Social Network Bots as the Interface

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Abstract

This project focuses on designing, building and evaluating a Value-Sensitive social bot which will be embedded in a collaborative or social platform to help support the students' decision making in their course selection. The social bot will be able to communicate with the users and take their value system into account to provide accurate advice about which courses could be a good choice for them.

Here is the link to the Slack team: `https://mzellhuber.slack.com/signup` a *@staffmail.ed.ac.uk*, *@ed.ac.uk* or *@sms.ed.ac.uk* email address is needed to access the team.

Here is the link to the Facebook Messenger page: `https://m.me/courseB0t` A digital version of this document can be found in `http://afternoon-reaches-72164.herokuapp.com/show-pdf/`

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Declaration

I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or professional qualification except as specified.

(*Melissa Zellhuber*)

Table of Contents

List of Figures

Chapter 1

Introduction

1.1 Motivation

The dawn of a new semester sees students handed their first stressful task: making the right course selections. The students' choice will shape their academic identity and can even help direct their future career. Informed and conscious course choices can put a student in the best place to achieve their dream, yet the time-consuming process is still unevolved. Newcomers to academia can be particularly apprehensive about the process, even though their selection will determine the course of at least the next four months of their academic lives. The aim of this project is to provide a useful web assistant that streamlines the course selection process. The medium of delivery is a central characteristic of the project. While the web interface can be made available continually, human Personal Tutors are likely to have limited time available for the course selection process. Additionally, the bot has information on all available courses, while a human Personal Tutor may have little knowledge of newer courses. The course selection system will allow the student to make a more informed choice by first assessing their value system.

According to the 2015 U.S. Mobile App Report conducted by comScore, users spend 91% of their time online using messaging apps[8]. This means that people's time spent online is largely biased toward human interaction, and as such creating a bot to help users is of an intuitive value to most businesses and institutions. Creating a conversational interface software that could provide advice to students via a messaging app could prove useful to both the University and the students.

Presently, students can preview their course load using Path. It provides facility for the user to see all the courses available to them presented with a color coding; red is

used for not available, green for available, and blue for already selected.

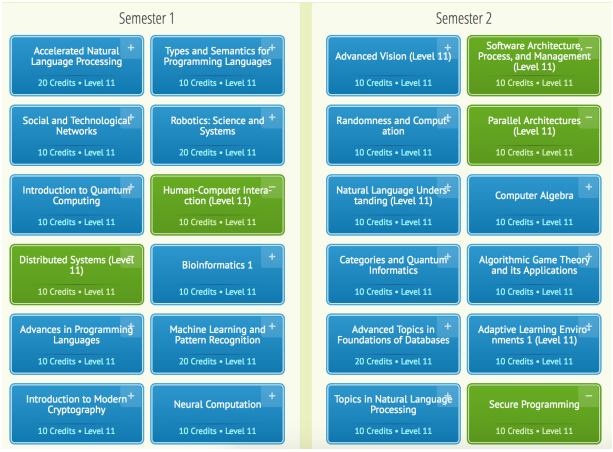

Figure 1.1: Path Course Visualization

Students can get information for each course by clicking on the corresponding box, but using Path for senior years of study can be more tedious, as there are more courses available and fewer or no compulsory classes to limit the students' choice. It is possible that the user will read information about several courses that they may not be interested in before finding an appropriate choice for them. This can cost the student time, as they try to select the optimal combination of courses.

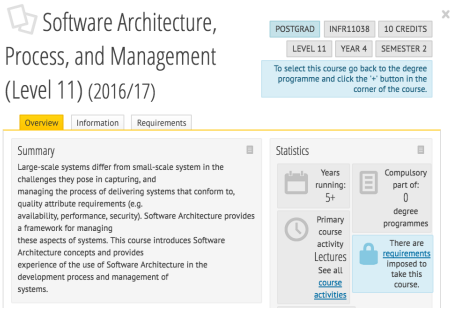

Figure 1.2: Path: Course Information

Path currently shows the students which courses they can take, but makes no effort to suggest which ones would be best for each individual. The onus then falls on the Personal Tutor, but it is unrealistic to expect every Personal Tutor to know about all the topics their tutees are interested in. Therein lies the essential requirement for a tool that is able to help students to make an informed decision.

1.2 Hypothesis

Students who use a Value-Sensitive social bot in their course selection process prefer the social bot and believe their decision making is more fully informed than students who only use Path.

1.3 Goal and Achievements

This project aims to construct a value-sensitive social bot that will help students find the courses most suitable for them. The following static parameters will be taken into account: the year the student is in, the number of credits required for that year, and the mandatory courses for that year. In addition, dynamic parameters such as academic interests and future plans will be used to shape the recommendations provided by the bot. Ideally, it will provide helpful advice to the students and the courses it recommends will indeed align with the students' interests and academic requirements.

The contributions of this project are:

- A social bot that is easily extensible, both for use on other platforms and to allow for additional and custom functionality.
- A bot that provides University of Edinburgh Informatics students recommendations on what courses will be best suited according to their interests, future plans and year.
- A Value-Sensitive social bot that analyzes the users value set and delivers accurate recommendations for course enrollment.
- A general social bot architecture on which other similar bots can be based.
- An outline and guide for other researchers on how to use a machine learning engine for intent classification to categorize and respond to user inputs.

1.4 Document Structure

Chapter 2 provides an overall background of the project's main topics: Social Network Bots, Natural Language Processing and Value-Sensitive Design. These topics are crucial for creating the building base of the social bot. Chapter 3 gives a general description of the what was done in the project, including requirement gathering methodology and results. Chapter 4 regards the design of the software, including the conversation flow design, database set-up requirements and Natural Language Processing method.

The detail of all things that were considered for the final product, including the Value-Sensitive Design methodology, are found within this chapter. Chapter 5 describes the implementation of the project. Technical details like database queries and server connections are discussed here, as well as the integration with social media platforms. Chapter 6 discusses how the software was evaluated; this will span across different phases of the project. Finally, chapter 7 contains results' discussion, conclusion and suggestions for future work and research.

Chapter 2

Background

Some parts of this chapter are based on the Informatics Research Proposal by Melissa Zellhuber [48].

2.1 Social Network Bots

Social bots are software applications that can converse with users in natural language, usually through text or audio. The bots are typically programmed to mimic human communication and conversational behaviour. Advanced social bots are evaluated against the Turing Test, developed as an assessment of intelligent behaviour in machines [46]. The test was developed in 1950, well before the average individual owned a computer. Thus, bots of this type have an extensive history of research, and functional implementations have long been anticipated. Modern social bots have a vast range of applications including productivity management, education, information look-up, marketing and customer service[40]. Major international businesses such as CNN, Disney and The New York Times are using social bots to increase engagement with their customers[2]. These big brands are using customer service bots to enhance their customers' experience. The bots create a personalized interaction, unique to each individual, while mitigating the need to wait for the assistance of a human agent.

Moreover, a social bot that will immediately reply can improve a client's satisfaction with the brand and their customer service. The Harvard Business Review report found that the primary factor in retaining customer loyalty is reduction of customer effort[11]. Other reports suggest that customers find phone and voice conversations to be the most frustrating customer service experiences, highlighting the need for and strengthening the virtue of social bots as the consumer interface [12]. The results

presented state that 54% of millennials have retracted their custom from companies because of poor customer service quality. The safeguard of continually available responses to customer queries allows institutions and businesses to maintain a higher service quality with little extra overhead. An additional benefit is that information which would otherwise be extracted by human-to-human interaction can be more readily obtained.

Several characteristics of Artificial Intelligence software are exhibited by social bots. For this project, the key characteristics are: logic & reasoning, learning & heuristics, comparison and memory. Additionally, bots can be used for computational tasks such as to perform searching and solve simple math problems. In general, social bots are thought of as partially intelligent systems[24], however there are examples pushing the advancement, among them Mitsuku, the virtual friend bot. The complexity and refinement of Mitsuku's AI have twice secured it first place in the coveted Loebner Prize for the AI software best able to demonstrate behaviour like that of a human[1]. There are many examples of simpler social bots which are implemented using a simple AI and basic natural language processing. This strategy is often sufficient if the intended purpose of the bot has a specific and limited range.

2.1.1 Social Impact

The first evidence of social bots was in 1966 with Weizenbaum's ELIZA[44]. The design of the Artificial Intelligence program simulated conversation between the agent and a human by pattern-matching. Although research into ELIZA went as far as to include clinical uses[7], it was only recently that social bots left a tangible social impact. In 2017 the epidemic of "fake news" became bread-and-butter vocabulary, and although the implications of this are beyond the remit of this work[47], it is probable that most Twitter users have not only seen a social bot, but may even have been influenced by one[31].

It is fair to note that any negative societal impact is not solely caused by the existence of capable bots, but also by whom they are being used and what they are being used to achieve. A simple Twitter bot used only to simulate a human 'follower' cannot have the same momentous social impact as an entire swarm proactively circulating mendacious information to all those they can find. Social bot design therefore must not only consider the emotional or ethical reaction of single users in a survey, but also the wider context of the impact on society as a whole and even the long term repercussions

of any action the software might take.

Some online retailers and brands use social bots to reduce pressure on customer service operators[28]. It gives customers assurance that their enquiry will be responded to while they wait for human support. Unlike being on the phone with a customer service agent, messaging with a social bot is an asynchronous communication that can elicit a more positive response from clients and increase efficiency, as customers are able to pause and pick up the conversation whenever it is convenient for them[23]. Software like this has no other significant social impact, and is similar in concept to hold music or automated redirection systems.

2.2 Natural Language Processing

Natural Language Processing (NLP) studies began after World War II, when there was a race to create a device that could translate automatically from one language to another. In 1958, Noam Chomsky found that the devices that had been created so far could recognize nonsense sentences if they were grammatically correct, for example: “Colorless green ideas sleep furiously”. Chomsky expected machine models to classify these kinds of sentences as improbable[38]. Since then, two branches of research have emerged, split into symbolic and stochastic studies of natural language. The stochastic studies are focused on statistical and probabilistic methods, and symbolic studies are focused on rule-based methods[38].

NLP facilitates computer analysis and comprehension of conversational human writing and speech. Input processing techniques allow the natural language to be manipulated to a form suitable for machine analysis[6]. A domain-specific bot with only a narrow range of functionality may only require basic NLP, which allows for the bot to be configured to respond appropriately to a range of specific inputs. The diversity of the interaction can then be built up by stacking more complex mechanisms on top. NLP and Artificial Intelligence make up the backbone of intelligent social bots capable of self-analysis and self-improvement.

2.2.1 API.ai

API.ai is a platform that helps developers create human-computer interaction technologies using conversations in natural language. It was purchased by Google in September 2016, and it provides tools to help developers build conversational bots[26]. It employs

machine learning on example input sentences, and using domain knowledge and natural language understanding, it analyzes the user's intents to classify every part of the sentence. It is cross platform and supports 15 languages. Mercedes-Benz and The History Channel are among a number of companies using API.ai as a base for their customer service assistants[4]. The API can handle speech recognition, intent recognition and context management. For instance, developers can create domain-specific knowledge such as incorporating synonyms to manage ambiguity. Speech recognition compatibility opens doors for development not only of social bots, but also for IoT applications.

2.3 Value-Sensitive Design

Value-Sensitive Design is an approach to technology design that takes human values into account comprehensively throughout the development process. It uses an iterative tripartite methodology, consisting of conceptual, empirical, and technical investigations[17]. To create a system that follows true Value-Sensitive Design, the designer must put heavy emphasis on the interests and values of both direct and indirect stakeholders. As such, it needs to have different levels of analysis: individual, group and societal, and every level must be used in each of the three phases[15].

Opt-in cookie acceptance was first implemented by Friedman et al. in 2002[16]. This was also the first implementation of Value-Sensitive Design in a large-scale real-world software system. Before 2011, empirical data had shown that most websites that used invasive tracking cookies did not disclose this to the users, and yet 88% of the users surveyed during the research stated that they would prefer to be given the option to reject the cookies[16]. In May 2011, The Cookie Law was implemented. This law requires that websites give users the right to refuse the use of cookies and was implemented in all EU countries[27]. This was tangible evidence that users felt their ethical values were being betrayed prior to the institution of this law. Although this ethics breach was clear-cut enough to incite new cookie laws, a new and wide ethics problem arises when a human is expected to communicate with a computer in a way it would communicate with another human. It is intuitive to presume that as social bots progress, it may become necessary to inform the user that they are communicating with a computer. As an illustration, if a bot used illegal sales tactics instead of a human, it could potentially swerve trade standards legislation. The law was not created with computer agents as a possibility. The social bot of the future may even actively try to

find new people to talk (or indeed sell) to, and the potential reaction from the public is unknown. The lines become gray, and the importance of Value-Sensitive Design is realized.

Value-Sensitive Design at its core is a model of respect. The values of all direct or indirect stakeholders of the information system should be considered. Requirement gathering studies should be performed, and the design of the information system should be corrected according to the feedback. The process should then be repeated for user acceptance studies until those representative of the user base are satisfied that it behaves according to their values[39]. It is of course not clear from this description what 'values' includes, and undoubtedly the level of acceptance varies between individuals. For instance, some would argue that protection from data harvesting and processing is a fundamental human right. Others argue that the ethical value of safety, through the processing of the data by law agencies, exceeds the other groups' desire for privacy[42, 10].

As such, a comprehensive Value-Sensitive design must thoroughly investigate and account for values at each stage of the development process.

2.3.1 Human Values

Human values and ethical considerations no longer stand apart in human to computer interaction (HCI). In the article "Human values, ethics, and design" Friedman et al. presented a list of 12 human values with ethical import which must be considered when designing a software that is going to be used by humans [18]. Many of these values are traditional values that focus on a deontological and consequentialist moral orientation. The values are the following:

- Human Welfare
  It is imperative to maintain the well-being of all the users and stakeholders when designing software. The welfare of society overall must also be emphasized. Failure to assess this value thoroughly could have serious repercussions.
- Ownership and Property
  Ownership and property is a complex issue within the context of software. If a person owns an object, it is a tangible article that can be kept in a single place. In contrast, software is distributed and if it is replicated, the original is unchanged. US patents and copyright law do not cover look-and-feel issues for software, nor do they cover ideas. Hence, a similar software can copy or mimic the look, feel

and functional purpose from another without being in breach of the copyright law[18].

