance, the chatbot would need access to information about the students and the expertise of the professional student guidance core. This information could be collected through an initial questionnaire about when the students first used the system and from a feedback form sent to the orientation professionals that work with the students. Based on the student's interactions and feedback, the knowledge base for contextual AI orientation can offer personalized advice and guidance.
4. **Continuous learning and updating (Re-Evaluating and Re-Implementation):** AI LLM models are dynamic tools that can learn and improve over time with the help of a fine-tuned knowledge base. Through continuous feedback, the chatbot can refine its guidance strategies, increasing its effectiveness over time.

3.3 Training and fine-tuning of LLMs

Large language models are initially trained on a diverse range of Internet texts. However, to specialize them for the task of career guidance, they need to be fine-tuned on a more specific dataset. This dataset should ideally consist of dialogues

and text related to career advice, educational pathways, and job market trends. The fine-tuning process involves continuing the training of the LLM on this new dataset, allowing the model to adapt its generated responses to the context of career guidance.

3.4 Data collection for personalization

To provide personalized career guidance, the chatbot needs access to information about the expertise and experiences of professionals that work with students. This information could include academic performance, interests, career aspirations, and other relevant data. To collect this data, students and professionals could be asked to fill out a detailed questionnaire when they interact with the chatbot.

The questionnaire could include questions about the student's aspirations, subjects of interest, extracurricular activities, career goals, and other relevant information. The responses to this questionnaire are then used to personalize the guidance provided by the chatbot.

To ensure the privacy and security of the data, all data collection processes should comply with relevant data protection regulations. The data should be stored securely and only used for the purpose of providing career guidance.

To maintain the effectiveness of the chatbot over time, it is important to implement a system for continuous learning and updating. This could involve periodically retraining the model on updated data as well as implementing a feedback system where students can rate the usefulness of the chatbot's responses. This feedback can then be used to further fine-tune the model, helping to improve the quality of the guidance provided over time [23].

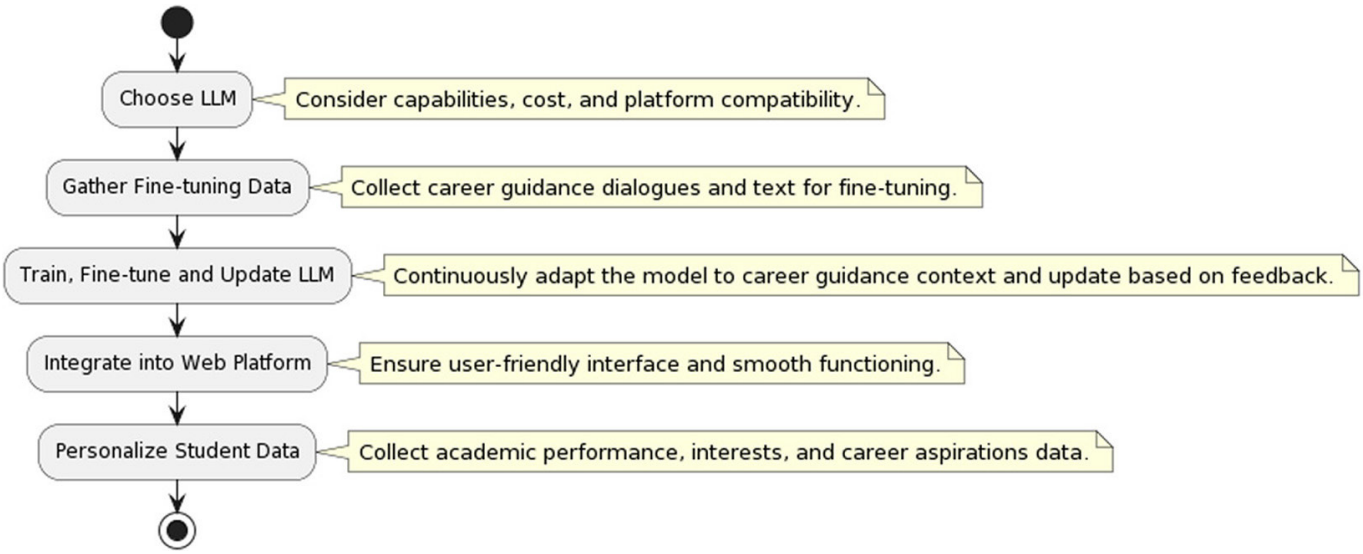

Fig. 1. AI and E-orientation system implementation process

3.5 Challenges and opportunities

Implementing an AI-orientated system in Morocco is a journey that comes packed with a set of exciting opportunities as well as formidable challenges.

