Multiplatform Career Guidance System Using IBM Watson, Google Home and Telegram

A User Experience and Usability Evaluation

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Abstract. Even with the availability of several tests to provide clarity in choosing our career path, the decision remains a tough one to undertake. Most of the available tests are either monotonous, resulting in a tedious effort to go through them entirely, or are just plain boring. In this paper, however, we present a new and different approach to career guidance systems. We use Google home as a speech-based interface and Telegram as a text-based interface to generate a conversation between the users and a bot for career guidance. The idea is to provide an easy and friendly interface with an interactive user experience while gathering the required data to provide career guidance. To evaluate the system, we used the University of Costa Rica's Computer Science and Informatics Department scenario. In this scenario, students must decide between three possible emphases: Software Engineering, Information Technologies, and Computer Science. A usability and user experience evaluation of the system was performed with the participation of 72 freshmen.

Keywords: Career guidance · IBM Watson · Personality traits · Google home · Conversational interface · Telegram

1 Introduction

Career guidance is a complex task that has a high impact on the life of people undergoing a career selection process. Career guidance includes informing, advising, assessing characteristics, teaching to enable, networking, managing, mentoring and interviewing to extract information about a person [1]. Moreover, career guidance is a process that requires the involvement of multiple people and can't be effectively carried out by a single guidance practitioner [2].

For many years, companies and researchers have developed career guidance tools based mostly on online surveys or traditional computer-based interfaces. These tools, however, are usually used for self-assessment and are an add-on to the much bigger process of career guidance.

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In this paper, we present a career guidance system, focused on the IT domain (i.e., helps to select between software engineering (SE), computer science (CS), and information technologies (IT) management), which uses Google Home and Telegram to extract information from the user to create an assay and with it perform an analytical comparison of personalities using IBM Watson personality models.

The focus of this research emerged due to the separation of the CS career at the University of Costa Rica (UCR) into three different emphases. In order to test our career guidance system, we used three profiles based on those three academic emphases.

The system was built using model driven development and API.AI, a development tool that allows creating natural language conversations and provides a processing engine to easy the creation of the dialogues [3].

The system user experience was evaluated with the help of seventy-two incoming Computer Science students and the results were promising.

This document is structured as follows: Sect. 2 shows related work, Sect. 3 describes the proposed systems, Sect. 4 explains how the system works, Sect. 5 describes the evaluation and the results, and Sect. 6 includes conclusions and future work.

2 Related Work

Different technological approaches have been explored to support the career guidance process. This section describes some of those efforts.

Games are an interesting way to engage and extract information from people starting their studies [4–6].

In their work, Shi and Shih [4] use a current version of the Holland Codes [7] to define career paths. Their game is based on interactive fiction and simulation. The goal of the game is for users to understand the occupational characteristics and difficulties to provide a comprehensive understanding and ultimately help them improve their career decisions.

Dunwell et al. propose a similar approach in [5] that consists of a serious game with elements that promote professional development, decision making and understanding the dynamic nature of the job market. Authors, however, do not describe the theory used for the development of the tool.

Waypass, proposed by Garcia et al. [6], uses a different approach to gaming. It provides an experience using scenarios and storytelling to motivate users. Their proposal is based on the self-determination theory [8] and uses concepts such as auto-discovery, inspiration, transformation, and exploration to guide the user through the career selection path.

Other, simpler approaches have also been implemented, for instance [9] proposes L4All, a system that aims to support the exploration of experiences, so to reflect on them while making decisions. It uses different categories including educational, occupational and personal. The goal of this system is to find the qualifications of an individual in a domain of expertise to determine if it fits the user.

Other systems are more focused on the career guidance method than the user experience method, which involves the overall usability of the system. For instance, [10, 11] delve in how to use big data tools and fuzzy logic to facilitate goal alignment and generate career path recommendations.

Other works, such as [12], focus on comparisons of performance over classification algorithms applied to vocational orientation (i.e., focused on the machine learning part of the problem). Moreover, clustering algorithms have been applied to classify students based on the likeliness of their profile with other students that already picked a career [13]. Expert systems have also been developed for vocational decisions [14].

Similar works, to the one presented in this paper have also been performed. For instance [15] presents a computational platform that makes psychometric questions for about 40 min, and then generates an analysis that is sent as a report to the student through email. The report includes personality analysis, aptitudes, skills, motivations, and preferences. The authors describe that this analysis is made through an artificial intelligence engine capable of getting conclusions as a professional would.