– Privacy

Protecting people's privacy is a prominent issue in modern society. Individuals are concerned about the amount of information they share online and how that information will then be used. The HCI community has developed three main approaches to privacy protection. The first is to not only to inform everyone what kind of information is being taken and when, but also to disclose to whom it will be made available. The second technique gives people freedom to choose which information to share and when. A possible implementation is to use buttons akin to camera and microphone switches in a video conference. The third approach uses privacy-enhancing technologies (PETs) that aim to prevent sensitive data from being linked with a specific person[18]. To ensure fairness for all stakeholders, software must inform users about what will be done with the information they are sharing.

– Freedom From Bias

Bias can be described as when a computer technology systematically and unfairly discriminates against certain individuals or groups of individuals in favor of others[18]. For example, a computer game for children that has a choice of only male characters is unfair to the female population that want to use the game. This is a small example of the gender bias which is ingrained into every society. Techniques to minimize the bias in computer systems include:

Develop an awareness of common biases with everyone involved in the design of a piece of software. Some common biases are age, color blindness, hearing impaired, gender, language and literacy[14].

Explicitly target potential users. Most systems do assume target users, but after deployment actual users may represent a wider demographic[14].

Design for diversity. Designing with diversity in mind can help to minimize the bias from a system. Designers can take into account individuals with a range of backgrounds to help reduce bias[14].

– Universal Usability

Universal Usability tries to ensure that all "who desire to do so" can use the product correctly once a week. However, all users is too strict a constraint, and as such a more realistic target would be to aim for 90% of the possible user base. The once-a-week requirement may not be appropriate in some contexts. Taking

into account user diversity and gaps in user knowledge can help achieve this goal[18].

– Trust

There are two trust contexts that are recognized in the HCI community: e-commerce and interpersonal relations. The e-commerce context covers issues of trust in all commercial activity online. As an example, the main e-commerce websites offer insurance on transactions in an effort to build customer trust. Interpersonal interactions range more in violations of trust between humans, including any hurt feelings or embarrassment. Trust is built differently in online interactions than in face to face communications[18].

– Autonomy

Autonomy is the capability and allowance for a user to make their own free decisions, guided by their own needs and wants and for their own reasons and purposes. Friedman et al. describe four aspects of systems that can promote or threaten user autonomy: system capability, system complexity, misrepresentation of the system and system fluidity[19].

– Informed Consent

Informed consent provides protection for user privacy. It also supports user autonomy and trust. Users are more likely to decide whether to trust a website if they are aware of what data is being collected. Consent means that users need to have both been made aware and fully comprehend how the information is going to be used[16].

– Accountability

Computers can participate in decisions that affect human lives. When a computer failure causes loss, the users can blame neither the software nor developer. The computer has no moral values and did not choose to fail, and the developer did not program the software to fail. Users need to try to reduce the tendency to attribute blame to a computational system[18].

– Identity

Identity concerns the way the user presents themselves for interaction. The scenario and environment a person is experiencing influences their manner and social cues. The purpose of software and environment of its use should help to determine the style and formality of the HCI interface[18].

– Calmness

Designers need to make sure that people using a system remain serene and feel

in control at all times. Information must be brought to people's attention only at appropriate times and must not cause the user excessive anxiety or stress[18].

– Environmental Sustainability

Researchers have been working on computer models of global warming, earth tectonics and other planet simulations in an effort to create a conscientious way for us to interact with our natural world. This value is difficult to apply to a software design if it doesn't have an environmental or natural focus. However, 'host' technologies and companies who provide them support varying levels of sustainability. This should be considered as a secondary factor if the primary system has no specific concern[18].

2.4 Social Platforms

Social media platforms use web and mobile technologies to create platforms where people or communities can create, share and discuss content. It is a form of communication that allows instant interactions between individuals that might even be all the way around the world. Social media platforms have many diverse scopes and functionalities; media sharing, professional networks and general communications are some examples[25]. It is different from paper-based media like newspapers in reachability, frequency, interactivity and immediacy. The massive nature of these characteristics make it ideal for content creators, who can reach a sizable audience in a small period of time. Messaging is an important feature when it comes to social media platforms. It allows people to communicate in a private manner both one-to-one and in groups. There are many popular messaging apps on the market but according to a September 2016 report by Business Insider the most popular in descending order are: Whatsapp, Facebook Messenger, WeChat, Viber and LINE[22].

2.4.1 Slack

Slack is a cloud-based collaboration platform that provides advanced messaging and file sharing to its users. It has been widely used by businesses, especially start-ups, for team communication. Amongst other features, it provides the integration of Bot Users which can automate some tedious processes like performing an attendance check or creating a to-do list. As of October 2016 it was reported that Slack has more than 4 million daily users, amounting to a total of 120 million monthly users. Weekly user-

base growth is approximately 4%. Seventy-seven percent of Fortune 100 companies use it[33].

2.4.2 Facebook Messenger

Facebook Messenger is an instant messaging service operated by Facebook. Users are able to send messages, photos, videos, stickers, GIFs, files and audio clips. Messages can also be exchanged with bot users created for Facebook Pages. Voice and video calling is also supported. It is the second most used messaging platform in the world with 1.2 billion monthly users[9].

This year in Facebook's F8 conference Head of Messenger David Marcus stated that chatbots are a main focus for Messenger development. The conference showcased new features that will enable businesses to create a better engagement with their customers and improve business visibility. These features include Discover Tab, Chat Extensions, Smart Replies, and M Suggestions. M Suggestions are reply suggestions made available when a prompt like 'good-bye' or 'make a plan' is written in conversation. This context-sensitive pattern matching is streamlining the user's experience and increasing their autonomy. Messenger's current goal is to convince businesses to retire their dedicated apps and move to Messenger modules providing the same functionality. This may increase user interaction because a vast number of individuals already have the app installed in their phones. For a consumer, finding every particular app, installing it and then interacting with their customer service system proves to be a lot more work. Over 65 million businesses are already active on Facebook and 80% of them use messaging to reach their customers[29].

2.5 Related Work

Siri, Alexa and Google Home are common examples of social bots. They receive user commands or cues in natural speech as input, and create an acceptable answer accordingly. These virtual assistants transform the words received from the user into text. The text is then processed in order to identify the meaning and search in a database for a response. Many responses are available, including searching a site like Wikipedia, playing a song from a music streaming site and redirecting the user to an external website for more information.

Microsoft's Social bot Tay was released on March 2016. It was supposed to engage

millennials and help researchers learn how this demographic communicate. Unfortunately, it used public data like Twitter inputs from users to learn, and this quickly became a problem when it started taking negative information for its interactions[43]. The social bot's responses quickly became inappropriate and it had to be shut down. As a response to this situation, Microsoft announced Zo, a modified version of Tay that incorporated censorship on its learning[5].

Poncho is a current example of a successful social bot, and in April 2016 became one of the first social bots to be integrated with Facebook Messenger[21]. Although its main functionality is to give weather forecasts, the developers embedded a friendly personality in it. The interactions with Poncho are often accompanied by GIFs or jokes. Poncho CEO Sam Mandel expressed that they were trying to build a chatty, friendly bot that would be easy to incorporate into a daily routine[21]. In alignment with this aim, the developers have incorporated a function that lets the user decide if they want to receive regular alerts about the weather. Since its conception Poncho has been integrated with many social platforms, including Slack. The developers use a combination of Artificial Intelligence and Natural Language Processing for Poncho. Corner cases where the user is too rude to the bot or curses were also considered. Every user has an internal score and every time a negative input is sent to the social bot the score diminishes, if it reaches a certain value, Poncho will not respond for 24 hours[21].

Chapter 3

Methodology

3.1 Requirements

Before any requirement gathering technique could be used to help determine the necessary functionality of the social bot, an outline of the potential actions a user could perform while utilizing the social bot was carried out. The outline also marked the entry points to each of the conversations.

3.1.1 Survey

The opinion of prospective users was invaluable during the initial phases of the software design. The goal of the survey was to pinpoint which values were important to a particular group of students, and further to take into consideration a range of different user perspectives. The contents and results of the survey can be found in Appendix B and the consent form that was distributed to the participants can be found in Appendix A.

3.1.2 Participants

The participants were a group of Informatics students, including 5 UG and 20 PG students that have participated in course selection at least once. Gender wise, the group consisted of 16 male students and 9 female students. The participants were comprised of a range of different nationalities. The target user for the survey are Informatics students that have at least a slight idea of their interests within Computer Science. There was no technical knowledge requirement to answer the survey. The survey was distributed via SurveyMonkey and the answers were collected remotely.

3.2 Value-Sensitive Design

An iterative tripartite methodology was used to implement Value-Sensitive Design to the social bot.

3.2.1 Conceptual

The first phase consisted of determining the relevant stakeholders in the bot, and what values are important to them. An obvious stakeholder is the group of students that will benefit from using the software. The online survey was designed to determine the values that are most important to them for course selection and their perspective on social bots. Other groups of stakeholders include the University and Personal Tutors. These stakeholders may be interested in overall student preferences and interests to keep the range of courses they offer competitive, and to know what students plan to do after graduation.

3.2.2 Empirical

In compliance with the methodology, the second phase consisted of an empirical investigation which entailed applying the survey to a sample of target users. In both UG and MSc levels there is a considerable population of international students, as such the demographic of those recruited for the survey reflects this.

3.2.3 Technical

After the survey was conducted, the values that were relevant to the students were pinpointed, and the appropriate modifications to the design were made. These changes were then validated by a focus group session.

3.3 Focus Group

The main objective was to determine if the users felt the developed software met their requirements. A group of 6 people were asked to use the social bot and then they were asked a series of follow-up questions. The entire structure of the focus group session can be found in Appendix D.

3.3.1 Participants

The participants were a group of Informatics students, including 2 UG and 4 MSc students that have participated in course selection at least once. Gender wise, the group consisted of 4 male students and 2 female students. The participants were of different nationalities. The target user for the survey are Informatics students that have at least a slight idea of their interests within Computer Science. There was no prior technical knowledge requirement to use the software but a Slack or Facebook account were necessary. For the recruitment of participants muffins, cookies, tea and coffee were offered.

Chapter 4

Design

4.1 Value-Sensitive Design

Although traditional software design can be functional and effective, it does not take into consideration the interests of all stakeholders. Traditional methods usually only consider the interests of the developing individual or organization. Even when traditional Human-Computer Interaction approaches to assessing usability are incorporated into the design process, users are not guaranteed to trust the final product. Nielsen says that even if a system receives a high usability score, people might not find it socially acceptable to use based on moral values[32]. Value-Sensitive Design recognizes that there might be a mismatch between what the software owners want and what is aligned with the public's interests, and so it creates a methodology to try to satisfy everyone's needs. This creates a well-rounded piece of software that will bring more benefits to all parties involved.

The following user scenarios represent the requirements of the social bot. The user may wish to:

- Create a list of courses she or he wants to take.
- Create a list of courses he or she does not want to take.
- Add interests to be considered during the course selection.
- Add future plans to be considered for the course selection.
- Request information about a particular course.

Additional scenarios irrelevant to course selection were devised. The user may:

- Ask the bot to tell a joke.
- Ask the bot to tell a fun fact.

- Swear at the bot.
- Ask for help.

The direct stakeholders identified are Informatics students of The University of Edinburgh. They will be using the software, and will benefit directly from it. There is a potential privacy infringement to be considered, since the students are sharing their names with the system. However, when the students use Path, they are again sharing personal information by being logged in to the university's system. The indirect stakeholders that were identified are: Personal Tutors, lecturers, ITO, the University, prospective students and other developers that will wish to continue or build over the project. It was important to ensure that the design of the project didn't conflict with the human values with ethical import, so for example the user's trust cannot be exploited for the sake of obtaining more information. The Value-Sensitive Design methodology is particularly useful to prevent that from happening and make positive contributions to all the stakeholders.

The following section details how the Tripartite Methodology of Value-Sensitive Design conceived by Friedman et al[17] was applied to the design of the social bot.

4.1.1 Tripartite Methodology

4.1.1.1 Conceptual

After the stakeholders were identified, the values most important to each group were identified. Table 4.1 shows the identified stakeholders and the values tied to each one of them. According to the values thought of for the students, the expected survey results are that students will want a service that is convenient and useful, and that will give them accurate advice about which courses they could be interested in.

Requirements were gathered by using a traditional and exploratory survey. The survey was designed to capture the normal behaviors, emotions and perceptions that individuals undergo while selecting their courses. Its purpose was to capture the essence of the experience they have while researching and deciding upon courses.

Surveys are a common method for information collection and people are used to their format. As such, it is an effective way of gathering data with little or no cost in a short period of time. The survey questions were designed based on the Likert Scale where a numerical rating was appropriate. For example for the question "How often do you seek assistance online?" a 5 point rating scale is used. Please see Appendix B for full information about the survey questions. This way we can get information

Table 4.1: Stakeholders and Values

Stakeholder	Values
Students	-Get course advice -Get course information -Convenience -Useful information -Choose the right courses for the upcoming year -Privacy -Custom tailored -Who else is taking the course?
Personal Tutors	-Get to know their tutees' interests -Give better advice -Know students' concerns
Lecturers	-See if their lectures are popular -See if people are considering their lectures
ITO	-Get course consideration information -See students' concerns -Course interests outside Computer Science
University	-Get information about what's important to students -See popularity of topics -Obtain a user friendly tool to create student engagement -Consider new lectures taking into account student's interests
Prospective Students	-See if the course offer fits their interests
Other Developers	-Understandable code -Not obscure technologies -Enough documentation

about the reactions of the user towards a concept or attitude and whether it is positive or negative. Open ended questions were included to build a more complete list of academic interests. The questions were also designed not to influence the responses of participants, to be neutral, not judgmental or condescending.

