April 2011

RBE Wiki for Independent Learning

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RBE WIKI FOR INDEPENDENT LEARNING

Interactive Qualifying Project Report completed in partial fulfillment
of the Bachelor of Science degree at
Worcester Polytechnic Institute, Worcester, MA

Submitted to:

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April 26, 2011

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Abstract

This project, which performed research on web based academic resources, revolved around the focus question “how does one utilize web-based communication media in order to facilitate the self-perpetuating exchange of knowledge in the academic engineering community?”. It examined the social implications of self-sustaining web-based resources, and found that any new web resource needs to fill a previously vacant niche in order to gather the user-base required to be self-sustaining.

Acknowledgements

The members of the RBE Wiki for Independent Learning Interactive Qualifying Project would like to extend thanks to the students, teaching assistants, and professors of the Worcester Polytechnic Institute Robotics Program for their time, input and feedback related to the Uki website. Also to our roommates for dealing with the erratic schedules we adopted to complete this project, and to our advisor Professor Michael Gennert for advising this project and helping us turn a simple idea we had into something which has the potential to greatly benefit the WPI community. So again thank you for all of your help from the Uki team.

Authorship

The RBE Wiki for Independent Learning Interactive Qualifying Project was carried out by five individuals: Timon Butler, Jonathan Estabrook, Joseph Funk, James Kingsley, and Ryan O'Meara. The project as a whole accomplished what it did based upon the efforts of the group as a whole. Specific task leadership was assigned to particular members, as outlined below.

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Chapter 1

Introduction

Information is what allows humanity, as a whole, to move forward from today to tomorrow. We as a race are constantly building new knowledge using old knowledge as a starting point. With the advent of the Internet and new ways to store and retrieve information, knowledge can be retrieved faster and in higher volumes than ever before. The sheer volume of information, opinions, and discussions presented can easily surpass the amount a human can possibly process. This overwhelming amount of available information can lead to something called “information overload” [23]. Without a way to intelligently access and view content, it is difficult for a user to find relevant information amid the sea of available data. Web resources must address this problem when they wish to provide information to their users, and the approach will differ based on the target audience the site is designed for.

As much information as is available on the web, in printed media, and in classroom environments, it must be organized into manageable subject divisions in order to be useful. Either this must be done on a single site internally, or be done through searching for information more effectively, which is the approach taken by search engines such as Google[5]. However, even searching for information better is not effective if a site is not organized in a useful way. Searching can only infer so many related subjects from a single search query. As a result, this project chose to focus on the organization of a single web-based resource that encompasses the needs of a specific commu-

nity. This being effective entails either reorganizing a massive number of web resources, libraries, and classroom plans, or converting information into a common format and organizing the information as it is being converted. This, in turn, presents the problem of converting massive amounts of data into a common format. In the context of web based resources, there are two common methods for this. The first is used by curated resources, such as the Encyclopedia Britannica[4], where a few approved people are entrusted to enter information which is written to a high literary standard. This is currently accepted as the safer option by the larger academic community. The second method is to let the information be compiled and refined by the very community that uses the resource. Perhaps the largest and most well known example of this approach is Wikipedia[15]. When this method works, the community regulates and corrects its own errors, and through this process constantly improves the quality and presentation of the resources content. Each of these methods are effective techniques to solve the problems of information overload.

As a result of these problems, our group questioned how effectively existing information resources can be used for practical applications, particularly by engineers. Specifically, how does one utilize web-based communication media in order to facilitate the self-perpetuating exchange of knowledge in the academic engineering community? Our project seeks to perform a study on web based resources which are run by a user base interested in information on engineering topics. Questions the project sought to answer included the specific format which is best suited to presenting information to such an audience, how to encourage a resource for this audience to become self-perpetuating, and the positives and negatives of such an approach.

Our main vehicle for this endeavour was a case study using a wiki web resource to store knowledge relating to the various engineering fields studied at Worcester Polytechnic Institute (WPI). The initial target for this resource was the Robotics Engineering Program, as it encompasses a wide engineering subject base. The resource created was based on the MediaWiki platform [9], which is the basis for similar websites such as Wikipedia. Our project created a platform called Uki, then added a small amount of content, a tool set, and an organizational framework. It was then released to our target audience. Our group conducted surveys of the target audience after the

resource had been released to gauge our site and the opinions of the users on what would be the most useful qualities for this type of resource.

Our group anticipated the project to result in a small but growing web resource for the WPI Robotics Engineering Program, which would eventually expand to encompass an increasing number of the engineering disciplines studied at WPI and other universities. Further, our group expected a large quantity of data on how the web resource was used during our study, and what format students of engineering disciplines find most useful when searching for information in a web based resource.

The importance of this project lies in its potential to be a model for similar resources, which would allow more web based resources tailored to their audiences to be created. This could result in a more centralized knowledge base for various subjects. If this study can begin to understand how community-driven resources become successful, this could lead to the current information overload problem being slowly resolved with more manageably organized formats. This in turn will result in faster and easier progress in many disciplines, as it will be simpler for present day students to learn and build off of pre-existing information.

Chapter 2

Background

During the course of the project our group researched various web resources, presentation styles, and the factors which have been investigated in relation to the success of self-sustaining community resources. An awareness of this research is necessary in order to fully understand the reasoning behind critical decisions during the course of the project.

2.1 Rationale for the Project

The original concept of Uki came from discussions on problems with commonly used web resources. Often, when searching for study material, the desired topics are buried within an excessive amount of irrelevant information. The current problem lies in the overwhelming amount of data available on the Internet, and how it is searched, indexed, and organized. Reference materials may be overly verbose and poorly descriptive, or may be spread too sparsely between resources to provide cohesive instruction.

The superfluous amount of data available on the Internet is simultaneously its greatest success and its greatest downfall. Some websites attempt to address this problem, but a single website cannot easily solve it for everyone. Since this problem cant be solved for everyone effectively, web resources should be designed around a specific target audience. By doing this, they can more easily be tailored towards the research and study habits of that community. With that in mind, this

project was created with the engineering community as its target audience, since this was the very problem area that sparked the idea for Uki. The goal for Uki is to develop a central, self-sustaining resource containing useful reference information for the engineer or engineering student, and to tap from the community knowledge base by allowing users the ability to add, edit, and refine its content to their needs.