In terms of challenges, data integrity, privacy, and protection present a significant hurdle. Robust safeguard measures need to be implemented, ensuring compliance

with relevant data protection regulations and secure storage and usage of student-related data. Additionally, language compatibility is another potential issue, given Moroccan linguistic diversity. Developing an AI-chatbot to cater to the Moroccan context will require extensive resources and processing capabilities.

Despite these challenges, the potential advantages are vast. Of notable significance is the opportunity for personalized guidance. By providing each student with tailored advice based on their academic performance, interests, and aspirations, these systems take career guidance to a new level. They democratize access to quality guidance by overcoming barriers like geographical location and socio-economic status.

This exploration extends avenues for further studies in several areas, including understanding best implementation practices for AI-orientated systems in developing countries, exploring collaborations with technology firms, and developing affordable, scalable infrastructure solutions for chatbot deployment [24].

4 RESULTS

Evaluating the robustness of our AI-oriented system is a central concern. We engaged a diverse group of students, gauged their satisfaction and usability using different engagement metrics, and offered them an opportunity to share qualitative feedback—both positive comments and criticisms.

One crucial finding was a noticeable increase in user engagement over time. A higher frequency of system uses and longer duration of interactions was a trend, which indicated growing trust in the system's utility and effectiveness. This, along with other metrics such as satisfaction surveys and an alignment between the system's guidance and students' career aspirations, painted a positive picture of the AI-orientation system in action.

Gathering qualitative feedback also provided insights into its evolution. As the training data increased, students expressed that the chatbot could better understand and respond to their queries. Although initial responses had room for improvement, continuous learning from the chatbot led to more effective and personalized guidance.

The proposed implementation of an AI orientation system in Morocco seeks to revolutionize the landscape of career guidance in the country, making it more personalized, dynamic, and accessible. The use of LLMs such as Facebook's LLAMA2, OpenAI's GPT, and Google's PaLM holds the promise of creating interactive chatbots capable of serving as virtual career counselors.

The AI chatbot, integrated into a web-based platform, is designed to provide a wide range of information to students. This information includes different career paths, the educational requirements for each path, potential future opportunities, and forecasts of job market trends. The breadth and depth of this information can provide students with a comprehensive overview of their potential career paths, helping them make informed decisions about their future.

The use of LLMs ensures that the guidance provided by the chatbot is not just informational but also personalized. By processing the information provided by the students, including their academic performance, interests, and career aspirations, the chatbot can offer tailored advice and suggestions. This personalized approach has the potential to enhance the effectiveness of the guidance process.

The implementation of an AI-oriented system also comes with the advantage of dynamism. As AI models can learn and improve over time, the chatbot can continually refine its guidance strategies based on feedback. This continuous improvement

can help ensure that the guidance provided remains relevant and effective in the face of changing educational trends and job market dynamics.

The online platform also increases the accessibility of career guidance. With the widespread use of the Internet, students from various parts of Morocco, including remote and rural areas, can access the guidance system. This accessibility can help democratize career guidance, ensuring that all students, irrespective of their geographical location or socio-economic status, can make informed decisions about their future.

While the implementation of AI-orientation system holds significant potential, it also presents certain challenges, which will be discussed in the next section.