4.1.1.2 Empirical

A week after distributing the link to the survey, the results were collected and the survey was closed. The survey provided a significant portion of information useful for designing the social bot. These were the students' comments about their experience with course selection:

- Students have a wider range of interests than the ones anticipated. Some of the newly introduced interests are: Agents, Design, Coding, Computer Architecture, Music, Math, Embedded Systems and Data Science.
- Almost none of the students used Slack as a messaging platform but most of them used Whatsapp and Facebook Messenger.
- Students are moderately concerned about the amount of information social platforms collect.
- Students seek online assistance occasionally and have used social bots before.
- Users are very likely to use software to help them on course selection.
- Their main motivations for attending The University of Edinburgh is to get a job and gain knowledge.
- The most important thing when selecting a course is that the subject matches their interests, but they will also take into account who the lecturers are or who else enrolled in the course.

4.1.1.3 Technical

After the results from the survey were analyzed, the appropriate design changes were carried out. First of all, since the vast majority of participants expressed that they used Whatsapp or Facebook Messenger for their messaging communications. On July 26, 2017 Whatsapp announced that one billion people around the world use WhatsApp every day[45]. This makes it the most popular messaging platform in the world, however it does not provide a public API that can be used by developers or any bot integration to create social bots. The second most popular platform is Facebook Messenger with 1.2 billion monthly active users[9]. An integration with this service was implemented. The

change provides an access method convenient for all, and should boost user retention while improving usability. The pervasive nature of Messenger gives the bot the correct setting to become an always-available instant access service, and should improve the user's autonomy since so little effort is required to start using the bot. Additionally, the structure of the database was modified according to this feedback. A new column for the popularity of the course was added to the *Courses* table, so that the most popular courses within the student's interests are presented first. This addresses the students' preference of courses also taken by their friends. Students are more likely to find their friends in popular courses.

To address the students' concern about privacy, only essential information was taken from their profile. By default, the Facebook API garners some data unnecessarily. Gender and location data is already 'public' on Facebook, but the user's gender and location are not required for record keeping, and so they are not saved into the database. To gather information regarding which topics students are interested in, an in-depth investigation into the courses' content was performed, alongside implementing changes obtained from the survey feedback. This expanded the list of potential interests, which aims to be extensive enough for the course selection process.

After all the changes and with the information compiled by the survey the main values for the user

- Convenience
- Availability
- Privacy
- Has information needed
- Enroll courses that will provide them with knowledge of the subject and will get employable skills.

With this in mind, it is fair to say that students are very open to the idea of using a social bot that will take into account the value set that is most important to them to try to determine the ideal courses they should enroll in.

4.1.2 Human Values

- Human Welfare

  There are no significant concerns for this bot around human welfare issues.
- Ownership and Property

  The Slack licence states that all object code is their property, but grants "a

non-sublicensable, non-transferable, non-exclusive, limited license" to the object code for the customer's purposes. The design of the social bot does not infringe the Slack terms of service in this regard for either public or private use of the bot.

API.ai has a similar model, providing a licence for their copyright-protected object code. Again, the terms of use of the programming interface have been consulted thoroughly and are not being breached by public or private use of this social bot.

The user is expected to provide no working functionality and are not expected to contribute any novel information of any kind including ideas, files or knowledge. If the user somehow unwittingly does this, the bot will not retain this information further than a single conversation flow and rights to the copyrightable material remain with the user.

– Privacy

In accordance with the tripartite methodology of Value-Sensitive Design, iterative conceptual, empirical and technical investigation into privacy were carried out as part of the design process. This included an initial analysis as to which data is essential to take from the user, and the extent to which the data is sensitive. This was carried out on the basis of the first prototype's data requirements, which were derived entirely from the initial platform of Slack. Following this, during a requirement gathering survey [see Appendix B] users were asked for their consent to share their responses anonymously. The survey provided the basis for implementation of an initial prototype

Further acceptance testing was at this stage planned and the issue of privacy reiterated during implementation.

Slack uses first name, last name, email, profile picture, and timezone. Facebook by default accesses first name, last name, location, timezone and gender but for the purposes of the social bot only first and last name were requested.

– Freedom From Bias

Due to the great diversity of cultures representing the University's student population, creating a software that was free from any cultural bias was highly important. The student population is also multi-gender, and so gender-specific pronouns were avoided in conversation with the user. Simple English was used to ensure people from different countries would not be put off by over-complicated language.

– Universal Usability

  Universal Usability is defined by Friedman et al.[18] as 90% of all the users "who desire to do so" successfully using the telecommunications product once a week. Of course, there is no need for frequent use of the bot created for this project, Hence, the conversation flow and potential variations in a user's responses underwent several design iterations, user acceptance is of particular importance, especially given that the demographic of the bot includes many international students who may not be fully expert in English. However, the demographic is limited to tech-aware Informatics students, and so achieving this special case of freedom from bias should not require any simplifications to the technology. Hence, the vocabulary, spelling and grammar awareness of the bot will be the main subject of the iterative Value-Sensitive Design process.

– Trust

  The first trust context specified by Friedman et al.[18], e-commerce, does not apply to this social bot. However, the second, Interpersonal Interactions, are a significant factor for the course selection bot.

  The interpersonal interactions context covers violations of trust, like a comment causing hurt feelings or embarrassment. The bot has been designed to avoid these, providing instead a functional conversation line. The additional features are designed to be family-friendly and have been chosen to be as inoffensive as possible.

– Autonomy

  The traditional method of electing courses with a Personal Tutor is not entirely autonomous. There are a vast array of courses, limited information on their relevance to students' interests, and further, a limited time in which to select the perfect courses for them. Students often do not have time to attend all potential electives, and even if they do, in doing so the time taken to preview courses may yet still not be sufficient to fully investigate which courses are the best choices for them. Friedman et al.[13] noted that it was possible to enhance user autonomy by streamlining or removing those choices from a user which are extraneous, such as courses which they do not have the prerequisites to take and irrelevant options which do not match their interests. The unwanted information may cause more confusion for the student in making their choice. For instance, a student for whom AI and Maths are of interest may not wish to spend time attending design-based courses.

The bot allows for greater user autonomy since it learns about the student's interests, and then removes the step of manual investigation, presenting the student with a succinct and relevant options list. This leaves them free to sample appropriate classes. The tailored recommendation acts as a guide to the courses that reflect the needs and wants the user themselves specified to the bot. The bot provides quick links to each course, eliminating the need for the student to spend time searching.

Questions regarding user autonomy were included in a focus group study to investigate whether users felt more confident in approaching their Personal Tutor to make a final decision. The bot aims to not only give the student more autonomy with its availability and advice, but also to give the Personal Tutor more autonomy by reducing their need to help the student with the selection.

– Informed Consent

The Belmont Report delineates ethical principles and guidelines for the protection of human subjects. It incorporates the principles of: respect for persons, beneficence and justice[37]. It contains a list of applications, one of which is Informed Consent and it has three elements that are:

  - Information - disclose the individual with enough information
  - Comprehension - the individual's interpretation of what is being disclosed.
  - Voluntariness - make sure that the individuals' actions are not controlled, that they posses the mental, emotional and physical capabilities to give the informed consent.

By creating an account in a social platform, users are already giving a preliminary consent for their data to be used. They can access their account preferences to change the information that they share.

– Accountability

The bot's responsibility is to find appropriate classes for the user's consideration. The user does not have any knowledge of how the suggestions are obtained, and so for the case of imperfect recommendation a disclaimer was added, ensuring that the student is advised to actually attend the classes to make sure they are suitable. This is particularly relevant for first year students, who may not yet be fully aware of the importance of their selection.

– Identity

The user is expected to communicate with the bot in a natural way, neither informally nor formally. The combination of fixed-option, open-ended and fun-oriented communication modes support this and aim to allow the user to be themselves when interacting with the bot.

– Calmness
The operation of the bot should be as streamlined as possible and avoid inducing unnecessary stress and anxiety in the users. The language used by the bot is friendly and avoids making demands of the user.

– Environmental Sustainability
The bot in and of itself presents a negligible environmental concern.

4.2 Social Network Bot Design

4.2.1 Conversation design

4.2.1.1 Scope

The software has a fixed range of functionality, and information on each is described to the user in the welcome message, and expanded in the help dialog. The main functionality is to help students with their course selection; by asking a series of questions the bot creates a query to retrieve a list of courses that will suit the user best. It can also provide a short summary of each of the Informatics courses. Additional functionalities embedded in the software are modules for jokes and fun facts and a module to handle user swearing. A 'help' command will be made available that will clarify basic questions a user might have. Outside of the scope of this first version of the software is course scheduling, as more time would be required for implementation, and also the course list must be updated each semester depending on how lecturers and rooms are allocated.

4.2.1.2 Personality

When defining the personality of the social bot it was taken into consideration that university students should be able to relate to the bot. Avoiding unnecessarily complex grammar or language structures was essential, given that 69% of undergraduate and 81% of postgraduate Informatics students at The University of Edinburgh are from outside the United Kingdom[34]. Friendliness and approachability are also important

characteristics incorporated into the personality of the bot. Students should feel like they can easily use the software and should not be intimidated. The conversation aims to be as person-like as possible, yet not trying to trick the user into believing they are communicating with a human, since that could make users feel uncomfortable. Responses to the students' queries aim to be as concise as possible, with the hope of the interaction being considered helpful but also efficient.

4.2.1.3 Conversation Flow

Human interactions are incredibly complex and trying to fully recreate one with a social bot would be an epic task. There are different communication styles, many ways in which the same information can be expressed, and everything depends on the context of what has been previously said. However, the creation of a limited, context-dependent, custom-tailored experience for university users that are trying to figure out which courses would be better for them is much more realistic. The aim of the conversation is to work seamlessly with little user input, and in return provide information they may find invaluable. The bot's conversation also has to be intuitive to ensure the user is not confused as they interact with it. It is very important that the bot is perceived as helpful rather than an obstacle, so the conversation planning is of the utmost importance. The purpose of the conversation is to guide the user through the process of trying to find the best course selection for them. A normal conversation pattern was employed with a greeting to the user, an introduction to the bot explaining what it can do, the body of the process where questions are asked and a conclusion.

The interaction starts with a welcome message for the user. Facebook provides the capability of having a welcome screen. However, Slack does not have this characteristic so the user has to start the conversation with the social bot. Nonetheless, personalization is still implemented in both platforms which obtain the user's first and last name.

The entry points for the system which commence an interaction are when a user says 'Hi' see Figure 4.2 or any other similar greeting variation to the social bot, or if in the Facebook Messenger platform, the user taps the GET STARTED button see Figure 4.1. This will start the conversation and instruct the bot to ask the users if they need help with their course selection.

When possible, quick replies or buttons were used to help the user provide a reply. This has some advantages for both the user and the social bot. It adds more structure to the messages and it lists potentially responses the user might give. This limits the

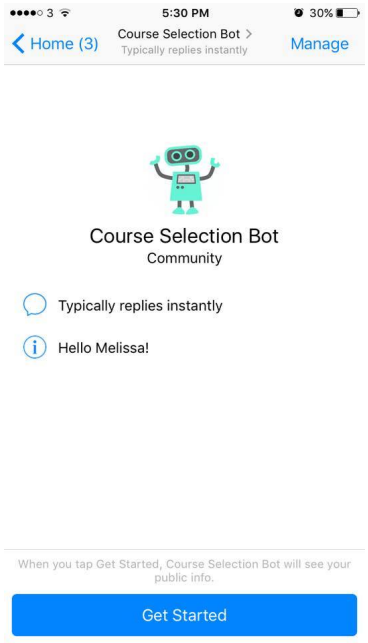

Figure 4.1: Facebook Welcome Screen

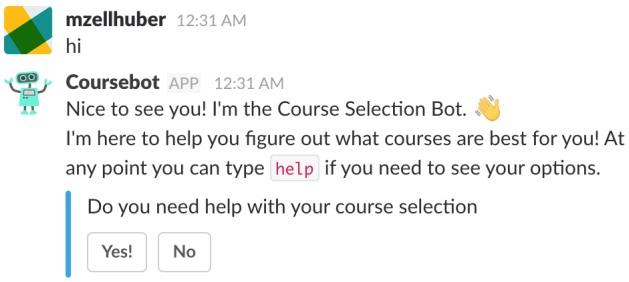

Figure 4.2: Starting a Slack Conversation

potential for a typo or synonym to interrupt the conversation flow due to an incomprehension on either side. It can also hint the user about the kind of actions it can perform. If the user is typing while moving, tapping on a button is easier than writing. Also, standalone questions can lead users to respond in ways the social bot does not support. However, it might also reduce user engagement because it disrupts the traditional person-like conversation, where chatting with people does not happen by merely pushing buttons.

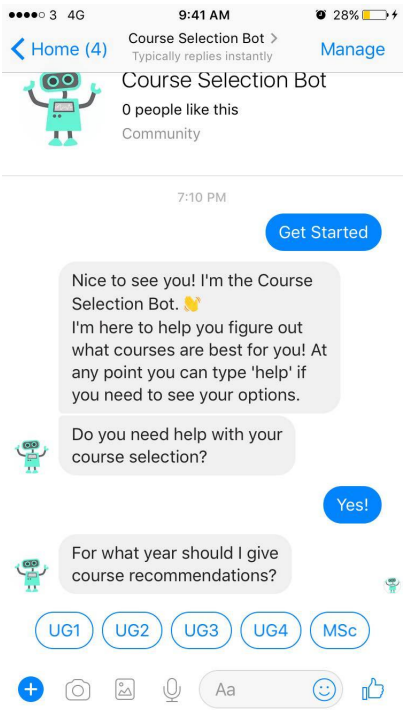

Figure 4.3: Quick Replies

Whenever a standalone question is prompted, a range of communication styles are accommodated. For example, a student can specify courses which they want to take in different forms and the social bot will still understand. An instance of this is how the course Informatics 1 - Computation and Logic can be written: the previous, 'INF1-CL' or 'Computation and Logic' will all refer to the correct course. Similarly with inputs like greetings, it could be written as hello, hi, hey, and so on. It can be expected that some users will swear at the social bot as a means of entertainment, and as such a module handling offensive language is embedded into the bot. An additional conversational characteristic is that if the user says something that the social bot does not comprehend, it will handle it with a response and not just ignore the input.

