WolfPal: Your Planning Assistant

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ABSTRACT

Every student attending a university faces a recurring and baffling task of choosing a limited number of courses from the enormous collection of courses offered by the university. Since this decision directly affects the career of the student, it has to be a well informed one. The students use multiple techniques to obtain information about particular courses that are best fit for them. These techniques can be broadly categorized as university provided resources and peer remarks. Since these resources are scattered over different platforms, the task of selecting courses to make a course plan becomes tedious. A survey conducted by us revealed that students are not being able to make an effective course plan for their graduation. The reasons inferred were the sparse presence of the available resources, lack of knowledge and lack of communication among the students. This paper presents the solution to building an effective course plan using an interactive platform that integrates multiple resources used by the students to help them make a better choice. Along with providing the resources, the platform possesses the capability of recommending a course based on the student's preferences and ability. Additionally, it helps students to find and communicate with relevant peers for the specific course.

Keywords

Course Planning; Course Recommendation; Peer Help, Wolf-Pal, CSC Graduate Students

1. INTRODUCTION

The United States of America is a home to thousands of universities each of which has a huge number of students pursuing higher degree. These students are required to dedicate most of their time towards the coursework in order to achieve success in their field of study. On top of it, the students have to go through the enrolment process every semester which burdens them with additional work of scrutinizing the gigantic list of courses to find a few that are a good fit for them. This task involves a lot of effort of going through all the available resources, talking to the professors, talking to other students who had taken the course earlier and many other factors that help the students to arrive at a conclusion. Apart from this list of enormous tasks, the students are also expected to get involved in non-academic

activities or events that help them to make a balance between their academic and non-academic life. These variety of tasks are important for a student but consume a lot of additional time. The most time consuming task among these subjacent tasks is selection of courses for enrolment. It tops the list because of its importance in guiding the career of the student. To help college students search courses more efficiently, many coursework recommendation systems [4, 6] and many search tools [1, 2] have been proposed.

As per the online survey conducted by us, a lot of the students talk to their peers or seniors who possess the knowledge about the course and they also read the details of the courses provided by the university before making a decision. Seeing the results of the survey, it can be inferred that there is a lot of room for improvement in the existing systems that will help students to save a lot of time while doing subjacent tasks.

1.1 Problem Statement

There is a lot of information available online which can help student make a well informed decision but this information is sparsely present. Due to the scattered presence, this information is sometimes hard to find which makes it ineffective. Additionally, the students prefer to communicate with their peer who have information about a course. According to our survey, this technique was used by most of the students. The students also reported that sometimes it is hard to find peers with knowledge about a particular subject. Also, the information about the events and activities are available on university's website but still students do not know about it due to scattered presence of every available thing. In this paper, we propose a solution of tackling these two problems - lack of information and lack of communication.

1.2 Proposed Solution

An interactive platform which integrates the resources provided by the university with the remarks of the students on a course, who had taken the course earlier will be ideal for the tackling the problem of lack of information. Apart from connecting student remarks to the information, the system will provide a way to connect to other students for sharing any information or queries. This will improve the communication among the students. To make the course selection more easy for the students, the system will pro-

vide them help with recommendations and suggestions interactively using chat-bot. Also, the system will allow the students to formulate a course plan which lists the courses that they will be taking during their graduation. Since this information is stored in the system, the students would not be required to reiterate through the whole process during the enrollment. They can simply use their prepared list to enrol into courses.

The following use case diagram(Figure 1) represents the user interaction with the system we are proposing.

Figure 1: Use Case Diagram: WolfPal
https://www.sharelatex.com/project/5a6fa9c8bcab1c4195f0a889

Figure 2 shows the system architecture envisioned for our system implementation.

2. LITERATURE SURVEY

Despite steady work done related to course recommendation and feedback system, course selection remains a challenging process for any graduate student. Considering the course selection as the crucial part of the graduation, and extensive list of courses offered by the university, the existing system needs to demonstrate a good level of assistance to student. In the following section we will discuss the previous works related to course recommendation and feedback system along with a few drawbacks in them.

2.1 Course selection and recommendation system

"Course selection and recommendation system" [6] creates a common forum on popular platform "Piazza" in which senior students can post their reviews for each course. Each review includes five criteria: professor rating, grades, content, job perspectives, and workload. With those reviews, students can look-up keywords to gather information for the
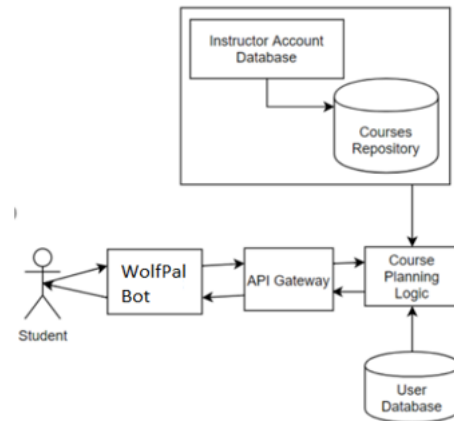
Figure 2: Envisioned System Architecture: WolfPal

course in which they are interested. This paper also provides another solution targeting the students that know what criteria they want but have no clue which courses match them. Using text mining algorithm through all reviews on Piazza, it can give a list that matches a student's choice for the five criteria. Although this paper provides a good way to gain information about the courses, there are concerns like some students not following the guidelines when they grade this five criteria, or mistype scores. However, we think forum is still a good way to exchange information.