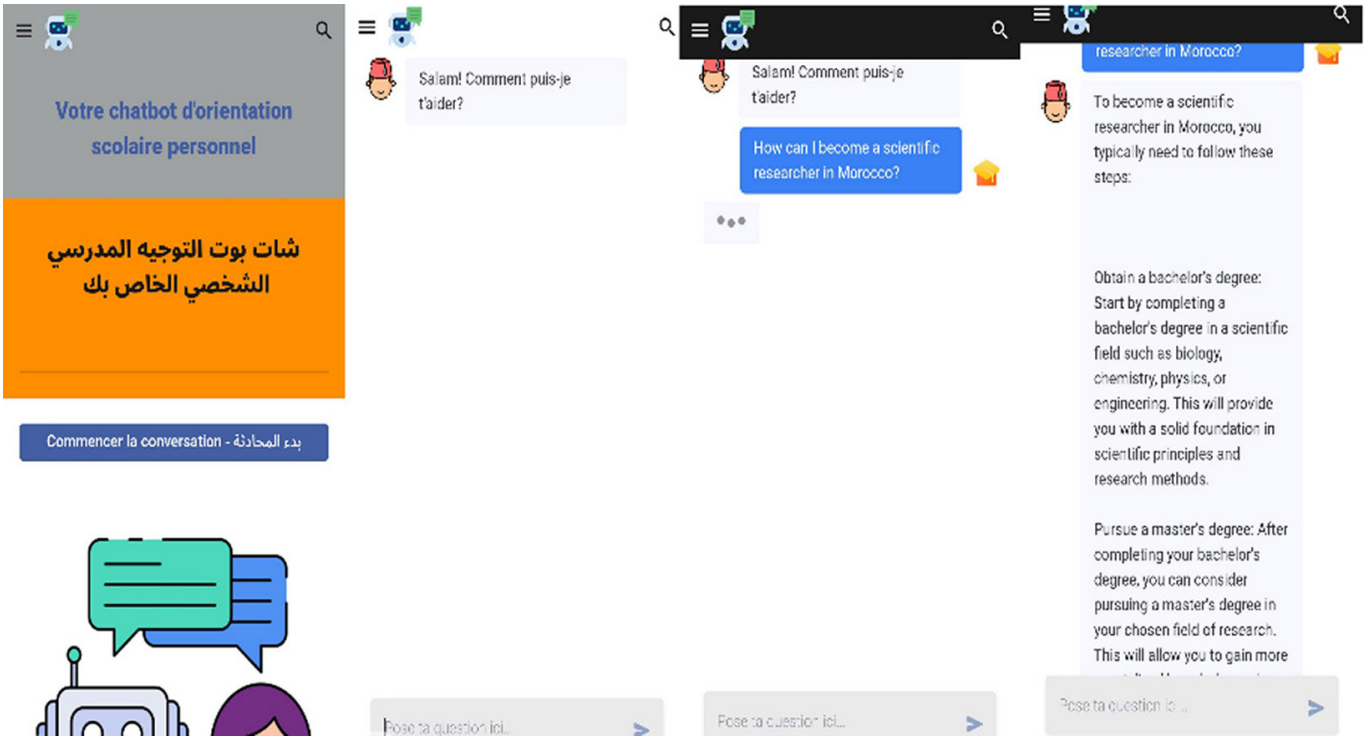

Fig. 2. Screenshots of a Moroccan AI-orientated Chatbot in use

4.1 Evaluating the success of the implementation

To evaluate the success of the AI-orientation system implementation, it is crucial to establish key performance indicators (KPIs). These KPIs will provide quantifiable measures to gauge the system's effectiveness and impact on students' career decisions.

The KPIs list includes, but not exclusive to, the following:

1. User engagement: This KPI measures the frequency and duration of student interactions with the AI system. Elevated levels of engagement indicate that students find the system useful and are utilizing it for career guidance.
2. Accuracy of guidance: Surveys or feedback collected from students can be used to assess the alignment between the career guidance provided by the AI system and the students' interests and career aspirations.
3. User satisfaction: Regular student surveys can measure their satisfaction with the system. High satisfaction levels would indicate that the system is effectively meeting students' needs.

4. Career outcomes: Tracking the career paths of students who have used the system for guidance can provide a measure of the system's effectiveness. If a considerable number of students end up in careers that align with the guidance provided by the AI system, this would indicate its success.