Another potential stumbling block that has been accounted for is rhetorical ques-

tions. The user may be tempted to answer these, potentially with some kind of interaction the bot is not ready to handle. The common practice of confirmation was implemented in order to make sure that the system has the correct data from the user. It was also important to leave out gender-specific pronouns, as the tool is to be used by both female and male students.

Parameters that were considered aside from the students academic topics of interest include which year they are in (as some years may have compulsory courses) and courses the student may either already want to take or avoid. The social bot is able to provide more detailed information about each of the courses with a brief description, links to university website with further information, and the different classes of interest which the course covers.

The user is prompted with a series of simple questions at the beginning of the interaction, and the assistant tool then attempts to pinpoint their academic interests, taking into account their plans for after graduation. The software makes an effort to accommodate the needs of each student, and analyzes the available courses in order to give the best recommendation.

Figure 4.4 represents the conversation flow after all these considerations.

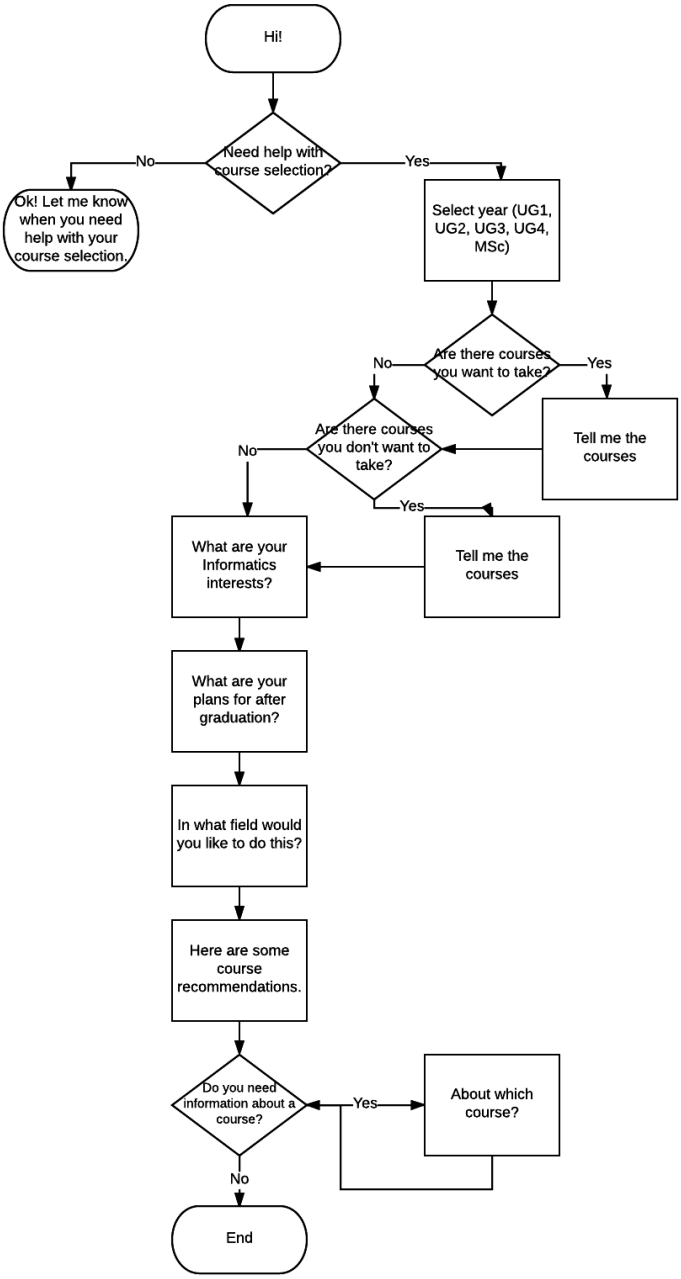

Figure 4.4: Conversation Flow

4.2.2 Software Architecture

The software architecture was designed in a modular way, so that every action received by the NLP engine would be treated as a different function. This allows for functions to be added easily and thus increasing the social bot's capabilities.

4.2.3 Database

The database used for the project is PostgreSQL. It is an open source object-relational database system. There are two tables used: courses and students. *Students* contains the id, name and preferences of the person including classes she wants to take or the topics that she's interested in. *Courses* contains all the Informatics courses, with keywords that guide the software to know the main areas that are discussed during the lectures. It also contains the URLs for the course websites, a short description, how many students were enrolled in the 2015/2016 lecture and if it is mandatory for any year. Figure 4.5 shows the database structure for the *Courses* table and figure 4.6 shows the database structure for the *Students* table.

Column Name	Type	Length	Not Null
course_name	varchar	56	true
euclid_code	varchar	9	true
acronym	varchar	8	true
ai	varchar	2	false
cg	varchar	2	false
cs	varchar	2	false
se	varchar	2	false
level	int4	10	true
points	int4	10	true
year	int4	10	true
delivery	varchar	4	true
lecturer_s_coordinator_s	varchar	44	true
course_url	varchar	36	true
school_course_page	varchar	49	true
university_course_page	varchar	50	true
assessment	varchar	25	true
description	varchar	1936	true
keywords	varchar	93	false
popularity	int4	10	false
mandatory	varchar	30	false

Figure 4.5: Structure of Course Table

Depending on the user's inputs, a query that will retrieve the courses will be constructed. For example if she's interested in Software Engineering, the software will look for courses that have the keyword Software Engineering. The final results are ordered with preference for mandatory courses first, user preferences and then popularity.

Column Name	Type	Length	Not Null
user_id	varchar	150	true
first_name	varchar	50	false
last_name	varchar	50	false
email	varchar	200	false
year	varchar	30	false
want_courses	varchar	500	false
dont_want_courses	varchar	500	false
interests	varchar	500	false
plans	varchar	500	false
field	varchar	500	false
recommendations	varchar	2000	false

Figure 4.6: Structure of Student Table

4.2.4 Natural Language Processing

4.2.4.1 API.ai

API.ai provides the programmer with a framework to create a conversational platform or agent. A typical agent consists of Intents, Entities, Contexts and Actions with parameters. The Entities define the pre-existing values that an element might have and their synonyms. For example, if a student has an interest in Machine Learning, the interest could be written as AI, Artificial Intelligence, ML or Machine Learning. The entities that were created are: courses, interests, non-academic plans, field for their future plans, future plans, school year and swearwords. Intents were created for every user prompt or question; the question “For what year should I give course recommendations?” is tied to the intent *enter-year* and the action *specify-year*. A general context to pass information about intents was created so that all the information that is being collected can be available at any time.

After all intents and entities were created, the AI needed to be trained. For this a significant amount of conversations with the bot need to be performed. API.ai has its own interface to train the AI, so when a user has a conversation with the social bot which does not develop according to the plan, there is the possibility to go to that interface and classify the intents according to how they should have been.

4.2.5 Course Selection Criteria

The parameters that are taken into account when computing the courses for each individual student are: topic interests, future plans, the school year they are in, any mandatory courses for that specific year and the number of credits required for that year.

4.3 Focus Group

The focus group outline was created to make participants feel like peers. In peer settings, people are more likely to share their opinions, perceptions, wants and needs[30]. This is crucial if honest feedback will be taken into account to improve the software. Trying to make the participants feel at ease with the group dynamic requires some planning. A neutral and relaxed environment was promoted by creating a comfortable seating space where a circular seating arrangement removed any visual suggestion of a social hierarchy. To reassure the group about how the information would be used and what their role was during the study, the entire study plan was explained thoroughly and consent forms with the concerning ethical issues were handed out. The participants' comprehension of the session was ensured with free questions, and every step was then explained again to the participants. A safe thought space was critical to gather meaningful information. The complete focus group outline can be found in Appendix D.

4.4 Design Alternatives

The least complicated alternative to a social bot is a simple software system that performs according to language processing rules. This would make for a very limited and difficult to maintain software which will not be tolerant to failure or any unknown user inputs. This approach has major drawbacks, especially where there is such a diversity and variation in the way simple expressions like 'hello' can be expressed. Another approach is to use a framework like Botkit to build the social bot. The downside to this is that they lack flexibility in the characteristics and developers have to stick to defined rules, free versions of these frameworks are often open-source and while they are usually maintained by the community, documentation seems to be less than a priority. A more complete solution is to use a tool for Natural Language Processing. There are several language processing platforms available, some examples are Wit.ai, Amazon Lex and API.ai. These are able to create a more robust customizable solution, however API.ai proves to be the more flexible one. Wit.ai does not provide the wide range of social platform integrations and Amazon Lex only works with Amazon's proprietary Alexa. API.ai also provides some has built-in domains of knowledge like a 'Small Talk' module that handles common user interactions like greetings and good-byes but that are not relevant to the bot functionality. API.ai makes integrations with Actions on

Google, Facebook Messenger, Slack, Viber, Twitter, Twilio, Skype, Tropo, Telegram, Kik, LINE, Cisco Spark, Amazon Alexa and Microsoft Cortana possible.

Chapter 5

Implementation

The project consists of the following files:

- app.json
  Contains simple information like the project title, description, logo, repository and keywords
- app.py
  The Python code for the app
- docs folder
  Contains a pdf of this document
- Procfile
  Tells Heroku the type of the app and where the main file is
- requirements.txt
  Contains all the packages required for Python to execute the app correctly

5.1 Heroku

Heroku is a Platform as a Service (PaaS) that allows for the deployment and maintenance of applications on the cloud. Because it is a PaaS, it already provides the architecture and environment needed to run the application and makes it easier to deploy. Both the Flask application and the PostgreSQL database are hosted here.

To create a project a Heroku account is needed. Afterwards a Git repository needs to be initialized, and a Heroku app needs to be created with the command in the Terminal

```
$ heroku create
```

After that, every time the project needs to be deployed it is only necessary to type

```
$ git push heroku master
```

and the Heroku platform will install the requirements that are specified in requirements.txt and update the project.

The project URL is: `https://afternoon-reaches-72164.herokuapp.com/`

Figure 5.1 shows the architecture of the social bot.

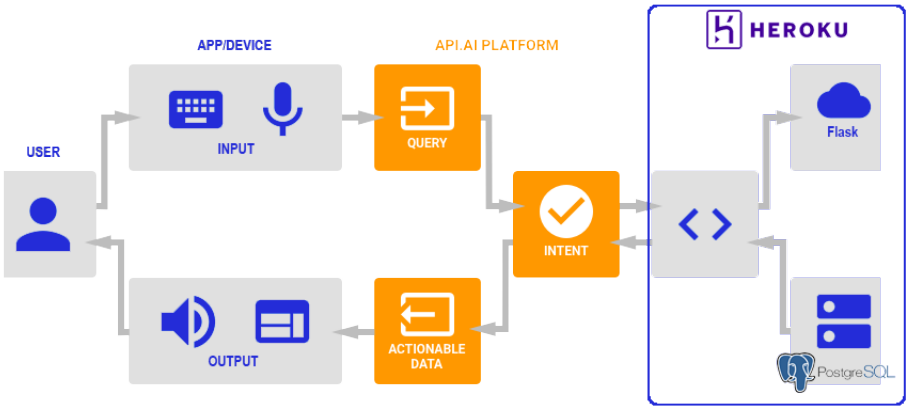

Figure 5.1: Social Bot Architecture based on [3]

5.2 Python

5.2.1 Flask

Flask makes the connection between the code, the database and the conversational agent possible. Flask is a microframework, and as such no extra libraries or tools are required, reducing space complexity and loading time performance. This Flask was used to create a RESTful Webservice for the webhook to work with the API.ai engine. A webhook (also known as a callback) provides real-time information to an application as it happens. The webhook catches and processes requests made to the bot as they happen, returning the data requested. For the chatbot, setting up a webhook allows the application to pass information from a matched Intent into a Webservice and have a result returned. This implementation was essential to connect the database with the social bot. Each Intent has a corresponding function in the program code. The functions are classified by module, according to their action.

For the Python project to work, certain dependencies needed to be installed in the Heroku environment. These dependencies are specified in the *requirements.txt* file the

contents of the file are:

```
#requirements.txt
Flask==0.10.1 #Installs Flask
psycopg2==2.6.1 #PostgreSQL adapter for Python
requests==2.9.1 #Python library to handle HTTP requests
```

The app route 'webhook' was defined such that when a request to the URL `https://afternoon-reaches-72164.herokuapp.com/webhook` is made, Flask will handle that according to the functions set with the specific actions defined in API.ai.

5.3 API.ai

Every time the user interacts with the social bot, a request is made to API.ai. The NLP engine then tries to match the input with one of the intents created. These intents work by classification to categorize and respond to user inputs. Figure 5.2 shows how the 'interests' intents classifies user input into the different entities that have already been defined by the developer or standard entities like year or date.