2.2 Current State of Web Based Resources

Web-based resources are increasingly prevalent today as educational tools and knowledge repositories. Currently, there are two main types of web resources to consider; article based resources and forums. Article based resources are more formal and present a web resource reminiscent of a textbook, while forums are more of a dialog between users which answer specific questions in a conversational format. Each resource has its purpose, with its individual advantages and disadvantages.

2.2.1 Article Based Resources

Article based web resources can be divided into two major types when considering the sources and management of their content. Some sites, known as curated websites, only entrust content management to accepted experts. These sites have a select few trusted members or administrators who are given responsibility for writing accurate and precise articles. On such websites, the public only has the capability to view information, rather than contributing to it. Other websites are much more open in their policies, and openly rely on the community to add, edit, and refine their content. Article based resources are not necessarily limited to these two types, but rather can fall on a spectrum anywhere in between, as there are positive characteristics to each resource type depending on the nature of the website. Through research on these various strategies, an ideal basis can be formulated for the format of Uki.

Curated Resources

Curated resources limit content control to the editors and administrators of the site. They usually allow for some user input, but any suggestions or proposals must be passed through an editorial board for verification, editing, and approval. This process of careful selection, care, and presentation of data is what defines a curated resource. It is the members of the editorial board and how a user becomes a member that differs amongst the different sites.

Wolfram|Alpha Wolfram|Alpha can best be described as a smart encyclopedia[16]. Its goal is for the user to enter a query in plain English, and then have the site compute the best possible answer for that query. The answers that Wolfram|Alpha provides are either calculated for the user, in the case of math related problems and unit conversion, or they are retrieved from a large database linked to the sites backend. This database is generated by experts affiliated with the site and a network of trusted editors who add and maintain the content of the site. It is because of this that Wolfram|Alpha is a curated resource. The information from them is highly accurate but it can be limited at times.

One advantage that Wolfram|Alpha does offer is their feedback page. This is where users can make suggestions and corrections if necessary, and it is up to the site administrators and editors to take this information and make changes to the site. This process might take some time but using this method the information can be verified by professionals in their respective fields to ensure accuracy.

Encyclopedia Britannica Encyclopedia Britannica is a mature and trusted resource that has only recently made an appearance on the Internet[4]. Encyclopedia Britannica was originally released in 1771 as a traditional encyclopedia and continued as such throughout most of its history. It wasnt until 1994 that Brittanica made its appearance on the Internet and became more readily accessible. Since Encyclopedia Britannica is a traditional encyclopedia resource, making the content open for community editing is out of the question. They pride themselves on having only accurate and

precise information in their database and would not let the users write their own entries. This resource is curated by a select few who can edit and add information. These members hold this position with great pride, and are usually great contributors to the academic community.

Open Community Resources

Open community resources are a new and rapidly growing addition to the Internet. An open resource is defined as a source of information that is open for users to add, edit, and expand upon. Our group aimed to create a resource of this type, as it would allow users to add to and expand the knowledge available based on what they believe would most benefit the community. The information in an open community resource is gathered and regulated by the users themselves. As the amount of input grows, both the volume and quality of stored knowledge grows with it.

Wikipedia The initial idea of having a free, online, open encyclopedia started in the early 90s[21]. This idea was not fully implemented until the turn of the millennium when the hardware and software of the day were up to the task. The earliest version of this idea was known as Nupedia. Nupedia was created as a free online resource, but all the articles were curated by its editors, which limited its growth.

Wikipedia was first formally launched in 2001, and quickly rose in activity to far surpass Nupedia[15]. The primary reason for Wikipedias success was that it allowed normal users to submit and edit their own articles, and the articles of others. In its current form, moderation measures are in place that keep people from vandalizing or abusing the resource. This helps verify and preserve the accuracy of posted content.

Another key aspect of Wikipedia is how information is presented. When searching for information on the Internet, conventional search methods such as Google can often lead to information overload. It is hard to predictably identify relevant information from the vast amounts of data a given query can potentially result in. Conversely, while searching for information in Wikipedia, there is a unique page structure for an article, and a single article for each topic. Each page is

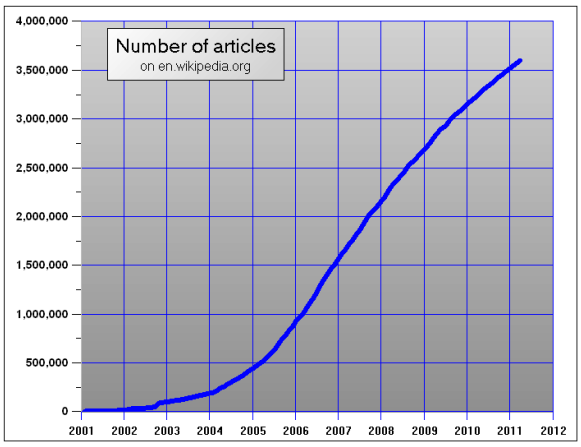


Figure 2.1: Wikipedia Article Count Over Time [15]

broken up into several distinguishable parts that can be easily separated. This is due to the top of each article displaying an in-page outline that links to subsections of the page. Such a system allows the user to easily locate the specific pieces of information they need, decreasing the time that is spent filtering through related knowledge.

FIRST Think Tank FIRST Think Tank is a web resource devoted to spreading information on topics relating to robot construction and design, specifically those relevant to those participating in the FIRST Robotics Competition[14]. Users of Think Tank write and submit articles, which must conform to certain quality standards. The articles are then reviewed by moderators and either approved or rejected. This leads to higher quality control, but also to a slower accumulation of information on the site. The site maintains on its front page a list of new and highest rated articles, which assist returning users in seeing what has changed, as well as presenting new users with the best the site has to offer.

The operation of this site is a hybrid of the two methods of adding material. It is trying to take the best of both worlds by having the users create and edit articles, while having moderators approve what gets posted to assure quality. This system may work for a small target community, but as soon as it gets larger the number of articles may become too great for the moderators to keep up with. This could eventually lead to the failure of the site unless the number of moderators

Figure 2.2: Sample Layout of a Typical Wiki Page [15]

increases with the site popularity, or the approval process is reassessed.

Forums

Forums are community resources which depart from the article format and instead seek to emulate face to face discussion on specific topics. A question is posed by a forum member, and others respond as they can, providing insight they may have or requesting more information to better answer the question. They are entirely driven by their users, with varying levels of moderation.