2.2 Course feedback system

"Course feedback system" [3] provides three features. One is a forum that can share short reviews for each course with like and dislike button that can increase its reliability. The second feature is a feedback system that senior students could answer eight questions for each course, such as numbers of project, number of assignment, course knowledge and so on.The third feature is a suggestion system that helps student search courses by 8 filters based on the data from second feature. We think this system is a more reliable and a more feedback friendly system than the previous one, because of its separate review and feedback, as well as grading criteria (questions) by multiple choice to prevent typing errors.

2.3 Graduate progress tool

"Graduate progress tool" [5] aims to help a student track their courses, grades and the progress of degree based on the profile the user has provided. This system is provided as a mobile app, a desktop app, and as an extension of the existing system - MyPack portal which is more comfortable to use because of the familiarity aspect for NCSU students. This track system is one of our goals. We would like to reduce some input information that can be provided by the internal database such as course credits.

3. INITIAL USER STUDY

We surveyed 44 students about the importance of the scope of our project, and the responses were very helpful for us in narrowing down the objectives of what we needed

to do for a successful implementation of our project idea. We observed that communication between the vastly diverse community of NC State students is the major issue which we felt should be handled, so we tried to broaden our search for data as much as we could. We got the opinions of students from even outside NC State, to check if the principles of our solution would be properly valid as widely as possible. We were able to make our inferences based on the data we received, and we have explained those according to each question we asked the users.

3.1 Plan for list of courses

We found that 72.7% (Figure 3) of the students had planned about enrollment in 5 or less courses for the duration of their graduation, which is less than half of the number of credits required for completing the criteria for graduating from most NC State programs. If a student had a specific plan to complete 10 different courses depending on a certain track planned for him/her, then proper enrollment into courses could be planned in a better way based on the availability of courses and proper balance of the student workload.
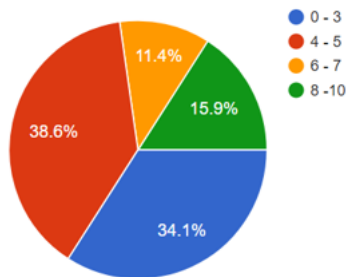
Figure 3: Did you plan a list of specific courses to enroll into before coming to the university? If so, how many courses were on the list?

3.2 Success of plan

We found that 65.9%(Figure 4) of the students could not completely follow the course plan they had in their mind before joining the university. This can be resolved by providing a proper solution for any student to follow a specific plan of courses by mitigating the factors which can make enrolling into a course impossible. These factors include availability of a course per semester, core courses requirement for a specific major, strength of classes conducted by the professor in the past semesters, etc.

3.3 Awareness of suitable courses

We found that 70.5%(Figure 5) of the students were not fully aware of the courses that were suitable for the specific graduation track through which they wished to graduate. If the students are not even completely aware of the courses which were properly suitable for their area of interest, then completing those courses with a good grade is very hard to be even considered.

3.4 Source of course information

We found that getting course information from peers and seniors was the most prioritized way (Figure 6) of getting course information by the new students. This method is currently limited by unavailability of a proper network to speak
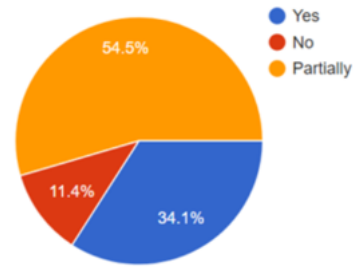
Figure 4: Were you able to follow the course plan you made?
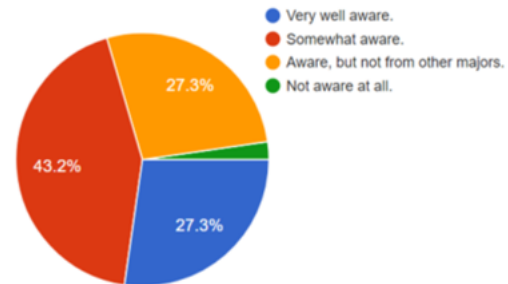
Figure 5: How aware are you about the list of courses relevant to your area of interest offered by the university (including courses from other majors)?

to the required people. If student has no proper method to even find the people who can provide the most relevant information about the topics he/she wants, then getting information becomes very hard immediately.

The second most used way to get the information about specific courses was to read the course description present on the course catalog. This information is very limited though, with no proper syllabus available in the description, grading policy absent ,and workload impossible to decipher.