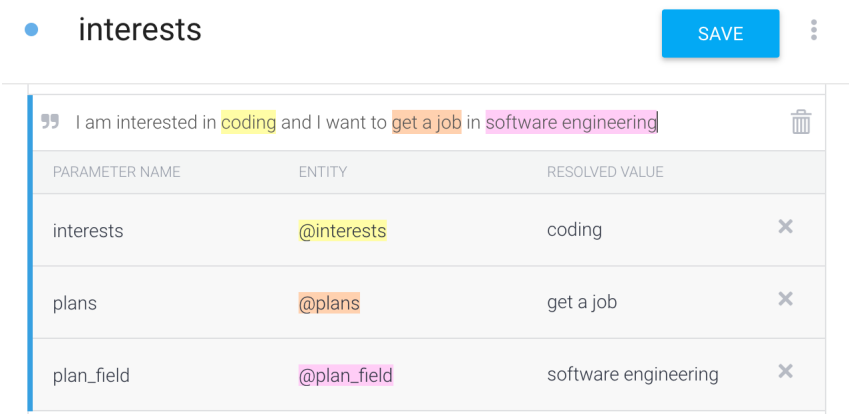

Figure 5.2: Intent Sample

A complete list of the Intents in the project can be seen in Figure 5.3

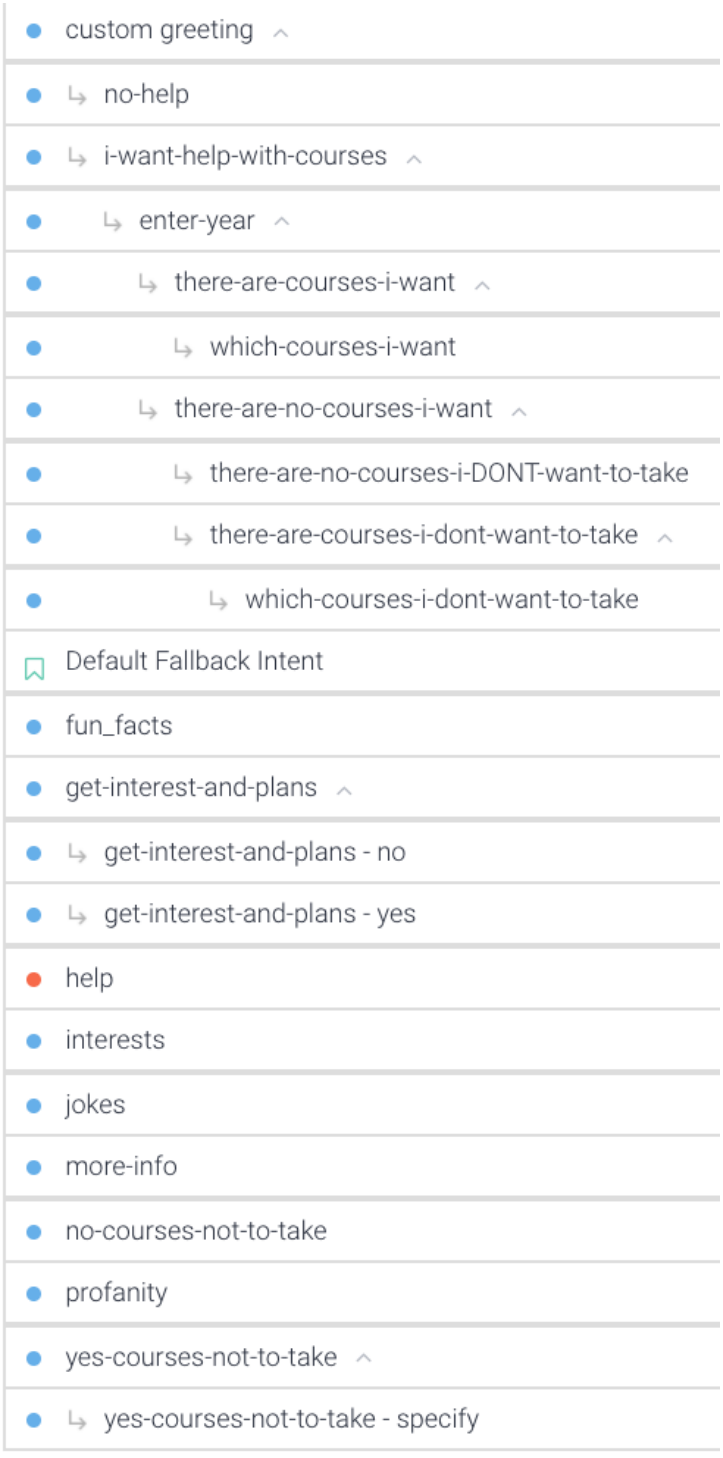

Figure 5.3: Intent List

Entities are used to extract parameter values from natural language inputs. There can be user created Entities or standard system Entities that are already predefined in the API.ai system. System entities include date and time, numbers, measure units, names, geography and even famous bands and songs. The Entities that were defined for this project are: courses, interests, non-academic plans, future plan field, swear-words and school year. Non-academic plans were added, taking into account students who might write in their plans they want to travel or start a family after graduation. Figure 5.4 illustrates how entities and it's values can be defined, each can have a set of synonyms. Synonym definition is very useful to map the way different users can say the same things. The interest 'Security' might be expressed as Security, Computer Security, Cyber Security or hacking. More synonyms can be added and that is can be determined by the way users interact with the social bot.

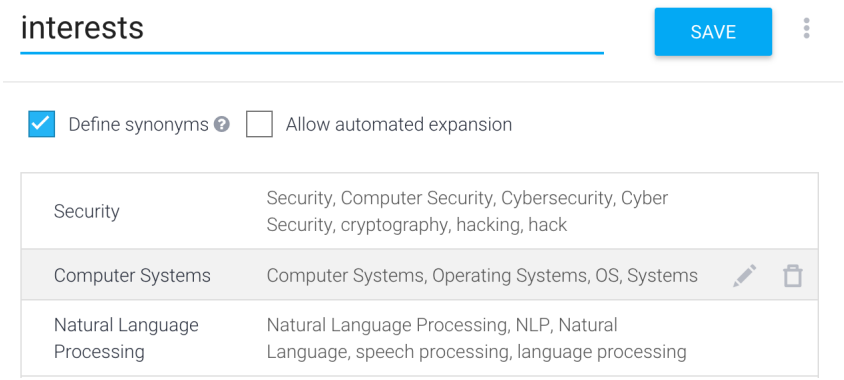

Figure 5.4: Entity Sample

The training section in API.ai is extremely useful for when the NLP engine is confused about what the user input actually means. When an unknown or unassigned input reaches the social bot, it will respond with a message informing the user that it can't process the request. Figure 5.5 shows an example of an input that is part of the should be part of the social bot's intents. However, Figure 5.6 shows an input that is not part of the scope of this project.

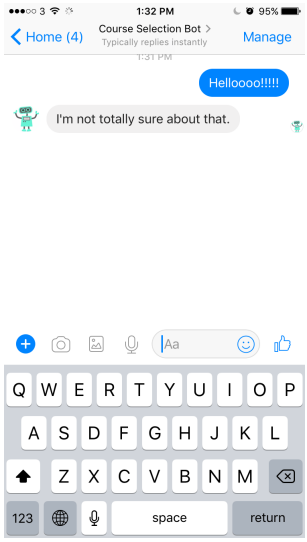

Figure 5.5: Unknown Greeting

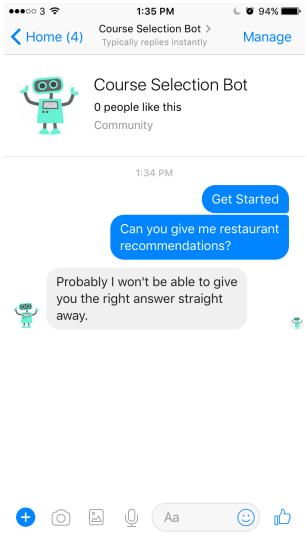

Figure 5.6: Unknown Input

From the point of the unknown greeting, the Training section of API.ai can be accessed and classify the input into the right category so that it can be identified next time a user writes it. Figures 5.7 and 5.8 show the process of training the social bot. The developer only needs to select the correct intent from the list.

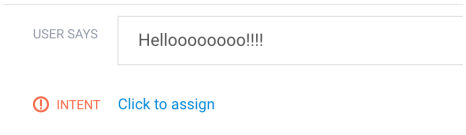

Figure 5.7: Social Bot Training

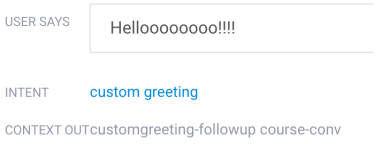

Figure 5.8: Social Bot Trained

The social bot is then trained and will recognize the input correctly, as the following figures show.

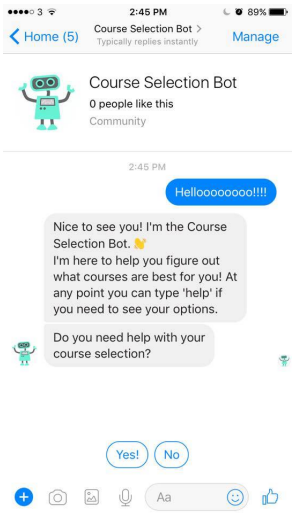

Figure 5.9: Trained Greeting Facebook

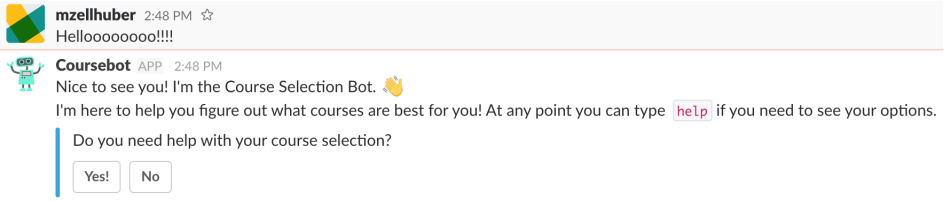

Figure 5.10: Trained Greeting Slack

5.4 PostgreSQL

PostgreSQL is an open source object-relational database, it is multiplatform and has extensive documentation. Heroku comes with a PostgreSQL easy integration and can be setup quickly.

All the Informatics courses' information was loaded into the table *Courses* the information was taken from `http://course.inf.ed.ac.uk/`. Apart from the data provided by the School of Informatics website, columns like description, keywords, popularity and mandatory were added. The popularity field was calculated by taking the information found in the Student course feedback site (`http://web.inf.ed.ac.uk/infweb/student-services/ito/admin/course-survey-reports`) and using the number of responses and the response rate to calculate how many students had taken the course in the school year of 2015/2016. For example, if a course had a total of 47 responses and a response rate of 41.2%, we can resolve that there were 114 students taking the course.

course_name	euclid_code	acronym	ai	cg	cs	se	level	points	year	delivery	lecturer_s_coordinator_s	course_url	school_course_page
Accelerated Natural Language…	INFR11125	ANLP	AI	CG	…	…	11	20	5	S1	S Goldwater / H Th…	http://course.inf.ed.ac.uk/nlp/	http://www.inf.ed.ac.uk/teaching
Adaptive Learning Environment…	INFR11069	ALE1	AI	CG	…	…	11	10	4	S2	H Pain	http://course.inf.ed.ac.uk/ale1/	http://www.inf.ed.ac.uk/teaching
Advanced Databases	INFR11011	ADBS	…	…	CS	…	11	10	4	S2	P Guagliardo	http://course.inf.ed.ac.uk/adbs/	http://www.inf.ed.ac.uk/teaching
Advanced Topics in Foundation…	INFR11122	ATFD	…	…	CS	SE	11	20	5	S2	A Pieris	http://course.inf.ed.ac.uk/atfd/	http://www.inf.ed.ac.uk/teaching
Advanced Vision	INFR11031	AV	AI	CG	…	…	11	10	4	S2	B Fisher	http://course.inf.ed.ac.uk/av/	http://www.inf.ed.ac.uk/teaching
Advanced Vision [Distance Lea…	INFR11127	AV-DL	…	…	…	…	11	10	5	S2	B Fisher	http://course.inf.ed.ac.uk/av-dl/	http://www.inf.ed.ac.uk/teaching
Advances in Programming Lan…	INFR11101	APL	…	…	…	…	11	10	4	S1	I Stark	http://course.inf.ed.ac.uk/apl/	http://www.inf.ed.ac.uk/teaching
Agent Based Systems	INFR10049	ABS	AI	CG	…	…	10	10	3	S2	M Rovatsos	http://course.inf.ed.ac.uk/abs/	http://www.inf.ed.ac.uk/teaching
AI Large Practical	INFR09043	AILP	…	…	…	…	9	20	3	S1	A Smaill	http://course.inf.ed.ac.uk/ailp/	http://www.inf.ed.ac.uk/teaching
Algorithmic Game Theory and it…	INFR11020	AGTA	AI	…	CS	…	11	10	4	S2	K Etessami	http://course.inf.ed.ac.uk/agta/	http://www.inf.ed.ac.uk/teaching
Algorithms and Data Structures	INFR10052	ADS	…	…	CS	…	10	10	3	S2	R Mayr	http://course.inf.ed.ac.uk/ads/	http://www.inf.ed.ac.uk/teaching
Applied Databases	INFR11015	AD	…			…	11	10	5	S2	S Maneth	http://course.inf.ed.ac.uk/ad/	http://www.inf.ed.ac.uk/teaching
Automated Reasoning	INFR09042	AR	AI	CG	CS	…	9	10	3	S1	J Fleuriot	http://course.inf.ed.ac.uk/ar/	http://www.inf.ed.ac.uk/teaching
Automatic Speech Recognition	INFR11033	ASR	AI	CG	…	…	11	10	4	S2	S Renals / H Shimo…	http://course.inf.ed.ac.uk/asr/	http://www.inf.ed.ac.uk/teaching
Bioinformatics 1	INFR11016	BIO1	…	CG	CS	…	11	10	5	S1	D Armstrong / M He…	http://course.inf.ed.ac.uk/bio1/	http://www.inf.ed.ac.uk/teaching
Bioinformatics 2	INFR11005	BIO2	…	CG	CS	…	11	10	5	S2	D Armstrong / M He…	http://course.inf.ed.ac.uk/bio2/	http://www.inf.ed.ac.uk/teaching
Calculus AND its Applications	MATH08058	CA	…	…	…	…	8	20	1	S1	NOT Allocated		
Case Studies in Design Informa…	INFR11094	CDI1	…	…	…	…	11	20	5	S1	R Hill	http://course.inf.ed.ac.uk/cdi1/	http://www.inf.ed.ac.uk/teaching
Case Studies in Design Informa…	INFR11095	CDI2	…	…	…	…	11	20	5	S1	R Hill	http://course.inf.ed.ac.uk/cdi2/	http://www.inf.ed.ac.uk/teaching
Categories and Quantum Infor…	INFR11128	CQI	…	…	…	…	11	10	5	S2	C Heunen	http://course.inf.ed.ac.uk/cqi/	http://www.inf.ed.ac.uk/teaching
Compiler Optimisation	INFR11032	COPT	…	…	CS	…	11	10	4	S2	H Leather	http://course.inf.ed.ac.uk/copt/	http://www.inf.ed.ac.uk/teaching
Compiling Techniques	INFR10065	CT	…	…	CS	…	10	20	3	S1	C Dubach	http://course.inf.ed.ac.uk/ct/	http://www.inf.ed.ac.uk/teaching
Computational Cognitive Neuro…	INFR11036	CCN	AI	CG	…	…	11	10	5	S2	P Series	http://course.inf.ed.ac.uk/ccn/	http://www.inf.ed.ac.uk/teaching
Computational Cognitive Science	INFR10054	CCS	AI	CG	…	…	10	10	3	S1	F Keller	http://course.inf.ed.ac.uk/ccs/	http://www.inf.ed.ac.uk/teaching
Computer Algebra	INFR11111	CA	…	…	CS	…	11	10	4	S2	K Kalorkoti	http://course.inf.ed.ac.uk/ca/	http://www.inf.ed.ac.uk/teaching