4.2 Impact on career decisions

The impact on students; career decisions can be assessed through longitudinal studies that track students' career paths over time. Surveys can be conducted to understand whether the AI-oriented system influenced their career decisions and how satisfied they are with their career paths. This data can then be analyzed to assess the overall impact of the AI-oriented system on students' career decisions.

5 DISCUSSION

Through our findings, we gained insights into both the effectiveness and the limitations of the AI-oriented system. While our metrics point to a successful contribution to career guidance in Morocco, recognizing the limitations and areas for improvement is just as important [25].

When positioned against literature and theory around career counseling and AI automation, our implementation showed a positive direction, highlighting the transformative potential of such technology. The curated AI-oriented system allowed for more tailored, dynamic guidance that resonates strongly with theories emphasizing student-centered, personalized counseling [26].

The cultural dimension was a consistent thread running through our work. Recognizing and incorporating a diverse linguistic landscape was key to making this system relevant for Moroccan students. On the ethical front, ensuring consent and maintaining data privacy and integrity were core to our methodology. Simultaneously, these requirements surfaced as challenges, hinting at larger ethical questions around AI-oriented systems tailor-made for career guidance [27].

While promising, the journey to develop a fully functional AI-oriented system in Morocco remains a work in progress. With each step, the system learns, evolves, and better serves its purpose of revolutionizing career guidance.

The implementation of AI and e-orientation systems in Morocco offers an innovative solution to career guidance, providing personalized and dynamic guidance that can be accessed from anywhere. However, the transformation towards AI systems is not without challenges.

One of the major challenges is the accessibility and reliability of the current internet. The success of an AI-oriented system hinges on its accessibility to the student's information likewise. While Internet use in Morocco has been increasing, it still lags in rural areas [28]. To ensure the broad-based impact of the system, efforts should be made to improve Internet infrastructure and accessibility across the country.

Data privacy is another significant concern. For the AI-oriented system to provide personalized guidance, it requires access to students' academic records and personal information. This raises legitimate privacy concerns. Robust data protection measures need to be put in place to protect students' data and maintain their trust in the system. Regular audits and transparent data policies can be effective strategies in this regard.

Language compatibility is another factor to consider. While Arabic, French, and English are widely used in Moroccan higher education, a substantial portion of the population is more comfortable with Moroccan Arabic dialects (Darija) while chatting and communicating. The LLMs mentioned, namely GPT, LLA-MA2, and PaLM, are primarily designed to understand English and may not be as effective in Arabic dialects. This issue calls for additional efforts to train these models in Arabic dialects or develop Arabic language models to cater to the linguistic diversity of Moroccan students. Another related challenge is the accuracy of Arabic optical character recognition (OCR) tools. Since a sizable portion of the information needed to guide students is contained in PDFs and other text-based resources, OCR errors could potentially limit the effectiveness of the chatbot [29].

Despite these challenges, the potential benefits of implementing AI and e-orientation systems in Morocco are significant. By offering personalized and dynamic guidance, these systems can help students make informed decisions about their careers. They also have the potential to democratize career guidance, ensuring that all students have access to quality guidance regardless of their geographical location or socioeconomic status.

This research opens several avenues for future work. More research is needed to understand the best practices for implementing AI-oriented systems in developing countries and how these systems can be adapted to cater to the specific needs of different populations. Exploring partnerships with technology companies could also be an effective strategy for advancing this initiative. Another area that warrants further research is the development of cost-effective and scalable infrastructure solutions for chatbot deployment, as well as the improvement of Arabic OCR technologies to ensure the accuracy of information extraction.

5.1 Ensuring data integrity, privacy, and protection

To ensure effective responses to students' guidance requests, robust data-safeguard measures should be implemented. These measures should be designed to protect students' academic records and personal information, which are necessary for the AI-oriented system to provide personalized guidance [29].

Compliance with relevant data protection regulations is crucial, and the data should be stored securely and used solely for the purpose of providing career guidance. Regular audits and transparent data policies can also be effective strategies for maintaining students' trust in the system [30].