Our approach differs to the projects presented in this section by two main characteristics. The first one is that our development is based on natural user interfaces using a chat-like communication or conversation (speech). The second one is that the evaluation is focused on usability and user experience rather than the technical part of the issue. This approach is based on engaging the young participants and determining their satisfaction levels while using the system.

3 System Overview

This section describes the system, its component, and technologies applied to it. This includes the user interface, the proxy service (API.AI) used for communication and dialogue computation, and the personality evaluator (IBM Watson). Figure 1 shows a graphical system overview including all these components.

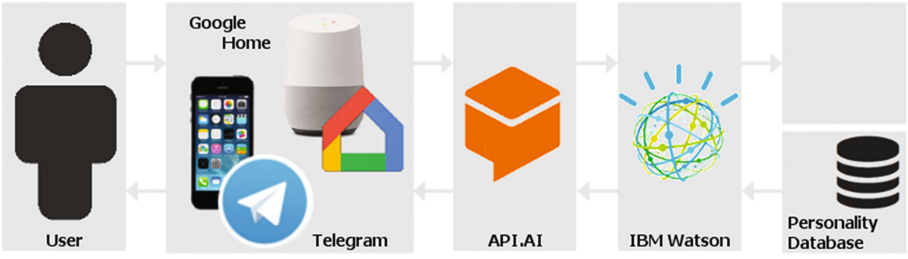

Fig. 1. System architecture and software used

3.1 User Interfaces

The idea behind this project was to create a natural and intuitive way to conduct a conversation that would allow the extraction of an assay, which could be compared with others stored in our database. To achieve that, we built natural interactions,

simulating a human conversation using Google Home (speech interface) and Telegram (text interface). Telegram was used in a chat-like format.

Google Home
Google Home is a voice activated speaker manufactured and commercialized by Google [16]. It runs a version of Google Assistant, an intelligent personal assistant designed to allow conversational usage [17]. Google Assistant uses a natural language user interface to answer questions, make recommendations, and perform actions by delegating requests to a set of services. Moreover, it delivers information to users predicting their requirements.

Some of the promotional commands for Google Assistant include: "Ok Google, Remind me to pick up a birthday card", "Ok Google, Book me a table for 6 at Quartino for 8:30", "Ok Google, Who invented sushi?" [17].

In this project, Google Home is used to interact using voice with the user. A set of questions are asked and the results computed and transcribed to be processed.

Telegram
Telegram is an instant messaging service that allows users to exchange texts, photos, videos, stickers, audios, and files. Telegram has developed clients for mobile devices and other operative systems in traditional PCs [18]. The reason to use Telegram is because it allows third-party developers to create bots. These bots can perform different activities, such as simulating a conversation. In this project, a bot is used to simulate a conversation with the user and asked the required information to perform a personality analysis.

3.2 Natural Language Interface (API.AI)

In this project, API.AI was used to develop a bot that generates the dialog using natural language, which is deployed in both Google Home and Telegram. API.AI is capable of recognizing entities and intents inside a text and transform it into actionable data [3].

A set of 18 intents were added to the career guider agent. Recognition of entities like dates, names and locations were used.

3.3 Webhook (Node.js)

A webhook is a common expression to refer to an HTTP POST action that occurs when something happens. In this system, the webhook is used to process the information gathered from the user through API.AI and then send that information to IBM Watson.

Once Watson returns the analyzed profile of the user, an analytical process takes place in the webhook to compare this profile against the different IT domain's profiles. This in turn, defines the most similar profile between a user and an IT domain.

3.4 Fulfillment Service (IBM Watson Personality Models)

The core of this system is the personality model provided by IBM Watson [19]. Watson is an artificial intelligence system capable of several functions such as processing data

in natural language or performing recognition patterns, with many more uses. In this project, we are using the Personality Insights provided by Watson.

Each time a user interacts with the bot, it transcribes the conversation into text that is then compiled at the end of the session. Later, the gathered text is sent to IBM Watson to execute the personality analysis. In total fifty-two traits of a personality are retrieved by Watson Personality Insights service.

3.5 Personality Database

The records of this database are in the form of summarized outputs of the Watson personality analysis. Ten profiles of each IT domain under study were gathered from the internet, and the personality evaluation was performed using the about me section in their professional blogs. For each domain, the fifty-two traits of each profile were summarized along with their partners inside the domain to generate a representative profile.