Figure 5.11: Course Data

The student table stores the information obtained from the users of the software. Storing the data permits later analysis and reporting; tutors of the University may be interested to know which topics are most popular and students' future plans. The table also supports record keeping for the students' later reference. The user_id field comes directly from the user id that was appointed to them by either Slack or Facebook. The first record in Figure 5.12 is a Facebook user, the second a Slack user. After the recommendations have been issued to the user, they are saved in the recommendation column.

user_id	first_name	last_name	email	year	want_courses	dont_want_courses	interests	plans	field	recommendations
1294305260686275	Melissa	Zellhuber	NULL	4	HCI,STN	ASR,IAR	Human-computer interaction,S…	PhD	Softwar…	Based on the information
U5WLNFB9N	Melissa	Zellhuber	melissa.zellhuber@gmail.com	5	SAPM,SP	PA	Software Engineering,Human-c…	job	Banking	Based on the information

Figure 5.12: Student Data

The query that used to get the recommendations is constructed in phases. Each question the user answers incrementally modifies the query in order to return the optimum courses for that student. Listing 5.1 shows an example of a query. It is for a 3rd year student who is interested in databases, does not want to enroll the course MLP, doesn't want to enroll in any courses in particular, and has no plans prepared for the future.

```
1 SELECT course_name, points, university_course_page,
    acronym, YEAR
2 FROM courses
3 WHERE course_name IN
4 (SELECT course_name FROM courses WHERE mandatory='3' OR
    acronym NOT IN ('MLP') AND (keywords LIKE '%Databases%
    '))
5 AND YEAR = 3
6 ORDER BY mandatory, popularity desc;
```

Listing 5.1: Recommendation Query

When this query is executed only 3 courses match the specifications. This is clearly insufficient: it does not meet the credit requirement. The software then executes a secondary query that retrieves all the courses for that year that have not been added to the recommendations and orders them by popularity.

Professional Issues	10	http://www.drps.ed.ac.uk/16-17/…	PI	3
System Design Project	20	http://www.drps.ed.ac.uk/16-17/…	SDP	3
Database Systems	20	http://www.drps.ed.ac.uk/16-17/…	DBS	3

Figure 5.13: Query Results

The secondary query created to complete the results from query in Listing 5.1 results in:

```
1 SELECT course_name, points, university_course_page,
    acronym
2 FROM courses
```

```
WHERE YEAR = 3
AND acronym
NOT IN ('PI', 'SDP', 'DBS')
ORDER BY popularity desc;
```

Listing 5.2: Secondary Query

The query then continues to add courses to the recommendations until the credit requirement is met. If enough courses were found with the first query, the secondary query is not created or executed. The output for the above preferences would be Figure 5.14

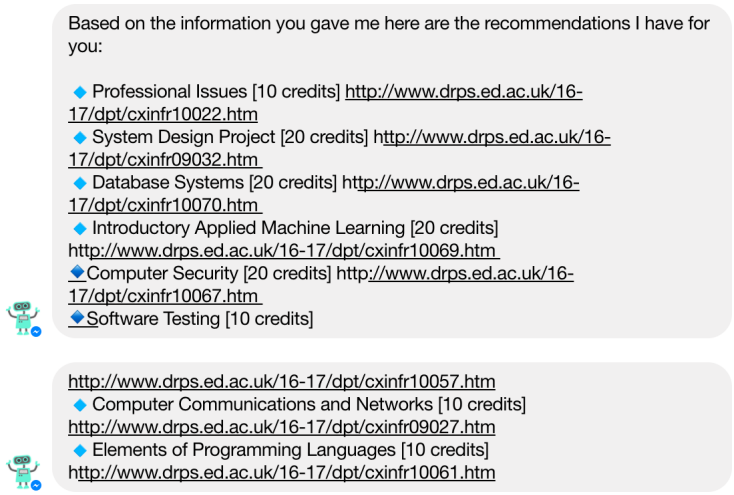

Figure 5.14: Recommendations

5.5 Social Network Platforms

5.5.1 Slack

To integrate Slack with the API.ai agent a new Slack App needed to be created and added to the corresponding Slack team. Afterwards, a Bot User needs to be added and made available too every team member. The Bot User needs to be subscribed to events like messages and groups so that it can issue a request to API.ai when a user interacts with it. Figure 5.15 shows the events that the bot *@coursebot* is subscribed to.

To complete the integration, the developer needs to enter the values for Client ID, Client Secret, and Verification Token in the Slack option of the Integrations section in

Event Name	Event Description
message.im	A message was posted in a direct message channel
message.groups	A message was posted to a private channel
message.channels	A message was posted to a channel
im_created	A DM was created

Figure 5.15: Event Subscriptions

API.ai. The Event Request URL and OAuth URL also need to be specified in the Integrations section, these values are found under Settings in the Slack app page. Finally, the developer needs to authorize the Bot User to access the team.

5.5.2 Facebook Messenger

In order to set up the Facebook integration a Facebook App needs to be created in the Facebook Developer Console. Once the app is created, the Page Access Token needs to be copied in the Integrations section of the API.ai console. To configure your social bot's webhook, webhooks have to be enabled in the Facebook Developer Console and the app has to be subscribed to messages and messaging_postbacks events. Finally the Callback URL that is provided in the Facebook integration in API.ai needs to be copied in the Facebook App page and a verify token that matches both pages needs to be specified.

The welcome screen that displays the 'Get Started' button and the 'Hello' message were also configured. A POST request is sent to the Facebook API using the Access Page Token for each of them. When the 'Get Started' button is tapped, it sends a custom request to the webhook, this forwards it to API.ai. The social bot needed to be trained with the custom payload 'GET_STARTED' so that it classified it also in the custom greeting Intent. The greeting message 'Hello [username]' uses the students Facebook public information to personalize the greeting.

5.5.3 Conversation Example

A complete example of a conversation with the social bot can be seen in Figures 5.16, 5.17,5.18 and 5.19:

At any point of the conversation a user can request more information about any of the courses. Slack and Facebook have different ways of handling attachments within their respective APIs and so the layout of this action is slightly different between APIs.

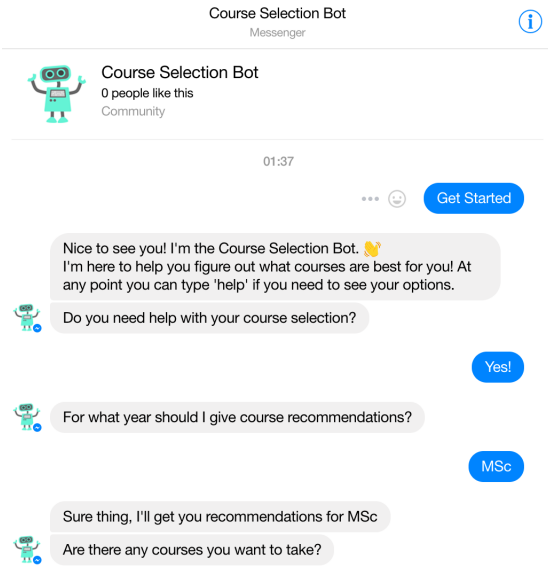

Figure 5.16: Example Conversation 1

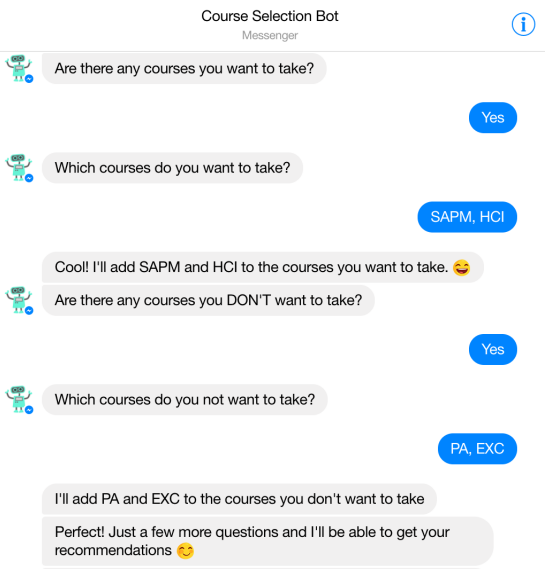

Figure 5.17: Example Conversation 2

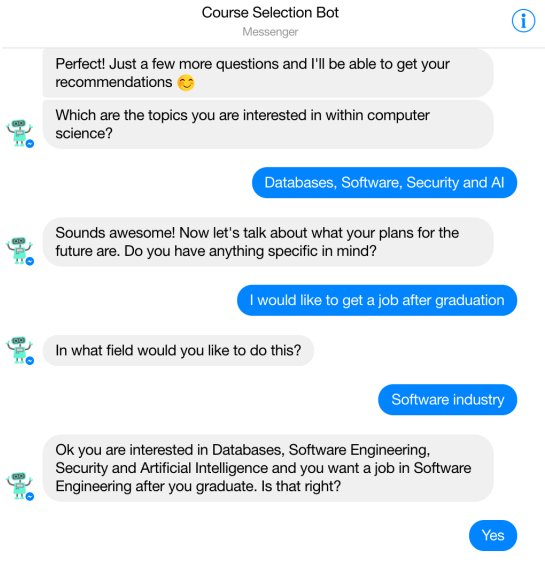

Figure 5.18: Example Conversation 3

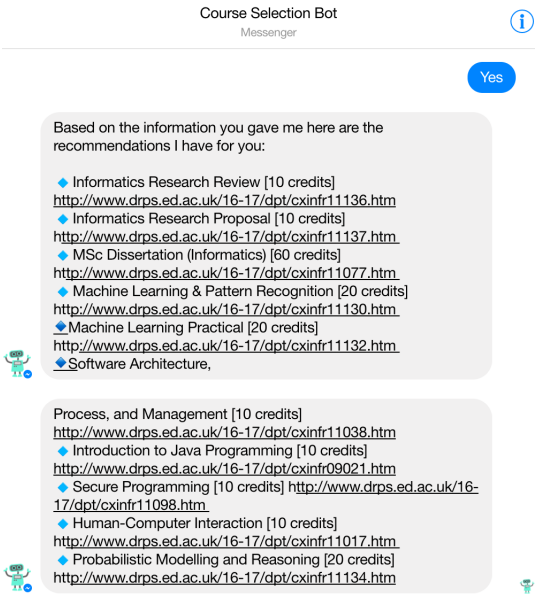

Figure 5.19: Example Conversation 4

Slack allows the developer to show 700 characters in the preview of a text and then displays a ‘Show more...’, it also gives the option to add a link to the title and a thumbnail for the content.

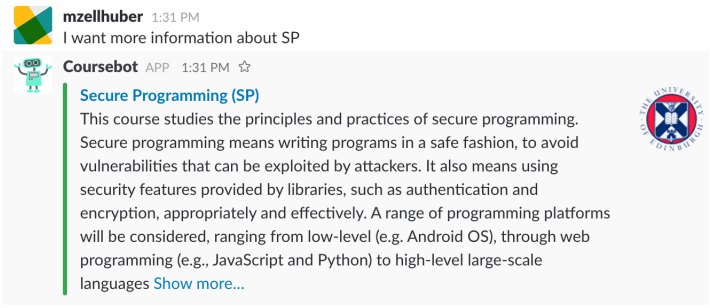

Figure 5.20: Slack More Info

In contrast, Facebook Messenger only shows the first few words of the description.

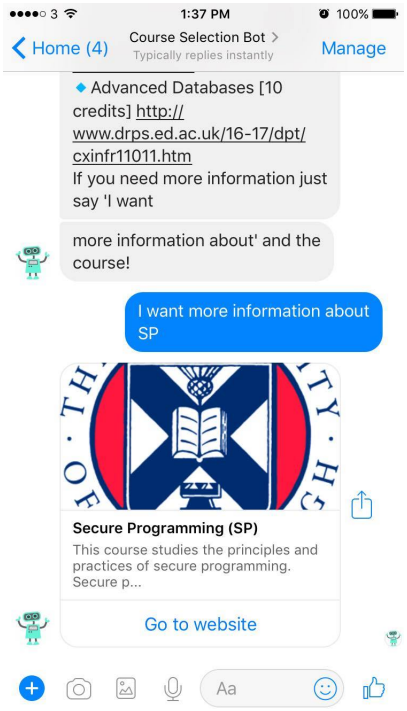

Figure 5.21: Facebook More Info

Chapter 6

Evaluation

The aim of the final evaluation is to investigate whether students believed that the social bot software improved the course selection process, and secondarily, if the software increased their confidence in making course choices. The evaluation also hopes to determine if the use of the Value-Sensitive Design methodology made a meaningful impact to the users' opinions of the software.

6.1 Focus Group

The chosen methodology for the software evaluation is a Focus Group. For the outline of the Focus Group please see Appendix D. In order to recreate the wide demographic of the University, the focus group participants were as geographically diverse as possible, representing 5 regions of the world. The focus group approach allows for the opinion-based open-ended discussion required by this evaluation. It permits the participants to freely express both positive and negative comments in a safe environment, where the participants can feel they are a part of the development process.

Table 6.1 shows general information about the focus group participants.

The focus group session was voice recorded, and the recording underwent several rounds of analysis. A preliminary analysis was conducted during the session through note taking. This was used as an early indicator of participants' thoughts and concerns. During the ensuing weeks, a compilation of participants' responses was produced and analyzed. The group's collective experience was compared against Path, the traditional method of course selection. In order to be able to assess the validity of their course selections, the study group were asked to look for courses relevant to the last academic year they undertook.