6 LIMITATIONS AND FUTURE RESEARCH

Looking forward, we hope to expand our study to more schools and universities across Morocco. By doing so, we aim to gather more data, which we believe will directly influence the AI systems' performance improvements.

Moreover, we plan to conduct more user studies and work on improving areas highlighted through our feedback mechanism. This includes refining resources, focusing on data privacy and protection, and addressing other challenges that stem from wider implementation scenarios [31].

In the end, we remain optimistic about the potential of AI-oriented systems in Morocco. The challenge lies in synchronizing technological advances with societal needs and unique cultural contexts. A truly inclusive, accessible, and effective system is the end goal, and we are constantly learning and adapting to make this a reality.

7 CONCLUSIONS

The fusion of AI and mobile technologies promises a new era of career guidance. By integrating AI-oriented systems into mobile platforms, we can offer dynamic, real-time, and personalized guidance to students, setting them on a path to success.

The focus of our study has been transitioning from conventional mobile e-orientation systems to adopting AI-oriented systems for better, more personalized career guidance in Morocco. Through the implementation outlined in this paper, we have understood the potential of such technology to affect a change in thinking in career counseling. While challenges remain, the promise that these systems hold makes them a captivating area of exploration.

Our discussions and findings function as a steppingstone for further research. The ongoing engagement of students and career counselors, custodians of the system, will shape its future directions. Through collaborative improvement, we hope to continue enhancing mechanisms such as AI-oriented chatbots to better serve our students.

Career guidance, or orientation, as commonly used in the context of the Moroccan setup, is a critical aspect of a student's educational journey. With the advent of technology, innovative solutions such as e-orientation and AI-oriented systems have emerged, providing personalized and dynamic guidance. In the context of Morocco, the implementation of these systems holds the promise of transforming the landscape of career guidance.

By using LLMs, it is possible to create interactive chatbots that serve as virtual career counselors. These chatbots, integrated into a web-based platform, can provide comprehensive information about career paths, educational requirements, and job market trends, helping students make informed decisions about their future.

However, the implementation of these systems comes with its own set of challenges, including Internet accessibility, data privacy, and language compatibility. These challenges underscore the need for a holistic implementation approach that takes into consideration not just the technological aspects but also the educational, social, cultural, economic, and linguistic realities of the country.

Despite these challenges, the potential benefits of implementing AI and e-orientation systems in Morocco make them a promising solution for enhancing career guidance in the country. By providing personalized, dynamic, and accessible guidance, these systems can empower Moroccan students to chart their own career paths, contributing to their personal growth and the socio-economic development of the country.

The discussions and findings presented in this paper provide a starting point for further research and practical efforts in this direction. With continuous learning, improvement, and collaboration, we can harness the power of technology to shape the future of career guidance in Morocco and beyond.

8 REFERENCES

[1] J. Kim, N. H. Jo, and C. Lee, "How an artificially intelligent virtual assistant helps students navigate the road to college," *AERA Open*, vol. 3, no. 4, pp. 1–13, 2017. https://doi.org/10.1177/2332858417749220

[2] M. A. Cardona, R. J. Rodríguez, and K. Ishmael, "Artificial intelligence and the future of teaching and learning insights and recommendations artificial intelligence and the future of teaching and learning," *Tech.ed.gov*, 2023.

[3] K. Zhang and A. B. Aslan, "AI technologies for education: Recent research & future directions," *Computers and Education: Artificial Intelligence*, vol. 2, p. 100025, 2021. https://doi.org/10.1016/j.caeai.2021.100025

[4] Y. Liu, L. Chen, and Z. Yao, "The application of artificial intelligence assistant to deep learning in teachers' teaching and students' learning processes," *Frontiers in Psychology*, vol. 13, p. 929175, 2022. https://doi.org/10.3389/fpsyg.2022.929175

[5] "Teaching Students to Use AI Tools," Edutopia, [Online]. Available : https://www.edutopia.org/article/teaching-students-use-ai-tools. [Accessed Oct. 2023].