Chief Delphi Chief Delphi is a community based forum developed for members of the FIRST Robotics community to discuss various problems and ideas they encounter as they face the engineering challenges presented by the competition[2, 1]. FIRSTs premise is that the best way to get students interested and excited about engineering is by hands-on experience and exposure to engineering mentors. Chief Delphi exemplifies this through its model; it is based more on learning through conversation than it is on formal articles dedicated to specific topics. This model requires a

large user base which actively participates in discussion, and implements a system of rating users. Ratings are a form of positive reinforcement for contributing constructively to the site, providing a way to passively discourage abuse of the freedom users are given. The site is organized into subject topics and threads, and users self-moderate where conversations should take place on the site. There is also a collection of white papers available, which can be referenced when someone asks for instructions on how to perform certain tasks. White papers are useful reports and explanations of concepts which go into detail on particular subjects, and can be easily cited to fully explain something a user summarizes in a forum post.

Stack Overflow Stack Overflow is a forum-style site which is dedicated to the asking and answering of questions related to programming[13]. The site employs a user rating system, where users rate their peers responses. As users get more positive ratings, they gain more moderation power, to the point where the top users on the site have almost as much power as the administrators. In this model, the web master has less upkeep for the site, as the more mundane administrative tasks such as moderating threads and content are handled by high-rated users. Additionally, this gives the power to regulate conversations to those who have been shown to have the greatest interest in teaching others through the use of the forum.

2.2.2 Previous Research

In order to better understand the task presented by this project, a logical step would be to study what has been done in the past to address the problems that our group is attempting to solve. This includes looking at past successes and failures, and learning from both, applying those lessons to the project.

Wikipedia

Reasons for Success Wikipedia is an often-cited example of a self-sustaining community knowledge resource. It has had a lot of success in developing a knowledge base created by and mon-

itored by its users. As a result, there are several studies on the success of Wikipedia. One such study is “Collaboration in Context”[18]. This study examines the relations between subject area, talk pages, number of edits, and article quality. It also breaks down what type of edits users have made to articles, and the amount of the original article that has persisted through the edits made. The study concluded that a remarkable amount of the original article text survives editing; this effect was termed first mover advantage. The study also concluded that although response to talk page content sometimes included vandalism and other negative edits to articles, it also garnered directed content modification which made articles more accessible. It also showed that talk pages are likely to be a valuable tool in web resources. The study remarked on the fact that while article quality was rather variable within subject disciplines, articles which were on obscure topics were less likely to be added to and given further detail and accuracy. This is thought to be due to a smaller number of users needing the information, in addition to a smaller number of users who have enough confidence with the subject matter to contribute to the article.

Indicators of Quality A study done by HP Labs analyzed the pattern of editing in Wikipedia and its relation to article quality[22]. Their results showed that though there is a multitude of articles on Wikipedia, a small number of them account for a disproportionally large percentage of edits, and that in general the quality of these articles increases as the number of distinct editors grows. As a result, these articles are brought to the front as articles of high relevance and quality. This implies that though Wikipedia is a site with a huge user base and open editing policy, those policies do not translate to inaccurate information as more mainstream information sources claim.

Contributor Makeup Power of the Few vs. Wisdom of the Crowd: Wikipedia and the Rise of Bourgeoisie is a study on the users who contribute to Wikipedia and whether it is driven by an elite few editors or the proverbial wisdom of the crowd, which is large numbers of users making small edits[19]. Its results show that sites such as Wikipedia have two general stages. In the beginning, the small group of elite users are responsible for most of the content, while later in the resources life, the crowd takes over as the largest driving force. It is once this large driving force takes over

that the site truly thrives and becomes self-sustaining. For a site to reach this stage, it will take substantial work and effort to make sure that it conforms to what the users want.

Previous Applications of Web-based Resources

The WPI project "Technology in Geoscience Education" sought to apply digital resources to teaching students to draw conclusions from data, think critically about information they are given, and apply it in problem solving techniques[17]. They measured their success via assessment tests and surveys, as the culmination of a learning curriculum using a digital teaching tool. The results were not completely determined by the end of the project, however early results indicated that the curriculum was having some success in encouraging critical thinking in students.

Another WPI Project, "The Role of Information Technology in Student Learning Assessment", studied the use of web-based student assessment[20]. The project group conducted formal and informal interviews, and used assessment tools firsthand in order to evaluate their effectiveness as fair measures of student learning. They concluded that such tools are effective as continuous assessments when they use repeated "drill" problem sets. This indicates that information which remains relatively constant and is small in scope is the easiest to distribute via a web-based resource.

2.2.3 Previous Solutions

iFixit

The site iFixit seeks to empower consumers to repair old electronics and keep them from ending up in landfills[8]. It does this via a Wikipedia-style model, with repair guide articles and step by step instructions for common problems. However, it is very specific to certain problems and devices, instead of being a broader knowledge base. It is more similar to a collection of instruction manuals than other web based knowledge resources, and is still in the beginning stages of its development.

HackaDay

HackaDay takes a newspaper approach to spreading knowledge. The administrators find projects which they deem interesting, and post them to the site[7]. The projects are often accompanied by detailed accounts of their development, and how the end result can be accomplished. Articles are organized by being tagged with keywords, which makes them show up when a particular category is selected. The community at HackaDay also includes challenges from the administrators, special how-to sections, and a list of the most commented on projects.

ChiefDelphi

ChiefDelphi uses the conversation model for spreading knowledge. Users start conversations about specific questions which interested parties then respond to[2, 1]. While this allows users to build off of each others responses, it is missing the ability of quick accessibility. The user posing the question may not do so clearly, and responding users may give incomplete answers. On the other hand, users can ask very specific questions which may not be addressed in an article on the subject.

Textbooks

Textbooks are not a web based resource, but they are a system used to spread knowledge. They contain a lot of information on a particular subject, and often include problems to test whether that knowledge has been learned. However, they are out of date as soon as they are printed, large, and can only be used after being acquired, which is often a costly endeavor. They often do not answer specific questions a user could have, and do not have the ability to improve in quality once printed.

Chapter 3

Methodology

Creating a self-sustaining web resource that can serve as a useful study reference is not a small task; it requires time both for careful planning and actual execution. Crafting such a resource to present information in a useful and non-diluted manner requires yet more planning to guide its development to this goal. The ultimate intention for Uki is to launch the site and guide its development such that it can become a commonly used educational tool within the WPI Robotics program. From there, it could spread to other academic departments within WPI, and possibly other institutions. It is hoped that this resource will provide an openly accessible means for students to find and exchange information they otherwise may not have been able to easily discover in the course of their studies.