4 System Functionality and Performed Analysis

This section describes the performed analysis and explains how the system works when the components are assembled.

4.1 Providing Career Guidance

As it was described before, the system is available in two platforms: speech-based (using Google Home) and text-based (using Telegram).

To offer a personalized and good user experience, the bot asks the users for their name and a brief introduction about themselves. The dialog consists of a set of open-ended questions made by the bot.

The idea behind the dialog is to encourage the user to provide information with relatively long answers (i.e., avoiding yes/no answers).

The bot can recognize the contexts of the conversation and handle the dialog accordingly. Once all the questions are answered, the analysis is performed and the results are shown.

The result is a description of the user's personality and a recommendation of the domain that would best suit the user according to their personality. An output example is:

> *Daniel, your profile analysis is ready. According to my professional lecture of yourself, the career path that I advise you is:* ***Computer Science****.*
>
> *This is your profile summary: You are shrewd. You are energetic: you enjoy a fast-paced, busy schedule with many activities. You are philosophical: you are open and intrigued by new ideas and love exploring them. You are authority-challenging: you prefer to challenge authority and traditional values to help bring about positive changes.*
>
> *Your choices are driven by a desire for discovery. You are relatively unconcerned with both tradition and taking pleasure in life. You care more about making your own path than following what others have done. And you prefer activities with a purpose greater than just personal enjoyment.*

4.2 Performed Analysis

This section describes the IT domains profiles, characteristics and how users' personality was analyzed to propose a recommendation.

Computer Science and Informatics School Career Paths Personality Traits
A general overview of the big five personality traits for each IT domain is shown in Table 1. On the other hand, Table 2 details which are the most different traits of each IT domain.

Table 1. IT Domain profiles with the five main personality traits' percentile values.

Personality trait	Software Engineering	Computer Science	Information Technologies
Openness	87.1%	79.5%	90.3%
Conscientiousness	50.9%	54.0%	49.8%
Extraversion	30.7%	15.5%	44.1%
Agreeableness	8.8%	6.8%	7.6%
Emotional range	61.1%	65.0%	66.3%

Table 2. Most different traits between IT domains. Computer Science as CS, Information Technologies as IT and Software Engineering as SE.

Personality trait	Domain	Direction	Detail
Practicality	CS	Less	Have a desire to get the job done, a desire for skill and efficiency, which can include physical expression and experience
Liberty	CS	Less	Have a desire for fashion and new things, as well as the need for an escape
Altruism	IT	Most	Find that helping others is genuinely rewarding, that doing things for others is a form of self-fulfillment rather than self-sacrifice
Openness to change	CS	Less	Emphasize independent action, thought, and feeling, as well as a readiness for new experiences
Challenge	SE	Less	Have an urge to achieve, to succeed, and to take on challenges

According to the analysis and summary performed by Watson over our personality database, we have concluded that computer scientists are on average skeptical and inner-directed. On the other hand, software engineers represent a shrewd and inner-directed profile. Finally, the information technologists showed to have a shrewd profile.

For Watson, our mean found was that the computer scientist is independent, the software engineer is trusting of others and the information technologist is energetic.

A common quality of all the profiles is to be authority-challenging and philosophical. Also for Watson, all the profiles tend to be unconcerned with both taking pleasure in life or tradition, they prefer to make their own path rather than follow what others have done.

Analyzing Users' Personality
One could say that any user could use Watson tools to get their profile analysis and make a comparison between his profile and other profiles. To make an objective comparison, however, we decided to use the Euclidean distance to find the nearest profile in a multidimensional space. Equation 1 shows how this distance is calculated [20].

$$(p, q) = d(q, p) = \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2} \quad (1)$$

The distance between the user profile p and every profile q is calculated. At the end, the nearest profile is selected and showed as the system's recommendation.

By using this method, we are getting a pseudo-ranking of recommendations, something that is useful if we would like to extend this system to a broader scope.

5 Evaluation

The evaluation of this project is focused on the user experience. Even though the career paths are very important, several studies have delved into this topic, therefore, we will focus on the usability and overall user experience.

5.1 Procedure

Seventy-two freshmen of the CS School at UCR tested the application. As they represent the real target of the application, their assessment of the user experience is the closest to the real perception users will have.

At the evaluation moment, Google Home only supported English. To test both experiences we asked English spoken students to test the Google Home bot. The rest of the students tested the bot trough the messaging app. The length of the interaction between the students and the bot was on average less than 12 min. Once the interaction ended, the students filled an evaluation of usability and user experience survey.