S/N	Gender	Age Group	Region of Origin	School Year	Platform Used
1	Male	18 to 24	European Union	UG4	Facebook
2	Male	25 to 34	Eastern Europe	MSc	Facebook
3	Male	25 to 34	North America	MSc	Facebook
4	Female	18 to 24	European Union	UG4	Slack and Facebook
5	Male	25 to 34	Asia	MSc	Slack
6	Female	25 to 34	United Kingdom	MSc	Facebook

Table 6.1: Focus Group Participants

6.1.1 Results

The results of the focus group were as expected and favorable. Every participant was able to complete a conversation with the social bot, obtaining recommendations for their preferences. One participant did have trouble entering their future plans, and entered the same data repeatedly. He/she then executed the 'help' command to get some guidance. After reading the documentation, the research subject was able to complete the conversation. 83% of the representative sample of participants completed the conversation on their first attempt, and 100% of the study sample obtained their course recommendations.

All participants stated that they felt the course recommendation was closely matched to their interests. They confirmed that most of the courses presented to them by the social bot were the ones they had enrolled in during their previous year,. The participants opined that the software was an accessible and intuitive way of exploring the courses they are interested in. One participant said that it could completely eliminate the need of start of the semester meetings with the Personal Tutor. Most participants indicated that they would have had higher confidence in their course selections if the tool had been made available at the beginning of the school year. This was a particularly popular opinion among MSc students, who are new to the course selection process at the University.

Social platforms were also discussed during the study. The students expressed some privacy concerns regarding the use of the software within a social platform, but strongly felt that it is more convenient to obtain course information this way than by either using Path or meeting with their Personal Tutor. The participants explained that they already spend much of their time messaging online, and are logged into Facebook Messenger by default in their phone. The group stated that this is not the case

with myEd or Path. Sixty-seven percent of the participants expressed that a dedicated platform is definitely not necessary, and the participants overall felt integration with a multitude of social media platforms would make the software more convenient for students at the University.

The jokes and fun facts modules were especially well received and all of the participants said it notably improved the personality of the social bot and made it more approachable. The emojis used in some of the interactions were also noted. Participants commented that the interaction felt more like a casual conversation, with a pleasant and informal tone.

The study could be improved by the inclusion of a Personal Tutor in the group. The tutor's experience around the course selection process could provide a reflecting point for the group to assess the software, and a more balanced perspective may be achieved this way. Multiple focus group stages could be performed with a larger set of participants. Although participants acknowledged the importance and necessity of making a good course selection, their swift acceptance of the course selection bot may make it necessary to remind users that the software is intended solely to act as an advisor.

6.1.2 Main Issues Found

One issue highlighted during the focus group was that the social bot needs additional training in order to identify the colloquial vocabulary of the users. This can be then solidified by asking more testers to use the social bot, examining the phrases the social bot did not understand or classified incorrectly.

Common feedback was that the course selection layout looked slightly cluttered, and it was difficult to make reference to the recommendation. The participants commented that the response could benefit from each course in the recommendation having a degree of visual separation.

6.1.2.1 Feedback Implementation

The issues that were illuminated from analysis of the study were addressed to create a better user experience. The previously unknown spellings were added to corresponding intents and the social bot was trained to interpret them. The set of response options was also updated, adding one new interest and two future plans. To remove the obstruction of complex output, the delimiters between each course suggestion were improved. This

should make the output easier for the students to parse and make reference to.

One of the participants suggested placing a course disclaimer to encourage students to attend introductory lectures to ensure they make their own decision on course selection. As such, the disclaimer is now visible to the user after the bot issues course recommendations.

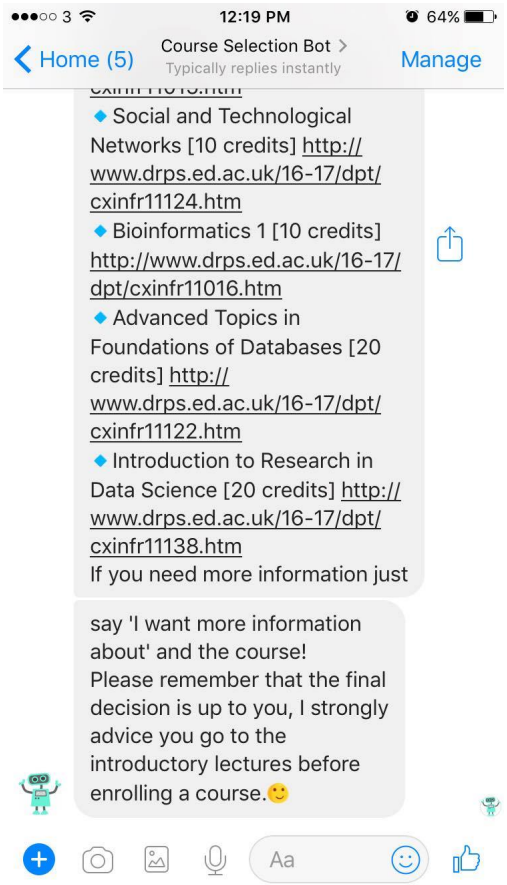

Figure 6.1: Disclaimer and Bullets Added

Chapter 7

Conclusions

This project provided the foundation for the implementation of a platform-extensible course advisor bot. The project streamlines the course selection process, making it easier for students to get information about available courses while giving priority to the courses that they will be most interested in taking.

The feedback of the questionnaire during the design stages was deterministic for the Value-Sensitive Design implementation. The VSD methodology was critical in ensuring the bot catered to the individual needs and values of each user, permitting that a customized process and recommendation could be delivered. This is in contrast with a traditional fixed list of potentially appealing courses. Incorporating the twelve human values with ethical import seen in section 2.3.1 inherently promoted the user-oriented characteristics of the tool, as seen during design section 4.1.2.

According to the results of the focus group presented in Chapter 6, a representative portion of the student population reacted positively to the use of the social bot as an aid to the course selection process. The study showed that the students felt the tool could help students feel more confident about their course choices. Notably, the participants of the study felt integration with their preferred social media platform increased convenience of the service.

This project demonstrates the virtues of social bots as the interface. Design principles such as convenience and constant availability were noted by all research participants. In addition, the project highlights how social bots can be used to build user confidence, in this case prior to a traditional face-to-face consultation.

7.1 Discussion

Non-human actors are steadily becoming established as a method for brands and companies to interact with their customers. The bots provide a simple method to obtain information or solve problems without the need for other humans to be involved. A successful Minimum Viable Product (MVP) was created and is fully usable for students to try for the upcoming school year.

The contributions of this project are:

- A social bot that is easily extensible, both for use on other platforms and to allow for additional and custom functionality.
- A bot that provides University of Edinburgh Informatics students recommendations on what courses will be best suited according to their interests, future plans and year.
- A Value-Sensitive social bot that analyzes the users value set and delivers accurate recommendations for course enrollment.
- A general social bot architecture on which other similar bots can be based.
- An outline and guide for other researchers on how to use a machine learning engine for intent classification to categorize and respond to user inputs.

The results of the project demonstrate that students who use a Value-Sensitive social bot in their course selection process prefer having the option of the social bot. The students who participated believe the bot would help them to make a better decision than Path, the currently available technology. However, since the focus group was only applied to 6 students, it is not a representative sample of the student population. It is reported that the School of Informatics at The Univesity of Edinburgh student population including UG, taught and research postgraduate students is 1,571[35]. For the study to be representative of the entire Informatics population the sample size needs to be calculated using the finite population formula.

$$n = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + (\frac{z^2 \times p(1-p)}{e^2 N})}$$

Where z is the z score that needs to be taken from a z table for a normal distribution. e is the margin of error and N is the total population (1571). For a population size of 1,571, a margin of error of 5% and z score of 1.96, considering a confidence level of 95%, the sample size for a representative study would be 309.

7.2 Future Work

The social bot has potential for future development. It could be expanded to all degree subjects with little technical effort, and it should face no additional barriers in serving students from other disciplines. The design aim of freedom from bias was particularly important in achieving this goal. There was no way to ensure that recommended courses do not have scheduling clashes; the University does not release the schedule until the new academic year. It would be possible for the bot to furnish the user with their semester timetable.

A major advancement would be to incorporate voice recognition and speech synthesis to the bot. Google offers a machine learning based API that is capable of performing the recognition as required[20]. A natural extension to this is to offer multiple languages, and Google Speech API can perform recognition on all major languages. The need for this bot to communicate in multiple languages has been mitigated by user acceptance and input recognition retraining. Further rounds of retraining could be performed to ensure maximum usability.

For the tutors, a web portal could be developed. This would highlight useful statistics gathered from the students' use of the bot. Course popularity and academic interests are especially useful statistics for the development of the degree programme. As an example, a fast-growing new area of interest may stimulate the addition of new courses. For the users, the social bot could be modified to offer the option to share their selection on social media. As evidenced by the survey, students desire to be in class with their friends. The students may also be interested to know last year's average mark for each course. An Amazon-style recommendation system was considered, letting students see which direction other students with similar academic interests took.

Research could have been performed on the efficacy of the Value-Sensitive Design. An A/B test could have been conducted using a both naive and Value-Sensitive Design prototypes. The study could incorporate eye tracking to assess how the students parse the text from the software. Another potential metric is time taken to complete a conversation flow.

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Appendix A

Survey Consent Form

The following consent form has been adapted from the Survey Monkey online survey consent form and was presented to the individuals who participated in the online survey[41].

The purpose of this research project is to create a social network bot that will help students at The University of Edinburgh select appropriate courses using Value-Sensitive Design. This research is being conducted by myself as part of an MSc project. You are invited to participate in this research project because you are or have been familiar with the course selection process at the University. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdrawal from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 10 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about you course interests and messaging platform use.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with The University of Edinburgh representatives.

This research has been reviewed according to The University of Edinburgh Ethic approval procedures for research involving human subjects.

ELECTRONIC CONSENT: Please select your choice below.

Clicking on the ”agree” button below indicates that:

- you have ready the above information
- you voluntarily agree to participate
- you are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the ”disagree” button.

Appendix B

Survey Questions and Results

B.1 Questions

* 1. What is your age?

- ○ 18 to 24
- ○ 25 to 34
- ○ 35 to 44
- ○ 45 to 54
- ○ 55 to 64
- ○ 65 to 74
- ○ 75 or older

* 2. Which are the topics you are interested in within computer science? (Please select all that apply)

- ☐ Artificial Intelligence
- ☐ Databases
- ☐ Natural Language Processing
- ☐ Algorithms and Data Structures
- ☐ Security
- ☐ Human-Computer Interaction
- ☐ Software Engineering
- ☐ Computer Networks
- ☐ Theoretical Computing
- ☐ Other (please specify)

* 3. What messaging platform do you use? (Please select all that apply)

- [ ] Whatsapp
- [ ] Facebook Messenger
- [ ] Slack
- [ ] WeChat
- [ ] Snapchat
- [ ] Line
- [ ] Viber
- [ ] Skype
- [ ] Telegram
- [ ] Other (please specify)

* 4. How concerned are you with the amount of information social platforms collect?

- ○ Extremely concerned
- ○ Moderately concerned
- ○ Somewhat concerned
- ○ Slightly concerned
- ○ Not at all concerned

* 5. How often do you seek assistance online?

- ○ Very Frequently
- ○ Frequently
- ○ Occasionally
- ○ Rarely
- ○ Never

* 6. Have you used a social bot before?

- ○ Yes
- ○ No
- ○ Not sure

* 7. How likely would you be to use a software to help you with your course selection?

0 Likelihood 100

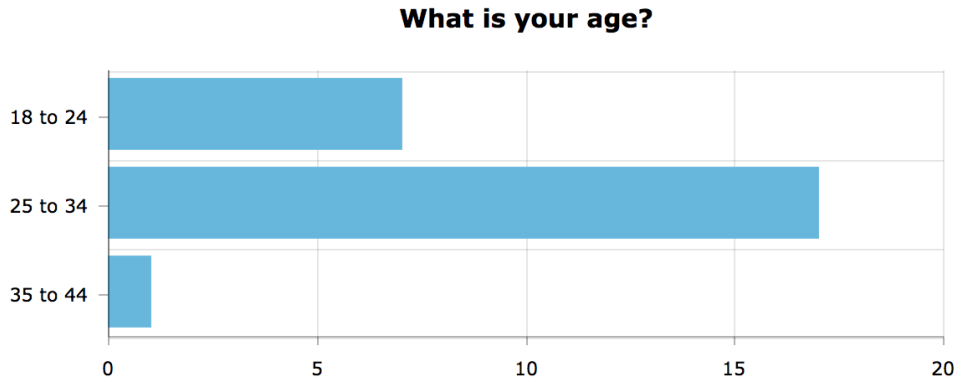
* 8. What is your motivation for attending The University of Edinburgh?