Grading policy and professor/advisor advice were used minimally by students to reach a decision. Information about these details could be helpful in reaching a decision over enrollment in a course.
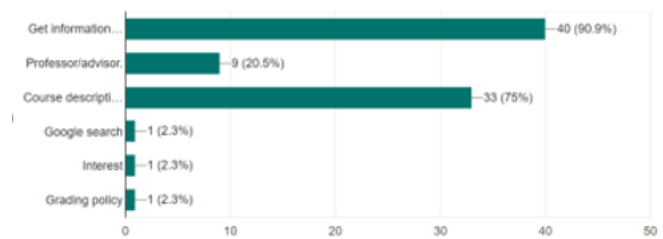
Figure 6: How do you gather information about the courses while choosing a particular course?

## 3.5 Difficulty in connecting people with same interest

We found that 70.5% (Figure 7) of the people did not find it easy to find relevant people to speak about the various details of the courses they wished to learn about. Talking to relevant people freely and in detail about the intricacies of different courses is an extremely important requirement before deciding to enroll in a course.
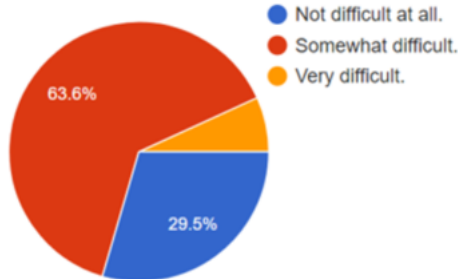
Figure 7: How difficult was it to find relevant people to gather information about the courses you were interested in enrolling?

3.6 Important factors for deciding course

Students picked grading structure as the least important factor considered for deciding about a course (Figure 8), while course description and information about project and research opportunities in a course were considered to be amongst the most important factors for reaching a decision about enrollment in a course. Improving the availability of information of these important topics for new students would be crucial for proper consideration of interest in a course.
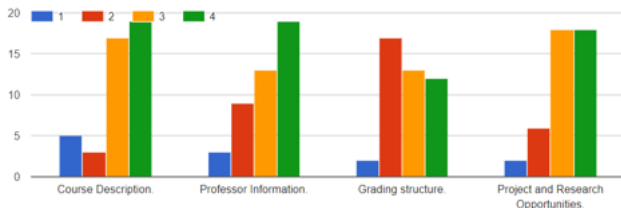

Figure 8: How important are these factors for deciding to enroll into a course?

3.7 Evenly distributing your academic workload

A whopping 88.6% (Figure 9) of the people do not find it easy to balance the workload of a semester based on how tough the coursework can be. If proper time and effort cannot be divided between the multiple courses in a semester, then successfully completing them can become very hard.

3.8 FAQ's related to course selection

100% (Figure 10) of the people think that it will be helpful to have a well answered FAQs section about specific courses available along with the course entry in course catalog. This
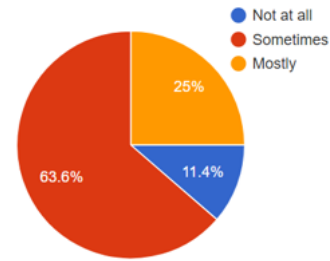
Figure 9: Do you find it difficult to pick the courses for a semester on the basis of the workload?

will take care of most doubts a new student has about enrolling in a course.
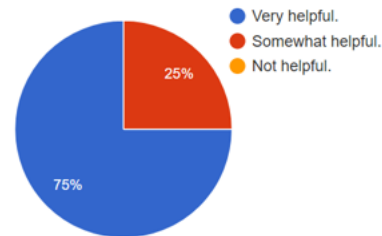
Figure 10: Do you think a list of well answered FAQs for a course would be helpful to know before enrolling in a course?

4. EXPERIMENTS

Our first step was to analyze specifically about the issues faced by students when planning to enroll into NC state. We observed that communication between the vastly diverse community of NC State students is the major issue which we felt should be handled, so we tried to broaden our search for data as much as we could. We got the opinions of students from even outside NC State, to check if the principles of our solution would be properly valid as widely as possible.

The second issue we found was the perceived lack of information related to courses. A prospective NC state student had no idea where to begin when getting to analyze the course load for the first semester. Multiple sources of data needed to be properly studied to have the slightest inkling of the suitability of the course for the student's area of interest. Taking up an unsuitable course for a student can be vastly detrimental to a student's education.

The most important issue we found was finding specific relevant peers to communicate about the issues faced in analyzing the courses. No specific platform was available to communicate with all students of the CSC department. So, communication is found to be narrowed down only between specific course based forums.