[6] K. Seo *et al.*, "The impact of artificial intelligence on learner–instructor interaction in online learning," *International Journal of Educational Technology in Higher Education*, vol. 18, pp. 1–23, 2021. https://doi.org/10.1186/s41239-021-00292-9

[7] D. Ng, J. Leung *et al.*, "Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world," *Educational Technology Research and Development*, vol. 71, no. 1, pp. 137–161, 2023. https://doi.org/10.1007/s11423-023-10203-6

[8] L. Jimenez and U. Boser, "Future of testing in education: Artificial Intelligence," Center for American Progress, 2021. [Online]. Available: https://www.americanprogress.org/article/future-testing-education-artificial-intelligence/.

[9] M. Housni, "Multidimensional forecasting and analysis: Exploring Moroccan learning data analytics in business, environment, and sustainability," *IETI Transactions on Data Analysis and Forecasting (iTDAF)*, vol. 1, no. 3, pp. 75–82, 2023. https://doi.org/10.3991/itdaf.v1i3.40353

[10] Y. Alami and I. El Idrissi, "Students' adoption of e-learning: Evidence from a Moroccan business school in the COVID-19 era," *Arab Gulf Journal of Scientific Research*, vol. 40, no. 1, pp. 54–78, 2022. https://doi.org/10.1108/AGJSR-05-2022-0052

[11] J. L. Holland, "Making vocational choices: A theory of vocational personalities and work environments," 3rd ed., Odessa, FL: Psychological Assessment Resources, 1997.

[12] N. Chafiq and M. Housni, "Towards the design of an innovative and social hybrid learning based on the SMAC technologies," in *Smart Innovation, Systems and Technologies*, vol. 111, pp. 126–133, 2019. https://doi.org/10.1007/978-3-030-03577-8_15

[13] N. Chafiq, M. Housni, and M. Moussetad, "Towards a dynamics of techno-pedagogical innovation within the university: Case study hassan II university of Casablanca," in *Smart Innovation, Systems and Technologies*, vol. 111, pp. 118–125, 2019. https://doi.org/10.1007/978-3-030-03577-8_14

[14] M. Housni, A. Namir, M. Talbi, and N. Chafiq, "Applying data analytics and cumulative accuracy profile (CAP) approach in real-time maintenance of instructional design models," in Lecture Notes in Real-Time Intelligent Systems. RTIS 2017. *Advances in Intelligent Systems and Computing*, Mizera-Pietraszko, J., Pichappan, P., Mohamed, L., Eds., Springer, Cham. vol. 756, pp. 17–25, 2017. https://doi.org/10.1007/978-3-319-91337-7_2

[15] M. Housni, M. Talbi, and A. Namir, "Simple technology is an improved solution for a post-pandemic informative system: A reference model," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 16, pp. 35–51, 2021. https://doi.org/10.3991/ijet.v16i16.23211

[16] C. Daverne-Bailly and C. Bobineau, "Orienter et s'orienter vers l'enseignement su-périeur dans un contexte de changement des politiques éducatives : incertitudes, choix, inégalités," *Éducation et Socialisation*, no. 58, 2020. [Online]. Available: http://journals.openedition.org/edso. [Accessed Oct. 2023]. https://doi.org/10.4000/edso.13048.

[17] A. El Gourari, M. Skouri, M. Raoufi, and F. Ouatik, "The future of the transition to e-learning and distance learning using artificial intelligence," in *Proceedings of the 2020 Sixth International Conference on e-Learning*, 2020, pp. 279–284. https://doi.org/10.1109/econf51404.2020.9385464

[18] N. M. Molodozhnikova, N. V. Biryukova, O. V., Galustyan, J. B. Lazareva, and N. N. Stroiteleva, "Formation of professional orientation of high school students to medical profession by using ICT tools," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 15, no. 1, pp. 231–239, 2020. https://doi.org/10.3991/ijet.v15i01.11423