The main source of questions for the survey used in this work is the System Usability Scale [21]. The survey included the following questions:

Close-ended questions
- I think that I would like to use this system frequently
- I found the system unnecessarily complex
- I thought the system was easy to use
- I think that I would need the support of a technical person to be able to use this system
- I found the various functions in this system were well integrated
- I thought there was too much inconsistency in this system
- I would imagine that most people would learn to use this system very quickly
- I found the system very cumbersome to use
- I felt very confident using the system
- I needed to learn a lot of things before I could get going with this system

– I felt the system is exciting
– I felt the system is innovative
– I felt the system is motivating
– I felt the system is attractive
– I would recommend the usage of this system to my friends

Open-ended questions
– What is the main goal of the system?
– What do you like least about the system?
– What do you like the most about the system?

Describe the system with 3 words
In a range from 1 to 10, how do you evaluate the system?
What career path you want to follow?
What career path did the system recommend you?

6 Results

This section presents the results of the evaluation performed. The results include responses to the System Usability Scale questionnaire and the rest of the questions asked. One of the main question asked was: What is the main goal of the system? No information regarding this was provided before the evaluation. Figure 2 shows the main results for this question.

In Fig. 2, the response with more support by the participants was to support a career choice, we believe that this response is associated with a guide more than a recommendation. The second response was to define the career path, we interpret this as a recommendation (i.e., the system decides for the user). The third response in significance was to analyze user personality. Other responses in less significance were combined into one category. They included: to gather information, to help in complex tasks, to talk, and to get a conclusion for a future decision.

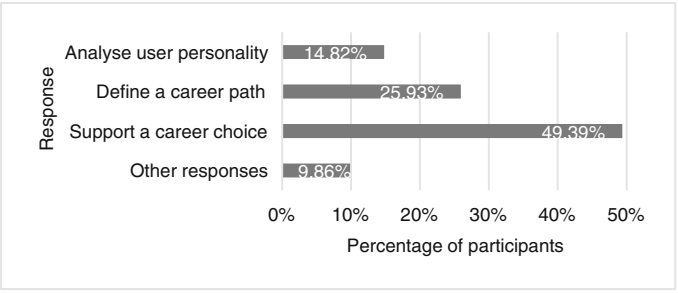

Fig. 2. Responses of participants to the question: What is the main goal of the system?

The responses to the System Usability Scale questionnaire were overall positive. Participants strongly agreed with the easy to use system and they also commented that it was easy to learn. Even though the participants agreed that the system is not complex

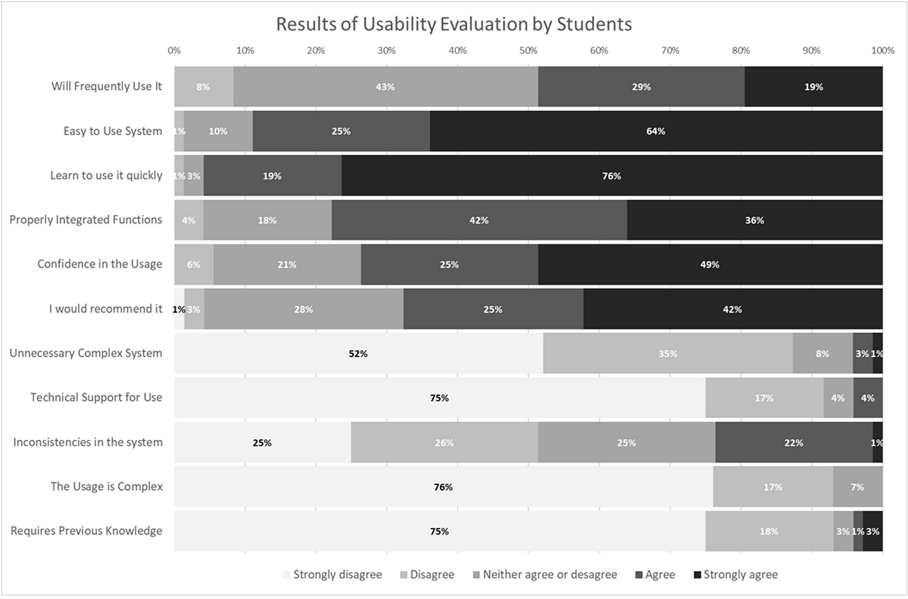

Fig. 3. Responses to the System Usability Scale.

and does not require any previous knowledge, it still, however, was found to have some inconsistencies during the sessions. Figure 3 shows the results of this part of the survey.