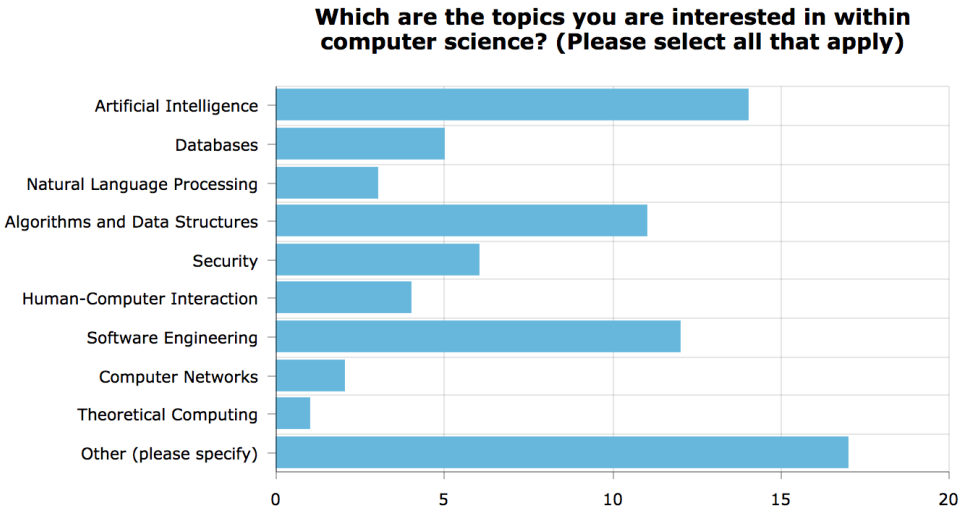
- [ ] Getting a job
- [ ] Knowledge
- [ ] Get to know people from all over the world and their culture
- [ ] Other (please specify)

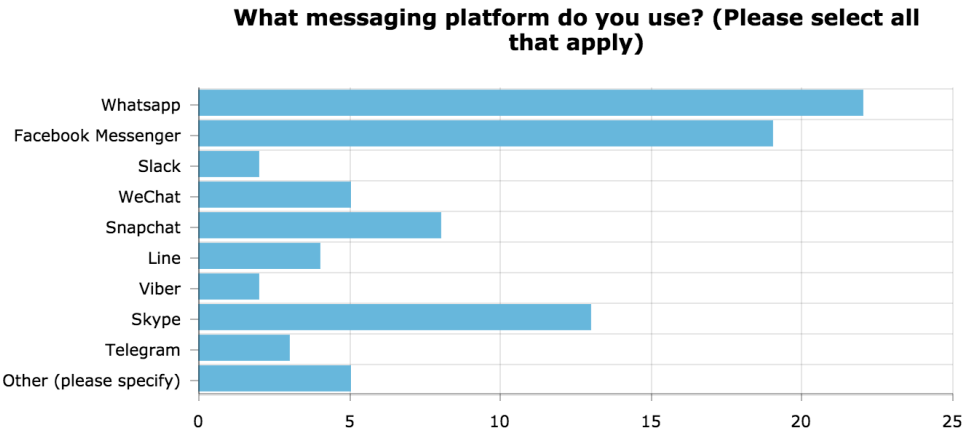
* 9. What are the most important things to you when selecting a course?

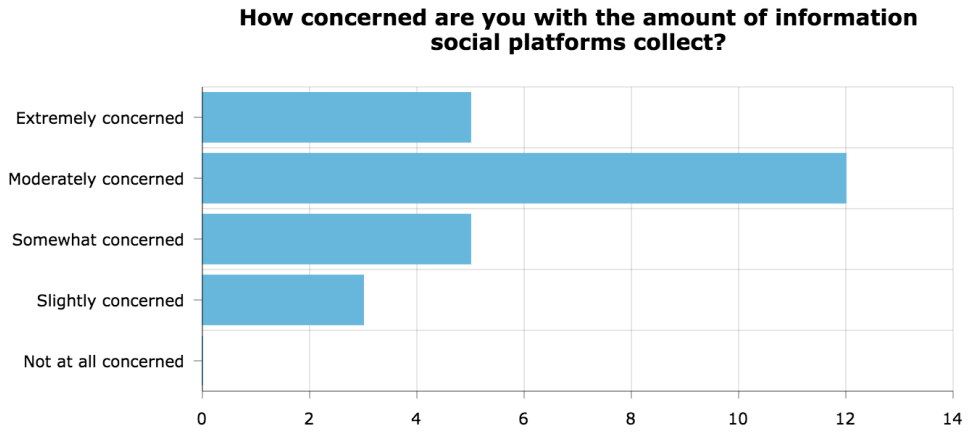
- [ ] Subject
- [ ] Lecturer(s)
- [ ] Schedule
- [ ] Who else is taking it
- [ ] Other (please specify)

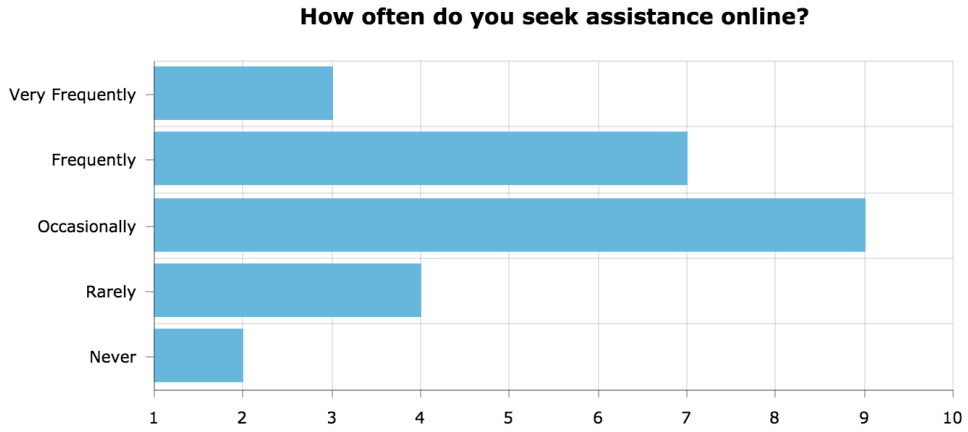
B.2 Results

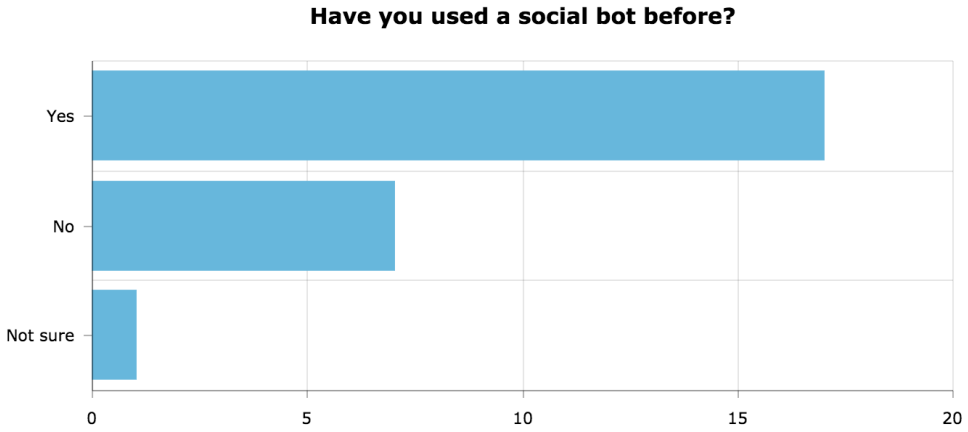

What is your age?
18 to 24
25 to 34
35 to 44
0
5
10
15
20


Which are the topics you are interested in within computer science? (Please select all that apply)
Artificial Intelligence
Databases
Natural Language Processing
Algorithms and Data Structures
Security
Human-Computer Interaction
Software Engineering
Computer Networks
Theoretical Computing
Other (please specify)
0
5
10
15
20

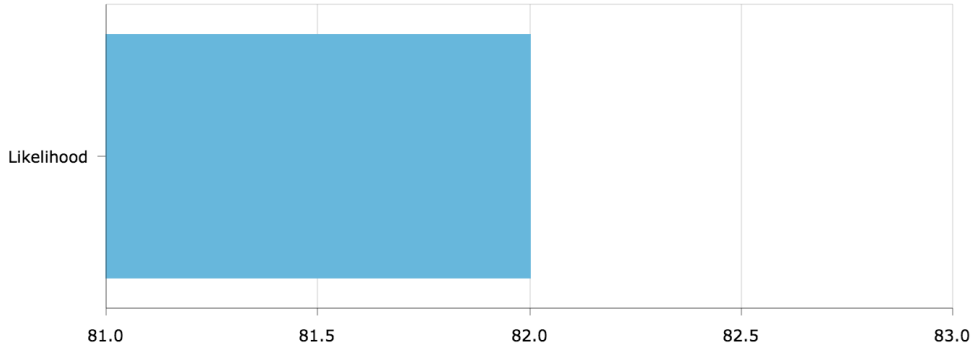

What messaging platform do you use? (Please select all that apply)
Whatsapp
Facebook Messenger
Slack
WeChat
Snapchat
Line
Viber
Skype
Telegram
Other (please specify)
0
5
10
15
20
25


How concerned are you with the amount of information social platforms collect?
Extremely concerned
Moderately concerned
Somewhat concerned
Slightly concerned
Not at all concerned
0
2
4
6
8
10
12
14

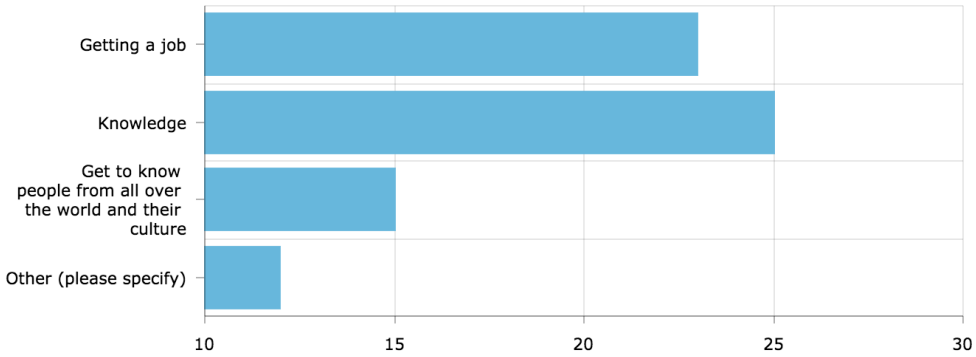

How often do you seek assistance online?
Very Frequently
Frequently
Occasionally
Rarely
Never
1
2
3
4
5
6
7
8
9
10


Have you used a social bot before?
Yes
No
Not sure
0
5
10
15
20

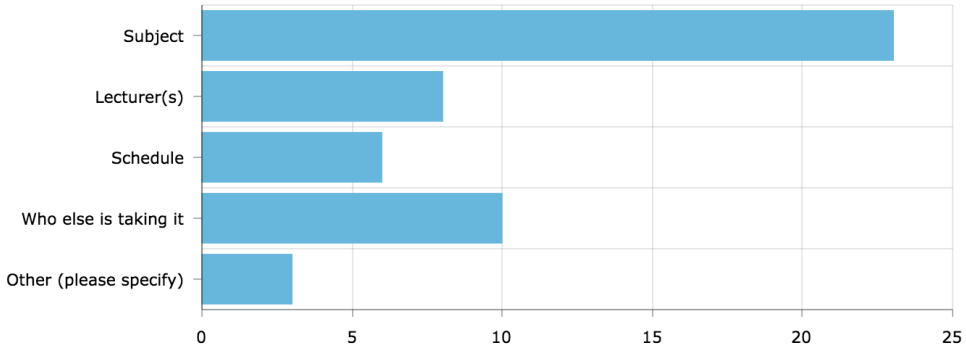
How likely would you be to use a software to help you with your course selection?



What is your motivation for attending The University of Edinburgh?



What are the most important things to you when selecting a course?



Appendix C

Focus Group Consent Form

The following consent form has been adapted from Focus Group Consent Form used by The School of Geosciences at The University of Edinburgh [36]

Research project title: Social Network Bots as the Interface Research investigator: Melissa Zellhuber

- I agree to participate in the focus group carried out by Melissa Zellhuber of the University of Edinburgh, to aid with the research of Social Network Bots as the Interface.
- I have read the information sheet related to the the project and understand its aims.
- I am aware of the topics to be discussed in the focus group.
- I am fully aware that I will remain anonymous throughout data reported and that I have the right to leave the focus group at any point.
- I am fully aware that data collected will be stored securely, safely and in accordance with Data Collection Act (1998).
- I am fully aware that I am not obliged to answer any question, but that I do so at my own free will.
- I agree to have the focus group recorded (audio), so it can be transcribed after the focus group is held. I am aware that I have the right to edit the transcript of the Focus Group once it has been completed.
- I am aware that I can make any reasonable changes to this consent form.

This research has been reviewed and approved by the Edinburgh University Research Ethics Board. If you have any further questions or concerns about this study, please contact Melissa Zellhuber (s1648304@sms.ed.ac.uk)

You can also contact the project's supervisor Stuart Anderson (soa@staffmail.ed.ac.uk)

What if I have concerns about this research?

If you are worried about this research, or if you are concerned about how it is being conducted, you can contact the Chair of the Informatics Ethics Committee, Frank Keller, University of Edinburgh, School of Informatics, 10 Crichton Street Edinburgh EH8 9AB, UK (or email at infkm+ethics@inf.ed.ac.uk).

Appendix D

Focus Group Outline

Hello and welcome to our session. Thanks for taking the time to talk to me. My name is Melissa and as you know I have created a course selection social bot for my dissertation at The University of Edinburgh. I would like your thoughts and opinions about it, and what you think might be improved. You were invited today because you have gone through the process of course selection in the past and are familiar with the enrolment procedures at the University. Please keep in mind that there are no wrong or right answers but rather different points of view, please feel free to share your thoughts even if they differ from what others have said. Negative comments are just as useful as positive ones. I will be recording this session for my own future reference but be assured that your comments and participation is completely confidential and it's only me who will have access to the recording.

Does anyone have any questions so far?

Ok, let's begin.

Before this session I sent you a link with the Slack team and the Facebook Messenger page. You can use either of those to access the social bot. Please use the social bot for the next 10 minutes, after that time has passed I will ask you to share your thoughts.

That's 10 minutes, does anyone want to share their opinion?

Perfect, I'm going to ask a series of questions, please feel free to share your thoughts.

- What did you think about the social bot's personality?
- Do you feel that the courses that were suggested to you by the bot reflect your interests?
- Would the social bot give you more confidence in making a final choice of courses?

- Did you find some courses that you would not have thought of but would be interesting for you to consider?
- Do you think you needed more information from the social bot?
- Did you find something particularly helpful or unhelpful?
- How was the experience compared with using Path for course selection?
- Would you prefer the bot in a dedicated platform or in a social media platform like Slack or Facebook Messenger?
- How comfortable do you feel with the amount of data that is shared with the social bot?
- Would you recommend the course selection social bot to other students?
- Do you have any other comments?

That's all the questions I have for you. Thank you so much for agreeing to participate, your answers are very useful feedback and will help me to improve the social bot.