Our team began the work which followed the agile methodology of development. The project was managed on GitHub as suggested by the professor, with issues created and assigned to team members based on the specific part of the project they had experience working in. But as we began working on the project, we felt that a few principles of the spiral model would help our purpose a lot. Specifically, com-
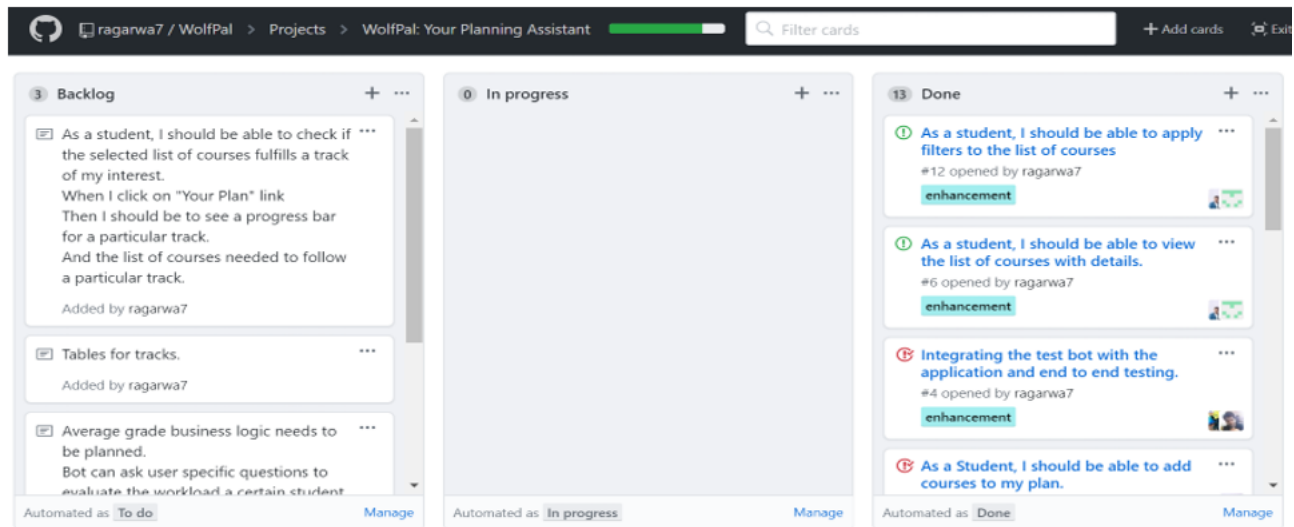
Figure 11: Story-board

mit partitions helped in proper analysis of the core functionalities due to which the system would considered beneficial. Once our core functionalities were decided, we could seamlessly work on completing them to help develop our system.

After the first commit partition, we created issues for starting the application development by assigning the development of bot to half the team, and assigning the website front-end and back-end to the rest of the team. Once this commit partition was completed, we designed 14 user stories which include all the functionalities of the application and further we had a sprint planning meeting to assign a priority to each story and we used Planning Poker estimation technique to find out the number of stories we can deliver in the given timeline. Finally, each developer started implementing and testing the story from the story-board (Figure 11) and moved it to relevant phases on the story-board. To make sure that each developer is able to progress with the story and to tackle any blockers as soon as possible, we used to have a scrum meeting every alternate days. At the end of the entire experiment we were able to successfully move 13 stories to completed phase.

5. DESIGN AND TECHNOLOGY

This application has been designed with consideration of modern technology - the mobile phones, which are extensively used by the students in this era. This application is designed to adapt to the screen resolution of every design while maintaining the usability and functionality with ease.

The responsive design (Figure 14) of this website has been developed using bootstrap and flexbox. These frameworks keep track of the display resolution of the device and render the UI of the application accordingly so that everything is readable and easily usable.

The application has been designed in 2 modules - the website and the smart bot. The website module uses Ruby on Rails under the hood which provides ease of development using MVC architecture. The vast available list of Ruby gems (similar to Java packages) helps with the development of a lot of features such as Authentication and Forum, with

ease. The smart bot module of this application uses HTML, CSS and JavaScript for managing the Q/A design and back-end calculations for recommendation. The bot accesses and stores the data in the form of JSON objects which are unique for every user to keep the recommendation specific to that user.

6. IMPLEMENTATION

After analyzing the responses of the survey conducted by us, we implemented the system with three crucial features to ease the process of course selection, recommendation and relevant peer connection for new students. The implemented system provide an effective solutions to the problems mentioned by the students that would be extremely helpful to efficiently formulate a course plan for their graduation. User interface of this application is built using bootstrap and JavaScript to provide a good user experience to students which makes this application effectively accessible through multiple platforms. In the following section we will discuss the core features of the WolfPal.