Another question was: What do you like least about the system? The main response here was that participants did not like the personality analysis (27.78% of the respondents).

The top usability issue reported by 9.72% of the respondents was that the speech-based system cut their voice when they were talking. Other users (6.94%) only reported that the system had bugs.

Focused on the conversation and the main goal of the system, 9.72% did not like the questions asked by the bot. Another group of users (2.78%) did not like that the system required long answers, and 4.78% did not like the extension of the session.

Some other issues reported by the participants include: the system changed the context of the questions, the analysis of the responses was inadequate, the system was monotonous, and the system was too formal. Moreover, they did not like that they weren't allowed to extend their responses once the question was asked and the first response was given. All these issues correspond to 38.28% of the respondents.

In contrast to the 'What do you like least about the system question,' we also asked, what do you like the most about the system? The top answers to this question included: easy to use (20%), questions from the tutor (15%), the interface (12.5%), the naturality (10%), and that the system was intuitive (4%).

Other participants responded that they liked the fast response, the results and that the system was coherent. They also liked that the interaction was in real time and that

the system was useful and kind. Other users liked the fact that they could use the system (it understood their responses) and that it was multiplatform. These answers represent 38.5% of the total responses.

Even though this was not the focus of this study, the accuracy in the career guidance is depicted in Table 3.

Table 3. System accuracy results based on students desired IT domain versus recommended domain.

Student's personal preference	Proposed emphasis	Percentage
Computer Science	**Computer Science**	**62.5**
	Information Technologies	37.5
Software Engineering	**Software Engineering**	**8.4**
	Computer Science	16.6
	Information Technologies	75
Information Technologies	Software Engineering	13.4
	Computer Science	6.6
	Information Technologies	**80**
No response	Computer Science	36.4
	Information Technologies	63.6

The total accuracy was 40%. The specific accuracy for IT is 92.3%, for CS is 62.5%, and for SE 8.33%.

Results show that 58.82% of the time, IT path was recommended, CS was recommended 20.59% and SE just 5.88%. More detail is provided on this in the conclusions section.

7 Conclusion and Future Work

The undergraduate CS curriculum at UCR offers three career paths. We developed a career path advisor using tools provided by Watson. In addition, we evaluated a speech-based version using Google Home and a text-based version using Telegram. The evaluation was focused on user experience.

The results allowed us to conclude that the system is usable and generates a good user experience. From our point of view, this tool will help users to get more engaged in the process of choosing a career path. Moreover, the students were comfortable interacting with the system. Most of them agreed or strongly agreed to recommend it. The participants were also able to correctly identify the system's purpose.

One of the most disliked attributes of the system was the extent of the conversation, as the users perceived it as a long process. This attribute is not directly related to the system usability. Therefore, the interaction between CS students and bots (based on speech or text) supported by artificial intelligence provides a satisfying experience.

The students chatted naturally using both interfaces. Eighty-nine percent of the students agreed and strongly agreed about how easy was to use the system. Ninety-five

percent learned to use it quickly. This experience should inspire the exploration of novel means of interaction between people and systems.

Furthermore, our system uses a personality database component to perform a profile analysis using Watson. Although the personality database was not directly assessed, the results were accepted by the students (only 27.78% of the participants expressed that they did not like the personality analysis). The personality database could be enhanced to get more accurate profiles.

Data concerning the accuracy of the system was taken although it was out of the scope of this study; It was done to have a base for future work. A 36.1% of accuracy is not at all satisfactory. Moreover, based on data there could exist a bias of the system to select Information Technologies path.

Given the characteristics of the information, we conclude that the SE profile had some issues, hence was not recommended properly.

In the future, we would like to test different decision backends to improve the performance of our current profile matcher. Moreover, a longitudinal study could be conducted to learn about how the career path recommendation varies over time.

As a reference to future work, a combination of these new interfaces and traditional mechanisms for career guidance could be evaluated to determine if a more natural interface affects the results of automatic career guidance systems.

Since the division of the CS emphases has taken place only this year, it is a premature problem. We would like to gather data related to the decisions made by students that participated in the test, to know the proper metrics required to measure the performance of career path recommendation systems directed to CS School students at the UCR.

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