To properly craft this resource, background research was performed on related web resources and platforms that could be used for this project. From this, the most viable platforms were considered and a good candidate was chosen based on usability for the purposes of the desired resource. An initial skeleton of the website was created to evaluate the platform chosen, familiarize group members with it, and do basic configuration. Following this, data was collected about how the resource should be structured. Based on that data, the resource was built, given a small initial population of articles, and released. After a short period of time, more data was collected to find out how users felt about the actual form the resource had taken.

3.1 Focus Groups

To begin creating the framework of Uki, a qualitative measurement was collected of what engineering students want from a wiki. The target population of users also needed to be made aware of our wiki such that it would be more readily adopted when released. This was accomplished by conducting a series of group interviews with WPI Robotics students and teaching assistants. Emails were sent out to the robotics program mailing lists, and participants were asked to RSVP such that room size and refreshments could be obtained appropriately. The results from these focus groups directed our efforts during the wiki design.

Focus groups are preferable to individual interviews for this purpose because it allows study participants to feed off of each other. The participants inspire ideas in each other, which in turn promotes more ideas and information for us to gather. Furthermore, talking to multiple people at once allowed us to simultaneously inform them of our project and create interest in our test platform.

Furthermore, focus groups are also preferable to surveys for a number of reasons. Surveys are best suited to quantitative analysis, since they are meant achieve a passive response to a set of predetermined questions. Focus groups, on the other hand, allow the participants to make comments and propose ideas entirely without restriction. In a focus group setting, study participants can answer relevant questions that have been posed by other participants. These questions may not have been considered prior to the focus group, and thus allowed a broader range of outside opinions to be gathered.

3.2 Survey

After the test wiki was released to its target audience, a quantitative measure of the projects success thus far was desired. To do this, a survey was distributed through email to the members of the WPI Robotics Program.

In this case, the use of a survey was preferable to conducting focus groups or interviews be-

cause quantitative information about a specific set of questions was desired for statistical analysis. Furthermore, the distribution of surveys allowed queries to be made to a larger number of subjects. The survey format, in contrast with that of the focus groups, allowed more structure to be applied when seeking answers to specific questions.

Selecting the questions for the survey was an important factor to consider when gathering user responses. Several questions were asked in the survey that addressed the types of users filling out the survey and whether they were familiar with the site, or wikis in general. These questions were asked so we could better understand the targeted audience and try to eliminate any biasing in our results.

After the questions that identified the subject of the survey and their experience, we then focused on data that was relevant to the site. These questions asked about the layout and structure of Uki. This information is critical because the site needs to be well organized so that users can easily navigate it and find the information that they are looking for.

Survey questions in general were formulated to be short, concise, and to the point. The aim was for individuals taking the survey to spend a minimal amount of time on it, while giving useful information to the project. Shorter, concise questions, understandable wording, and a small number of open response requests were integral to this strategy. Overall, our group wished to present a well-crafted survey to users to give them reason to spend their time responding.

3.3 Creation of Server

In order to host the web resource for this project, server space was needed such that the project had a place to house the website that would be created. While this could have been done from a personal machine or third party server, it could not necessarily be perpetually maintained and would have forced users to use and remember a longer URL. In order to allow users to easily utilize a web information resource, it must be easy to access and consistently available. If a person were to hear of the website by word of mouth, it would be simple to visit later if the URL were

short and easy to remember. With these criteria, a personal machine or third party host without consistent funding would not suffice.

Instead, server space was obtained from the Computer Science department in the form of a virtual server. Once acquired, a short, simple domain name was requested for it (http://uki.wpi.edu). This allowed us to put our web resource in a dedicated location that would be easily accessible from any web browser.

3.4 Construction of the Site

After the server was set up, a software platform needed to be chosen for the web resource being constructed for this project. It was installed and configured based on initial research findings. Once data had been collected from focus groups it was refined further based on discussions about the formatting and usages of the web resource most likely to appeal to the engineering community.

3.5 Addition of Base Content

For successful wiki resources, one of the most necessary components is the volume of base content. The initial base content must be large enough, and thus provide a sufficient level of initial usefulness to garner a strong and dedicated user base. The content that was chosen as the test resources focus was basic engineering knowledge that would encourage the target audience to visit the site. Our group selected several engineering disciplines to analyze and created an outline of the basic knowledge involved in each of those disciplines. Each engineering discipline selected was chosen based on its close relation to robotics engineering, according to WPIs expectations for graduates of its robotics engineering program. Students of the robotics engineering program are expected to “have a basic understanding of the fundamentals of computer science, electrical and computer engineering, mechanical engineering, and systems engineering”[12]. Systems engineering was folded into the the content for the other disciplines, while additional sections were created for math and physics, which were provided for the basic background knowledge referenced in

articles throughout the site.

Basic aspects of each discipline were focused on first, as opposed to immediately starting with more advanced content. This choice was made to help fill basic knowledge gaps that students might have due to different high school curriculum, compounded with course orderings at WPI. The advanced content is taught during the courses, and requires that a student understands the basic underlying concepts, placing additional importance on those underlying principles. Creating a strong foundation of basic knowledge and building up from there seemed the most logical strategy to use in this instance. /par Near the end of the project setup phase, as the site was being prepared for release to the public, the main focus when adding content switched from basic engineering knowledge to help pages. This decision was made to allow users to participate in constructing the site if they chose to, while preserving the desired format and feel of the site. In order to make it possible for them to easily contribute to the goals of the project, users were provided with a guide of how the site was intended to be used, how to access the tool set that had been created, and how to troubleshoot common problems. Our content base had been of secondary concern during the site construction due to the development of a useful tool set taking priority. It thus followed that energy should be spent on making every effort to help users access that tool set and use the site in the way it was intended.

3.6 Tool Set

Without the proper set of tools for creating articles and organizing a wiki, it would be quite easy for Uki to become an unorganized mess of poorly formatted articles. Furthermore, it would be difficult for users to find and format content with much consistency. To remedy this, a strategy was enacted to enable users to more easily add content to the resource with relatively little effort. A tool set was made to provide building blocks for wiki articles and content organization. To organize data in a more understandable format, portals were adopted to provide central access points for the various content categories in Uki, and a set of templates and help pages were constructed to

simplify content creation.

3.7 Responsibility, Privacy and Security Issues

As the format of Uki is a wiki, it is editable and viewable by all of its users. The web analytics tools implemented collect a vast amount of specific usage data. Two main concerns apply to situations of this type: the privacy of a website's users and the risk of users vandalizing content. To deal with these, policies and safeguards had to be put into place to ensure the privacy of the users and to avoid problems with the website's content.