6.1 Graduate Plan Formation

This features enables students to easily look for important details of the course like course description, syllabus, schedule, instructor, workload, grade distribution, projects, fieldwork, and also student can access the dedicated forum of each course to view the thread of discussions or raise relevant query which can be answered by the students who has already enrolled in that course. Moreover, students can use the combination of filters to search the course on the basis of the keywords, semester, project, core or fieldwork. This feature also includes an option for students to add or remove courses to the the plan. With the help of this feature, a new student can be provided with a proper blueprint of his entire university schedule till he/she graduates. Having access to such a significant resource before even stepping foot on university premises will show a marked upturn in a student's academic performance.
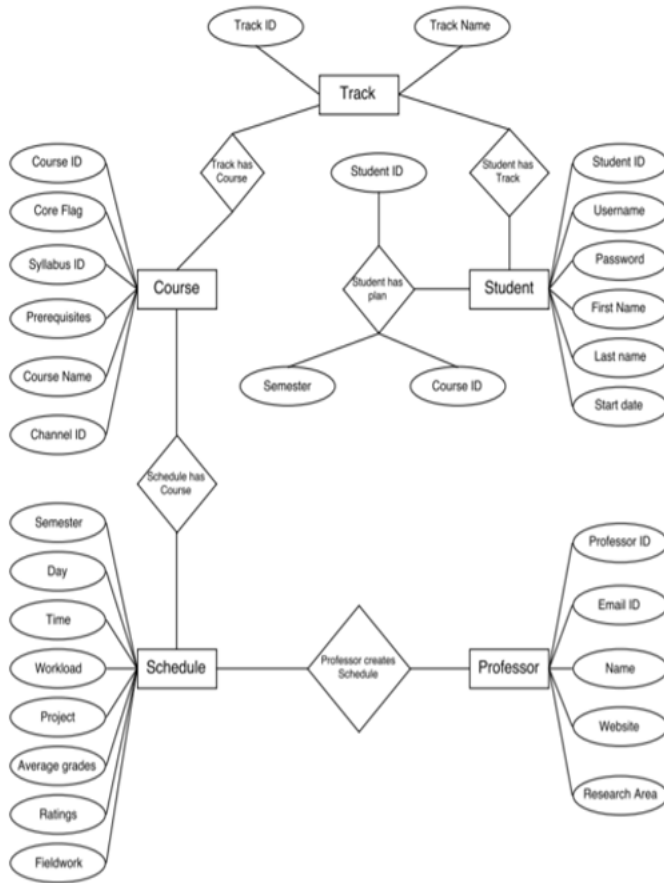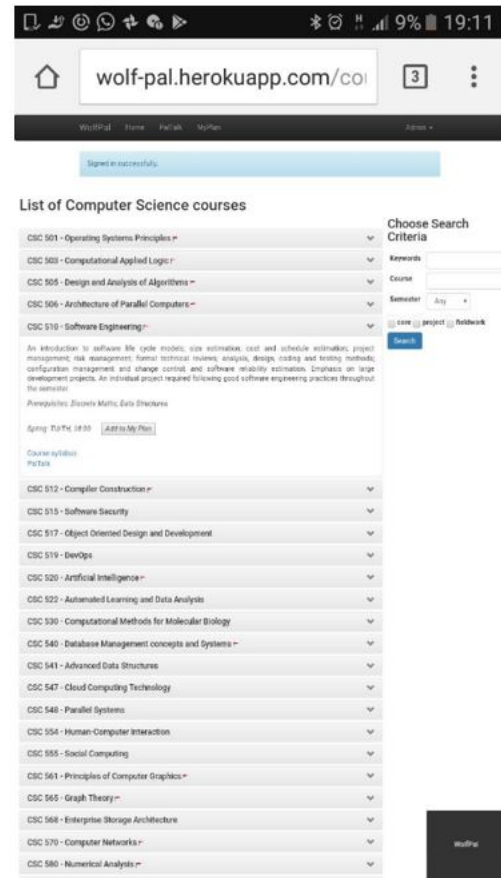
Figure 12: WolfPal: ER Diagram

Figure 13: WolfPal: Home Page

6.2   WolfPal: The bot for automated help

We implemented a bot to carry out several duties, as mentioned below, for a student in an automated way.

1. Lists the courses related to a particular area of interest.

2. Provides personalized recommendation of courses in the selected domain on the basis of the userâĂŹs ability to handle pressure.

3. Shows the course details such as average grade and prerequisites.

The bot uses the input data of the user to match with its trained data-set, and give out the most efficient plan possible which would suit the certain student uniquely. Each plan will be unique as data about the interests of a student is used in tandem with data pertaining to the past experience of the student. To help a student be certain about going through with this plan, the bot set up a way to discuss with peers who have been suggested similar plans or subjects, or peers who have similar areas of interests. Supplementing bot data with feedback from students going through the similar process gives us the best solution.

The assessment of optimum plan evaluation for every student was based on multiple factors. Using these multiple factors gave us a proper insight into what kind of a workload of courses a student can handle. We divided the workload evaluation of a student into the following two parts:

1. Static workload:
   This part was uniquely hard coded for every course. This part was decided on different factors of the course structure. The first factor to be considered was if a course was classified as a âĂŸcoreâĂŹ course by the department. The other factors included how much a specific grade was made up by exams or by projects. The final factor was considered to be number of assignments in the course. A specific value was evaluated to each of these values based upon the calculation in the algorithm, but the basic formula for static workload was:

$$StaticWorkload = CV + AW + EW + PW$$

   CV: Core course value,
   AW: Assignments weight,
   EW: Exams weight,
   PW: Project weight,
   SW: Static Workload