[19] O. Zahour, "Towards a Chatbot for educational and vocational guidance in Morocco: Chatbot E-orientation," *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 9, no. 2, pp. 2479–2487, 2020. https://doi.org/10.30534/ijatcse/2020/237922020

[20] O. Zahour, E. H. Benlahmar, A. Eddaoui, H. Ouchra, and O. Hourrane, "A system for educational and vocational guidance in Morocco: Chatbot E-Orientation," *Procedia Computer Science*, vol. 175, pp. 554–559, 2020. https://doi.org/10.1016/j.procs.2020.07.079

[21] O. Zahour, E. H. Benlahmar, A. Eddaouim, and O. Hourrane, "A comparative study of machine learning methods for automatic classification of academic and vocational guidance questions," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 14, no. 8, pp. 43–60, 2020. https://doi.org/10.3991/ijim.v14i08.13005

[22] K. Sellamy, Y. Fakhri, and A. Moumen, "What factors determine the academic orientation in Moroccan higher education?" *Sustainability*, vol. 15, no. 8, pp. 1–11, 2023. https://doi.org/10.3390/su15086866

[23] M. Oproescu, E. Jianu, I. Bulgaru, and D. Duminica, "School and Professional Orientation to Adolescents," in *Proceedings of the 11th International Conference on Electron-ics, Computers and Artificial Intelligence (ECAI 2019)*, 2019. https://doi.org/10.1109/ECAI46879.2019.9042064

[24] R. Ab Rashid, N. Annamalai, H. Saed, B. Yassin, and O. A. Al-Smadi, "Developing an interactive university orientation app: Potential users' feedback," *International Journal of Interactive Mobile Technologies (iJIM)*, vol. 15, no. 22, pp. 165–171, 2021. https://doi.org/10.3991/ijim.v15i22.24523

[25] K. Sellamy, Y. Fakhri, S. Boulaknadel, A. Moumen, K. Hafed, H. Jamil, and Y. Lakhrissi, "Web mining techniques and applications: Literature review and a proposal approach to improve performance of employment for young graduate in Morocco," in *2018 International Conference on Intelligent Systems and Computer Vision (ISCV 2018)*, 2018, pp. 1–5. https://doi.org/10.1109/ISACV.2018.8354043

[26] S. Hussain and G. E. Athula, "Extending a conventional Chatbot knowledge base to external knowledge source and introducing user based sessions for diabetes education," in *2018 32nd International Conference on Advanced Information Networking and Applications Workshops (WAINA)*, Krakow, Poland, 2018, pp. 698–703. https://doi.org/10.1109/WAINA.2018.00170

[27] P. B. Brandtzaeg and A. Følstad, "Why people use Chatbots," in *Lecture Notes in Computer Science*, vol. 10673, pp. 377–392, 2017. https://doi.org/10.1007/978-3-319-70284-1_30

[28] T. Karakose, M. Demirkol, N. Aslan, H. Köse, and R. Yirci, "A conversation with ChatGPT about the impact of the COVID-19 pandemic on education: Comparative review based on human–AI collaboration," *Educational Process International Journal*, vol. 12, no. 3, pp. 7–25, 2023. https://doi.org/10.22521/edupij.2023.123.1

[29] S. Athanassopoulos, P. Manoli, M. Gouvi, K. Lavidas, and V. Komis, "The use of ChatGPT as a learning tool to improve foreign language writing in a multilingual and multi-cultural classroom," *Advances in Mobile Learning Educational Research*, vol. 3, no. 2, pp. 818–824, 2023. https://doi.org/10.25082/AMLER.2023.02.009

[30] Z.-H. Ipek, A.-C.-I. Gözüm, St. Papadakis, and M. Kalogiannakis, "Educational applications of ChatGPT, an AI system: A systematic review research," *Educational Process*, vol. 12, no. 3, pp. 26–55, 2023. https://doi.org/10.22521/edupij.2023.123.2

[31] B. Huang, "The Influence of science and technology innovation perception education on entrepreneurial intention of college students," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 18, no. 19, pp. 128–146, 2023. https://doi.org/10.3991/ijet.v18i19.43909

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