The most immediate concern when choosing and installing web analytics software was the issue of usage data entering the hands of a third party. The originally considered option was Google Web Analytics [6]. This initially seemed like the best choice, as this tool set provides a very customizable set of web analytics options. However, this is a third party service, meaning information would not be stored locally. When privacy issues were brought up it became apparent that there are several issues with using third party services for this project.

While collecting usage data is an important feature for analyzing a user-driven website such as a wiki, there are ethical and security concerns when it comes to collecting data about users. With simple JavaScript techniques, it is possible to log virtually all mouse events and keystrokes within a web page. This presents concerns over user privacy, particularly with logging potentially sensitive and identifiable information on third party services. As such, it was important to notify users of the level of data collection being implemented, and find a recording solution with minimal risk of data misuse or privacy breaches.

Upon further research, another option was found, Open Web Analytics[11]. This is an open source web analytics platform that can run within the virtual server, rather than as a third party service. Also, due to past work between Open Web Analytics and the WikiMedia foundation, it is capable of full integration into the MediaWiki platform that Uki is run on. Using this tool, Uki administrators have access to an even more detailed set of web analytics resources than Google

Web Analytics would have provided, without the inherent risks of third party data storage.

Another issue that needed to be addressed was the licensing of the content on Uki. With Uki being an openly editable resource, there is risk of undesired or restricted content being placed in articles. Both the owners and the users of the website must establish responsibility for what content can and cant be placed in the wiki. To address this issue, policies needed to be well established for content created on the website itself, or referenced from other sources. Under normal circumstances, the owners of a website such as a wiki would be held responsible for any restricted content were it to appear on the site. This would be a major problem, since in the case of Uki, or any community-editable wiki, the users are the primary providers of content, not just the website administrators. This could be dealt with by creating and maintaining a proper licensing policy, which both users and owners would be held responsible for following.

In order to maintain a responsibility standard, the website required a defined license policy, and a way to inform users of the nature of that policy. So long as users are informed of the licensing and privacy policy, it is their responsibility to follow the rules laid down in the provided disclaimers when using Uki. Beyond this, since Uki relies on the community to add and edit content, basic community and administrator moderation was the simplest way to assure compliance and prevent legal issues with content licensing and the privacy of usage statistics.

With respect to the copyright issue, after group discussion on the matter, it was decided to follow in the footsteps of Wikipedia and use a Creative Commons license. Creative Commons offers six different types of licensing, each designed to offer different types of protection to suit the various needs of different sites on the Internet. Creative Commons licenses target different areas of protection such as disbursement, editing, and commercial use. After looking at the available licences, we decided to use a “Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported” License[3]. Denoted by the text string “CC BY-NC-SA 3.0”, the website identifies content as non-commercial, and gives users the right to reproduce, modify, and redistribute the content so long as it gives credit to the resource, is for a non-commercial purpose, and is presented under the same or a similar license. Choosing the non-commercial variant was the least risky

option with regards to copyright, as it prevents users from using content for commercial purposes. In terms of rights to reproduce and modify content, this choice was made because Uki is a wiki resource. The ability to modify and reproduce information is inherent in the definition of a wiki.

One further concern addressed was security, namely who had the ability to view and edit pages on the website. Under normal circumstances, access options on a MediaWiki are limited to full open access, locked editing for registered users only, manual registration by email, or an outright restriction on even viewing the wiki without being logged in. Uki is setup to allow full viewing by anyone, while restricting editing to registered users. When making such a choice, there was concern over the ability of any given Internet user to register and gain editing privileges; however it was also desired to have Uki be viewable with or without an account. Furthermore, if somebody were to act maliciously on the content of Uki, it would be desirable to not have anonymous email addresses linked with user accounts.

To fix this problem, slight modifications were made to Ukis configuration to only allow registration for users who provide an e-mail address in the wpi.edu domain. This would somewhat ensure that users cannot simply get a new “throwaway” email address to use should their account be suspended, and would somewhat force users to identify themselves should they wish to regain access to the wiki. Should there be abuse, users would be identifiable in this manner and proper disciplinary action could be taken.

Chapter 4

Procedure

In order to execute this project, research was conducted into the setup and operation of various community-run web resources and identify what various challenges, issues, and methods have and havent worked in the past. Preparations were then made to launch a wiki resource in the second term of the project. After obtaining a web host, a basic wiki platform was installed on the server, and a small amount of base content was added. Feedback, discussion, and web-analytics tools were installed on the wiki to obtain usage data after launch.

4.1 Focus Groups

The test case for this project, Uki, was created with the goal of making a web resource that, when mature, would be self-sustaining. For this goal to eventually be achieved, the web resource must meet the expectations and requirements of its user base. Our group decided to gather initial data on what these expectations and requirements were through the use of focus groups. These focus groups consisted of members of our initial target audience, the Robotics Engineering community at WPI. Focus groups were chosen as a more open form of data gathering, which would garner more information, with less potential bias than other available methods, such as surveys or polls. Bias was a larger issue at this stage of the project, as the data gathered had the potential to greatly influence the direction our group took to develop our test bed for the project.

The goal of a focus group is to gain input from potential users, and to help those performing a project better understand their targeted audience. For our focus groups, emails were sent out to the target audience, and several open session meetings were held. At these meetings our role was to facilitate discussion and take note of ideas and suggestions in the group. These discussions were kept to small groups, typically around five members, to ensure participation.

The main pool of potential candidates was students in the WPI Robotics Program, as our test web resource was to be initially focused on that engineering discipline. Our group advertised for focus groups via the robotics program e-mail list, and offered refreshments for participants. Once participants arrived, refreshments were brought out and offered, and then a question was asked to prompt a broad discussion on how a web resource for the program should be formatted. This first question was intentionally selected to allow the participants to choose which direction the discussion went as it began. This removes some of the bias that can be encountered in surveys, and allows participants to steer discussion to what points they are truly concerned with. In doing so, questions and points were raised that initially might not have been considered.

As the discussion progressed, major conversation points were recorded when deemed relevant to the development of the web resource. Such points consisted of article formatting, content to include, and ways to present large amounts of data in a concise and easily accessed manner.

4.2 Surveys

In order to assess the user response to our preliminary version of the resource, our group sent out a survey to the people involved in the WPI Robotics Program. The survey results are detailed in Appendix (C). Participants were sent a link to a survey hosted through Google Forms via e-mail, which asked a short series of questions about the basic aesthetics, usability, and usefulness of the site in the state it existed in at the time. The survey also asked questions about improvements that could be made to the site, and the style of content that would be most beneficial to their ability to find and use information.