   Each of the four terms on the right hand side was calculated in the algorithm. This part is the same for a specific course for any student.
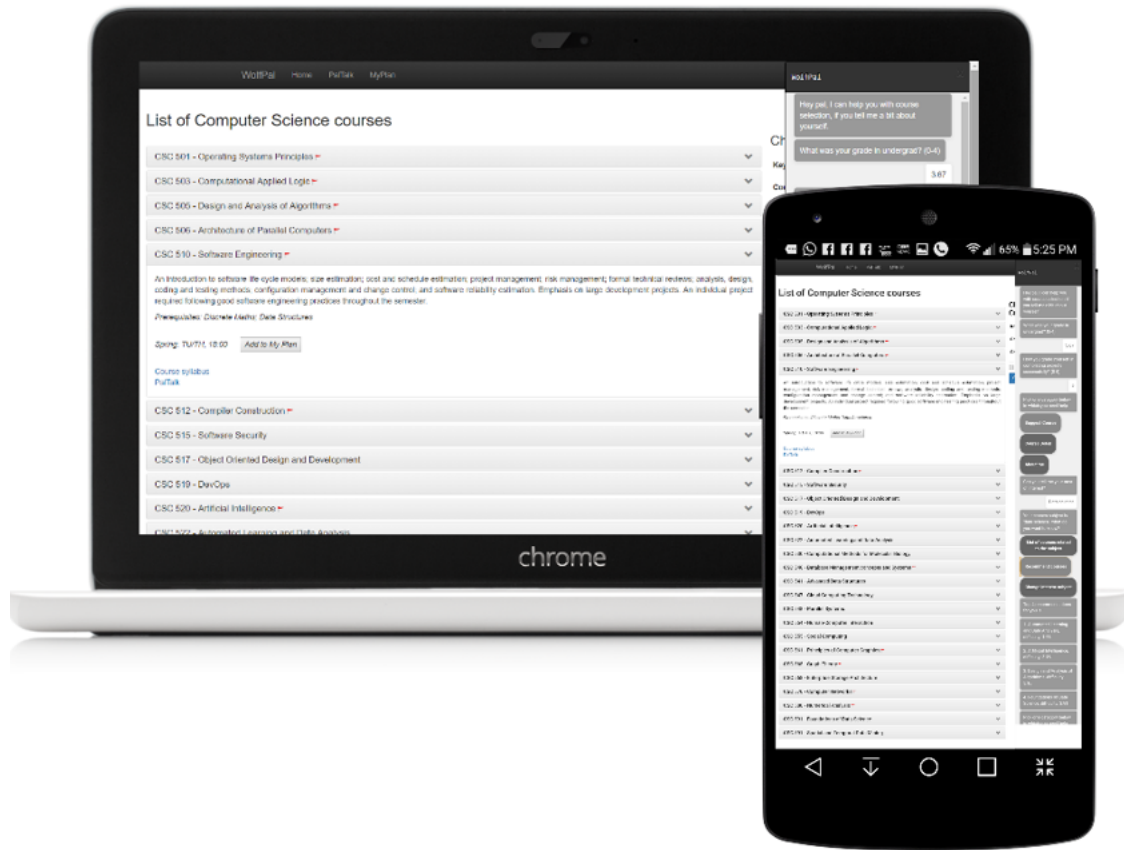
Figure 14: Responsive User Interface

2. Dynamic workload:
This part was evaluated based on the input of prospective student in the application. A new user would be asked for their undergraduate GPA, and their ability on projects. Based on these values, the algorithm will compute their dynamic workload, which would differ for every user. This workload would be calculated based on the following formula:

$$DynamicWorkload = SGPA + SPAW$$

SGPA: Student Undergraduate GPA value,
SPAW: Student project ability weight,
DW: Dynamic Workload

The final workload value of a course for a student would be evaluated after subtracting the dynamic value of the workload from the static workload value. The Course Workload for the student would be calculated using this relation:

$$CourseWorkload = SW - DW$$

6.3 PalTalk: Revamped student communication

The application provides a platform for students to communicate with relevant peers in the university which can help new students to discuss any queries related to course selection. Moreover, this platform provides an option to send a private message to any peer. We have tried to make this platform as generic as possible to promote communication by providing a public platform to interact with all students. This will help resolve any doubts a student possesses. A university-wide open forum promotes communication between the students to a previously unprecedented level. The academic study will be helped with department-specific and course-specific threads on this forum, to provide an open platform for communication. Additionally, this feature keeps the students more involved in campus life by keeping them informed about the upcoming events in the university. Specific threads of communication can also be created for this.

7. EVALUATION

After deploying the application, we requested our peers to evaluate our application. An outside perspective is the best way to understand and remove the chinks we find in the developed project. We tested the user responses in the evaluations, and tried to apply the improvements in our application in the best way possible.
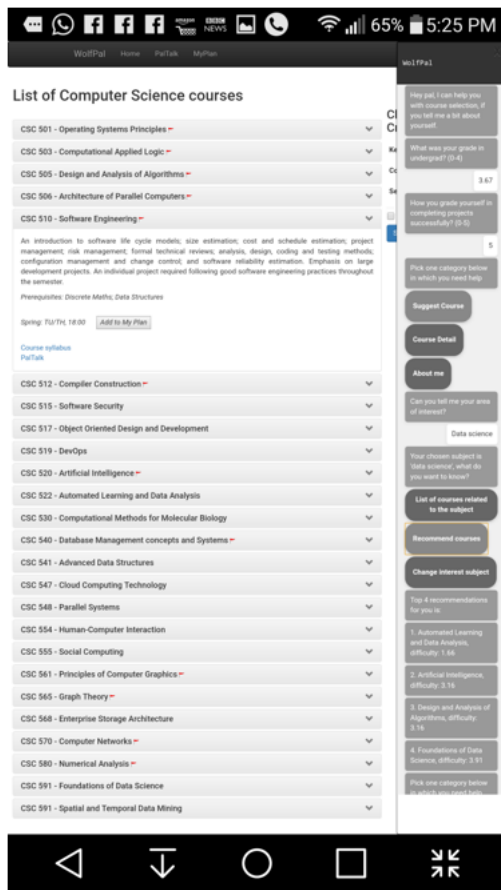
7.1 Usability