4.3 Research

In conducting research, source tracking was aided by a Firefox plug-in called Zotero. Zotero allows collections of documents to be shared between registered users, both allowing group members to share externally discovered resources as well as looking up existing curated collections of sources on various topics. This allowed the compilation of several documents pertaining to subjects relevant to the project, such as studies on Wikipedia, website sustainability, and other resources.

4.4 Creation of Server

The core of a web-based resource is a web server. As such, we needed to carefully pick a hosting option that would best suit our needs.

The advantages of a virtual private server over shared web hosting are numerous. The main advantage is that clients sharing the same virtual host can be isolated from one another, keeping them from affecting one another. Secondarily, it also means that clients can be allowed to make far more drastic changes to the configuration of their server, since those changes have no effect on others.

Compared to a regular private server, virtualization still has many advantages. By running inside a larger hardware resource pool, many weak virtual servers can be run simultaneously. This is a more efficient use of the hardware, and means that each client only uses what it needs to. Conversely, since there is a large hardware resource pool, if a client needs to upgrade, it is a trivial process. Backups and redundancy are also very easy with a virtual private server. Since the operating system and settings of the virtual server are all tied to a virtual set of hardware, the physical hardware running it can change in case of problems. No reconfiguration is necessary to move it.

With clear advantages over the other available options, our virtual private server choice was an obvious one.

The next choice was one of operating system. Since a number of our group members were

familiar with the setup and administration of a Linux web server, we decided to use a simple, stock Ubuntu installation. Ubuntu is known to be a stable and mature distribution, although it is still updated frequently. This provided a strong and stable operating system to base our web resource on.

Once an operating system was chosen, our group needed to pick the core software to run the project. The first decision required was which core web server to use. There are a number of valid options for this, depending on requirements. These range from very small, lightweight server programs that use very few resources but cannot do very much to rather large, extremely powerful programs. We decided to use the Apache http server, because while it uses a lot of resources, it is also one of the most powerful and easy to use web servers in existence. Since MediaWiki is written in PHP, the server needed to support that system as well. To do this, the PHP interpreter was installed into Apache.

The next requirement for a working base system was a database to support the dynamic content in MediaWiki. While it is possible to use files to provide dynamic content, databases are better at the task by far. They are optimised for quickly and efficiently retrieving their content. Similar to web server processes, database programs come in all varieties, ranging from the ultra slim to the monolithic. Similar to the case with Apache, our group chose to use MySQL, a larger, stable server application chosen at the cost of some efficiency, for the purpose of quickly and easily setting up a stable system.

Together, the full set of software used is common enough to be given its own name: LAMP– Linux Apache MySQL PHP. It is a common and highly stable combination of applications that form an effective and sturdy base for web development and deployment in everything from personal experimental to enterprise applications.

4.5 Construction of the Site

Once a robust hardware and core software platform was set up, the next step was to install and configure the software for the Uki platform itself. As previously discussed, MediaWiki was chosen for this task, thus it was the first thing installed and tested. When working properly, further components were installed and tested as needed.

The next piece of installed software was the Open Web Analytics (OWA) software package. This was installed as a MediaWiki extension, so that it would easily and completely integrate into MediaWiki. This did not go as expected however, since the two (despite being documented and advertised as such) were not entirely compatible. To solve this, some minor changes were made to the way OWA integrates into MediaWiki, removing a little of its MediaWiki-specific functionality, while restoring the usability of the MediaWiki installation.

In order to provide some necessary added features, a small number of different extensions were added to the MediaWiki installation. These extensions included the ParserFunctions extension, which allows conditional statements and string functions to be used within the wiki markup, and the Variables extension, which allows variables to be set within the wiki markup. These extensions expanded our ability to construct template pages within the wiki framework by allowing more dynamic elements within these templates.

4.6 Release to Test User Group

The release of Uki was split into several parts to maximise community awareness of the resource. The first part was word of mouth, to professors and fellow students. This was followed by a series of e-mails to the robotics engineering program mailing lists, advertising the existence of the resource. Additional e-mails were sent to perform surveys, which were written in such a way as to advertise the resource at the same time.

By releasing the resource to the WPI community, it was expected that users would, at minimum, view Uki in its initial state and perhaps begin using it. By doing this, it was hoped that users would

be capable of providing valid feedback on the current state of the resource and what changes should be made to improve it.

Chapter 5

Results

In the course of developing this web resource and obtaining input from users on what form it should take, many new issues were raised and addressed. Aspects of the development of Uki turned out to be more substantial efforts than initially estimated. Furthermore, from user input, the anticipated form and function of the website itself changed somewhat from the initial vision. The specifics of article formatting changed from what it initially was expected to be, and the website was structured with new considerations in mind. Additionally, several deeper topics emerged during the development of the test web resource, such as privacy, resource type, and differentiating Uki from other wiki resources. These topics were discussed during the course of this project, and addressed while it was in development.

5.1 Surveys

The surveys revealed that the groups initial assumptions about the desires of the target audience were close to, but not entirely, accurate. One of the largest points of contention among users was the format articles should be in. Our initial assumption was that short, concise articles would be suited to an engineering context. Users who took the survey indicated that long articles with discrete sections were preferred, by a very narrow margin. Some users agreed with our assumption, while other chose the format used by Wikipedia, which is long exhaustive articles. Another good

suggestion that kept appearing in the survey was to make the site contain more content specific to WPI. The users indicated that the idea itself is desirable, but having pages dedicated to fit their needs for specific courses would add further usefulness.

5.2 User Motivation

In both our focus groups and surveys, some users questioned the difference between Uki and other preexisting sources, such as the internal WPI course management system, MyWPI[10], and Wikipedia[15]. Given our original intentions for Uki, there should be a clear distinction between Uki and both MyWPI and Wikipedia, in terms of the general function of the website. However, for more fine grained issues such as content types and article formats, user input was required for more specific determinations.

Unlike MyWPI, the intention of Uki is to be a resource independent of a specific instance of a course. MyWPI course content is typically linked with a single instance of a course, and is inaccessible by those not directly involved in that course. While there is discussion board capability, users lose access to this content once the course is over, and can no longer participate in discussion after the course is completed. Effectively, this restricts user input to those teaching the course and those currently taking the course, and causes students to potentially lose valuable reference information from both the course website and discussion pages after the course has finished. Uki is capable of removing this restriction, as user discussion would produce lasting reference information in one central location.

5.3 Ease of Use vs Volume of Content

A main decision that our group had to make was where to focus the most effort when creating the foundation for Uki. Initially, we felt that the base wiki configuration would be a relatively insubstantial effort, and that we would be able to supply a usable level of base content prior to Ukis public release. However, as Uki developed, it became apparent that a good deal of effort

was required to make the wiki easy to navigate and edit for the typical user. The MediaWiki platform offers a very high degree of customization to users, but due to this it is very easy to poorly organize, present, and use the platform. We found that some navigational tools, such as sub-pages and content portals, do not exist by default, but must rather be setup and configured manually.

Our main choices of where to focus effort came down to tool set and background work, or visible content. The group decided that a usable tool set was more important, and to focus more on support content. The reasoning behind this was that if the site is easy to use, there is a lower start-up cost for a user to add content. This, in the long run, is more important than having a lot of content in a hard to edit format. While having a lot of content before a tool set would potentially garner a larger user base initially, it could easily result in the resource dieing a slow death, as the amount of content added would slowly stagnate. The website cannot grow if users cannot easily add and expand content.

It is extremely easy to make a wiki page with horrible formatting. We found that a good deal of effort needed to be put into providing a comprehensive help section and foundation of standard templates to allow for easy and consistent article formatting. Focusing on adding initial support material would allow the formation of article formatting conventions and tools to provide an explicit, community modifiable standard by which Uki articles would be written, rather than a wiki with content and no guide as to how to best contribute to it. In a way this became the base content of the wiki, rather than a large number of engineering articles.

By going with the long strategy of a slower, but more structured start-up to make for easier growth in the future, our group aimed to raise the probability of the site continuing to grow and build momentum until it reaches the level of content and user base necessary to maintain itself, at which point it will become self-sustaining.

5.4 Effectively Spreading the User Base

Once the wiki was ready to be released to the WPI community, our group needed to effectively inform potential users of its existence, so relevant feedback could be gathered to improve the resource. This proved a slight problem when conducting focus groups, informing users of the website, and releasing survey emails. Initial responses to these communications was less than desired due to users frequently overlooking, ignoring, or deleting emails. This resulted in a smaller turnout than desired when focus groups were first conducted.

After the minimal turnout for the first focus group, we switched to more aggressive methods of advertisement. This was largely word of mouth, and placing simple bulletins on public blackboards in various labs and classrooms where students were likely to see it. This garnered a better turnout for our second and third focus groups, and provided a workable amount of initial data to start with.

During release and survey emails, similar problems were encountered. In a community like WPI, many users are quite busy and receive a large volume of emails on a daily basis. This means that they often only take note of emails that have immediate importance to them, and then never get around to looking at the rest. References to the term IQP were avoided in our correspondence, since emails with that in the title have gained a negative connotation, on a comparable level with spam. Instead, we noted how the project was designed to help the department, and followed up with encouragement via word of mouth.

5.5 Effective Sources for Content

A question that any web based resource, especially a community based resource, has to answer is where it is going to get its content from. While the answer for an open resource such as a wiki is usually touted as the users, what good sources are there for users to add from?

Effective sources can be other web resources, text books, class notes, and personal knowledge. Some of these resources come with the additional overhead of verifying whether the source can be legally duplicated, paraphrased, or reused, but for most reference sources, proper citation is a safe

practice.

However, the safest and most abundant of these sources by far is the personal knowledge of the community. It is free, legal, and relatively easy to tap into. With a target audience of scientists and engineers, there is an even more useful basis of personal knowledge for this purpose than the general public would typically be able to provide. Users can go to the site looking for information, and then provide or expand on information they are familiar with, thus improving the resource as a whole.

5.6 Difficulties with this Resource

One of the main obstacles encountered when setting up a wiki resource arises from the very nature of the audience it is targeted at. Instructional engineering resources involve many examples, diagrams, and drawings. The effective and easy addition of integrated diagram editing is still a set of capabilities that is very much in development for web resources, especially when using a wiki resource. For this reason, there is not yet a resource for easily adding and editing diagrams on a wiki. This is mostly due to the fact that resources such as a wiki have not yet been widely applied to an exclusively engineering context, and so the issue of effective diagramming tools is not a high priority issue for most developers.

Web resources are dynamic, by the very nature of being publicly available, easy to add to and access, and simple to backup and move. However, these traits also come at the price of a shifting topography. The layout, location, and spread of knowledge on the web is extremely volatile and dynamic, which can lead to information moving from a known location, or being removed from the web, which results in things like dead links and server access errors. This is one of the larger problems of web resources, as any knowledge base must make decisions about what to transfer into its own set of articles, and what can be presented as a link to other resources, without high risk of the link being invalidated later.

An additional hurdle to the specific resource our group created was the decision of whether

to include content related to individual courses and projects. While useful, by including such content, there is a risk of stunting the prospective growth of the resource by limiting it to a specific university. In order to properly allow individual information, without limiting the resource to only being a WPI resource, the structure of the pages added must itself imply the eventual expansion of the resource. As such, a specific WPI category was added to Uki, allowing distinction between WPI-related and general content.

5.7 Advantages to this Resource

One advantage to a wiki resource is the ease of access. Anyone who has access to the Internet and is interested in finding the resource can use it. Using todays technology, it can be bookmarked, shared, e-mailed, even instant messaged, because all that is required is the address of the site. This is a huge improvement over a traditional textbook, as a textbook must be bought and carried around to be useful.

Another advantage is the lower amount of effort required on the part of the administrators once the resource becomes self-sustaining. A wiki resource lends itself well to this, as the content comes from and is upgraded by the users. A traditional curated resource requires the administrators constant attention and moderation.

A web resource is a good choice because, in addition to the previous reasons, the intended audience is more technology aware than the general populace. As the test case was intended for engineering students, it is reasonable to assume that the audience uses technology in their daily activities. Therefore they would be more likely to understand how to more fully use the potential of the resource instead of being tripped up by the basics of using the system it resides in.

5.8 Selection of Primary Supported Media

We chose to use the Scalable Vector Graphics (SVG) standard as the primary and encouraged choice for supporting image files. This choice was made due to the fact that SVG is a common and

effective format for vector graphics. In vector graphics, images are represented as a set of shapes and instructions. This is in contrast to rastered graphics (what most other formats, such as bmp, jpg, and png are), where images are represented as an array of pixels. The advantage of vector graphics is that they are often smaller file sizes, and since they have no native resolution, they can be scaled arbitrarily large and still maintain the same level of image quality.