Figure 15: WolfPal: Smart Bot

Figure 16: WolfPal: PalTalk

We found that 75% of the users felt the application was very easy to use. We worked diligently to make the application utilization as easily comprehensible as possible. We also asked the 25% people who felt difficulty in using the application for specific comments describing the difficulties. Once we understood them completely, we did our best to devise solutions to help users feel at ease in using our application.

7.2 Wolfpal influence on course enrollment

We found that 90% of the users would find WolfPal influential in reaching their decision for course enrollment. We asked the 10% for comments for why they wouldnâĂŹt find WolfPal useful. Their suggestions included elements which were outside the scope of our project, like adding real-time NCSU data and providing this application for departments other than Computer Science. We felt best to include these in the future scope of the project.

7.3 Personalized course recommendation

We found that 90% of the users really liked the feature of personalized recommendation of courses for the graduate plan of the following semester. Workload of a course will always vary for every student based on individual skill level and experience. Evaluating if the suggested course is optimum for the requirements of the specific student therefore feels like a helpful tool for any prospective student.
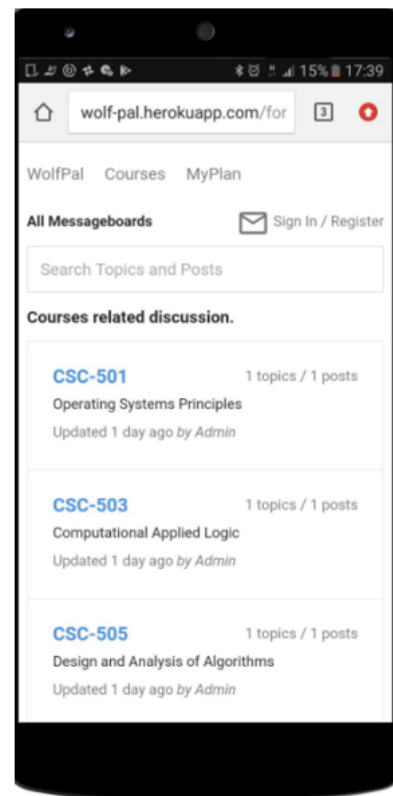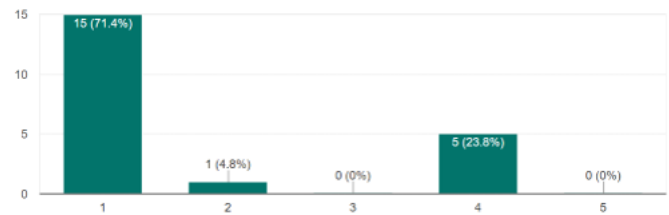

Figure 17: Were you able to use WolfPal properly without any assistance of the developers?
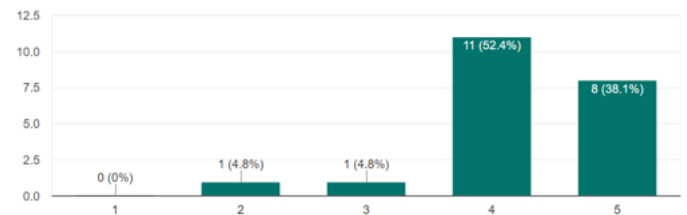

Figure 18: How much would the usage of WolfPal influence your decision in course enrollment?
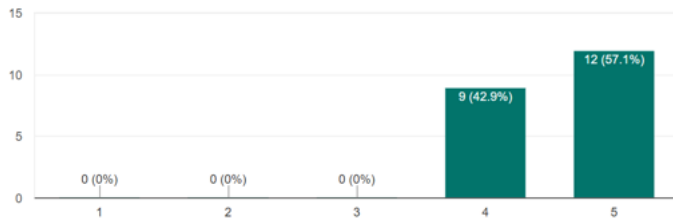
7.4 Peer communication

We found that 100% of the users really liked the PalTalk feature i.e. the common forum for curriculum discussion. The main problem faced by all students in universities is finding relevant peers to properly evaluate the various intricacies of the multiple courses offered in every semester.
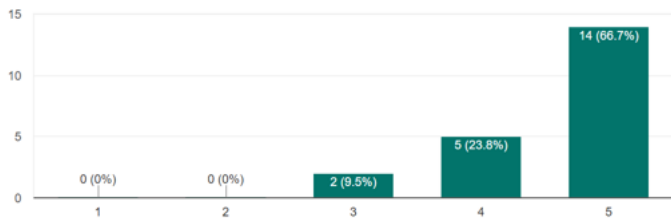
Figure 19: How much did you like the feature of personalized course recommendation (based on Undergraduate score and ability to handle projects)?

Providing a common platform for all students of a university would be a crucial step in solving this problem.

Figure 20: How helpful do you think this platform will be to connect with relevant peers for communication?

7.5 Real time data application

We found that 95% of the users really felt that the application would be extremely useful once the real-time data of university schedules and courses is populated in the application. Populating real-time data in the application is an important task if the application is to be put into production. But it was outside the scope of our project, so this will be an important feature of the future scope of our project.
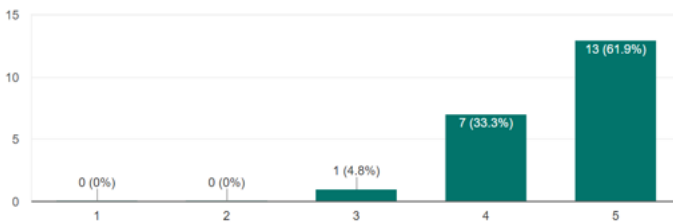

Figure 21: How useful did you find the PalTalk (forum) to be for new students when populated with data?

8. FUTURE WORK

The application can have a lot of future work added to it. We wished to work on many of these, but the constraint of time limited us on getting these done. We list these properly so that future work on them can be carried out:

1. Additions to MyPlan.
   There exists a lot of scope for development in the
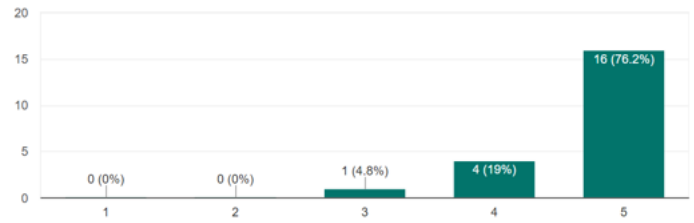
Figure 22: How useful do you think the application would be when populated with actual curriculum data?

MyPlan section. The functionality of recognizing a specialization track can be added at the backend so that the application can guide the user to pick specific courses to complete a track. Suggesting a graduate plan based on the preferred specialization track of the student would be the ultimate objective here.

2. Real-time population of data.
   At present, the application uses a static list of courses and their schedules which can be upgraded to populate the details of courses as they are updated by the instructor/university. Getting specific permissions from the university to display the current course data in the website is a major step in this direction. Adding forum details based on user data will also be a major breakthrough for the application.

3. Adding professor as the user.
   The application can have a specialized view for the professors using which they can update the course details. They can also get an estimate of students who are planning to enroll in the course and this estimate can be used to plan the allotted rooms based on the space required and sessions to the course. The professors would also be able to help other user through the forum. An interactive forum which includes the professor as a user can be a boon to all students.

4. Expanding to other departments.
   The application can be expanded to handle enrollment cases of students of other departments. Currently the application has been designed to function only for graduate students of the Computer Science department, but the principle structure of the application can be applied to any other department if proper data and permissions are permitted for use.

5. Expanding the course details.
   The information shown in the course details section can be extended to show the FAQs of the course, and course reviews from other students. The average grades of courses in previous semesters can be added by linking the gradient webpage. The smart bot would be a great tool to display such information along with the PalTalk forum.

6. Improvements to the Smart Bot.
   The smartbot can be made even more effective by adding Natural Language Processing capability. The bot can be designed to be much more openly interactive by doing this. The final aim can be to make it converse like a human.

7. Upgrading the current system to offer flexibility
   The current course recommendation systems suggests course based on the studentâĂŹs ability to handle assignments, projects, and course workload. In this case, different students are restricted to different courses based on their past scores i.e. harder courses are suggested to the top students while relatively easy courses are suggested to the average students. This system can be changed to enable students to select the priority during recommendation.

9. CONCLUSION

In this way, we have developed WolfPal for fulfilling this major problem faced by new graduate students before enrolling into university. Getting full relevant course information before enrolling into a course without much hassle is a major accomplishment of this project. The prospective student will now be able to make a well-informed decision in enrolling into courses. We were also able to automate the enrollment process for a student to a considerable level using the WolfPal bot. The bot interactively provides a unique optimum plan for the student, which suits the student based on their preferences. The other major accomplishment was reducing the communication gap observed by the students between their relevant peers. Students now have access to a common forum for the students of their university, which would also have specific forums based on the different courses. This has made getting course related questions answered very easily accessible for students. Project partners can also be easily found using this feature. Students can have their doubts related to any issues they face in university from other relevant students who have tackled them in an unprecedented simple way.

10. REFERENCES

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11. EVALUATION CHITS

1. SMQ
2. BOX
3. KUM
4. IVU
5. HFD
6. IPX
7. MBB
8. EYD
9. RFX
10. JQL
11. DMR
12. JIE
13. ZNO
14. RBT
15. AOV
16. AGS
17. JWH
18. ZZX
19. QST
20. UEO
21. LNX