Besides technology related reasons, there were two basic influences on the decision of which image format to promote as Ukis preferred file type. These were the subject matter being presented, and the type of resource the information was being presented on. In regards to subject matter, engineering knowledge presentation entails a large volume of examples and diagrams if it is to be presented correctly. As a result of this, the image format used had to be easily manipulated into technical diagrams, charts, and schematics, and relatively easy to edit. SVG, as a vector graphics format, fulfills these requirements, and can be edited by a large range of programs. With regards to presentation format, SVG files can be downloaded and edited without much extra overhead by a user, are scalable, and are supported across many platforms.

Chapter 6

Conclusion

The goal of this project was to address the creation and implementation of a self-sustaining web resource for engineers. In doing so, this project studied an important question. How does one utilize web-based communication media in order to facilitate the self-perpetuating exchange of knowledge in the academic engineering community? Over the course of the project, the group discovered that the full answers lie deeper than the scope a single IQP is capable of covering. However, much progress was made in answering this question.

6.0.1 Lessons Learned

This project found that there are two primary items to focus on when creating a community driven web-based resource:

- Initial content must exist that is sufficient to provide usefulness to the target community.
- It must be sufficiently straightforward for normal users to add content to the resource without confusion.

While our group put a much larger amount of effort into tools than into content, this turned out to not be the optimal solution despite making content editing far easier than it initially was. Even with an extremely useful tool set, a community based resource needs to have sufficient time

to gather an initial user base, to start the very thing that will sustain it: its community.

In the case of a knowledge resource, our results show that there must be enough useful content to make people want to use it, which will then lead to people contributing, which is where the tools come into play. Both tools and content are required in equal amount to build a successful resource; without one, there is no reason for users to visit the site, and without the other, users will not wish to make the effort to contribute. These two factors must be maintained for a sufficient period of time for the community to expand past a small initial user base.

Furthermore, some problems were encountered when attempting to garner community awareness of Uki. When attempting to gather focus groups, make users aware of the wiki in its initial release, and to gather maximum responses in our final surveys, the busy nature of college life at WPI made obvious some important points in how to properly spread word of such a project:

- Students tend to ignore emails that contain any mention of IQP, especially when in the subject or first lines of the message. Some even have filters to delete these emails automatically.
- Conversely, any mention of free food is typically not ignored.
- Students are liable to forget or overlook such a project in their busy studies if not reminded multiple times.
- Incentives need to be found for most forms of participation.

Another critical factor in the success of a resource is its scope and formatting. A resource which is aimed at a particular user base must tailor itself to that user base at the cost of usefulness to other groups. Web resources must either choose to be somewhat useful to everyone, or extremely useful to a particular subset of people. Uki is aimed at a subset of people, while Wikipedia is aimed at everyone. Wikipedia, while providing a massive user base and excellent quality of content, lacks some of the specificity in target audience to be more useful in some areas.

Additionally, the quality of information is not necessarily determined by the writer, but where the information is. On a curated resource, there is the writer, the proofreader, and then the process

is finished. On a community resource, the article is constantly being read, updated, edited, added to, spell checked, grammar checked, and re-written. For this reason, community resources excel in new fields. They teach as the knowledge is shared. An article may start as a stub, but then it grows as those who are knowledgeable on the subject share their information, and in doing so reinforce what they know about the subject.

6.0.2 Final Remarks

In conclusion, the future sharing of knowledge lies in the digital world. As a result of our project, our group feels that the format most likely to advance the goals of collaborative learning within the engineering community will take the shape of centralized, open community sites. Closed sources do not meet the demands of todays sharing infrastructure; the speed at which information flows is simply far more than a small group of curators can keep up with. So, simply enough, the future of digital information resources lies with the collaboration of the users who can use and contribute to the same resource to further their own horizons. With further time and effort, a resource such as Uki can garner a sufficient user base and interest to become a powerful and lasting resource within the academic engineering community.

Chapter 7

Recommendations

The first recommendation for future groups is to add content to the site. After discussions with our project advisor, professors, and fellow students, it appears that the main obstacle to building the user base is the amount of useful content that is currently on the site. The survey results reinforce this conclusion. Once the site content reaches a useful level the difficulty level of building a significant user base will be greatly reduced. The exact definition of this level is something that needs further research, as that definition is central to a model of how to build similar resources. We therefore recommend that this be one of the first tasks for any group continuing work on this project, and that significant data be gathered on the tipping point where the user base begins to grow at an increasing rate.

As part of adding content, something which may be worth investigating is creating or expanding upon a project portal to present WPI and other universitys projects. Similar to the courses portal providing a means of linking between topics and their respective courses without binding articles to one or the other, a project portal may be useful for showcasing real working applications of various topics and disciplines displayed within Uki. This was, in fact, suggested by some users in discussion, however it was not included due to lack of provided content for this section.

Groups continuing this project as an IQP would benefit from lessons our group has learned during the course of this project. One of the seemingly small yet significant observations we have

made is that when contacting the student populace regarding use of the resource, surveys, and the like, groups should avoid the IQP label. Attempt to phrase things to avoid explicitly designating the communication as relating to an IQP, at least until the end of the message. Especially avoid using the IQP acronym in e-mail subject lines; a large proportion of students actually have filters on their e-mail accounts to automatically send such e-mails to their spam folders.

The resource that was created is intended to allow for the possibility of use by other universities. To that end, our group highly recommends that any addition of WPI specific content (courses, projects) be done is such a way as to imply the possibility of easily adding other schools. For example, the course pages on Uki as of now are all in a WPI namespace, and the Courses portal includes, as the highest abstraction on its subject tree, the university which the course is offered at, implying that to add a school, all that must be done is add a new section at the top level of the tree for that school.

7.1 Notes to Consider

After getting users, it became clear that the community had some desires that hadnt been considered in the original intentions for the website. Users showed interest in having some course specific content on Uki, instead of purely course-independent articles, as was originally assumed. This was made apparent when users expressed interest in knowing what material would be expected background for a course, as well as what courses cover specific material.

The original intent was to have concise articles covering a practical overview of a given topic, rather than the lengthy amounts of background history frequently found in Wikipedia articles. However, survey and focus group data provided conflicting results on this matter. Some users desired short articles, others wanted long articles with extensive examples, and other users wanted long articles broken up into discrete sections. However, one common article formatting option that users seemed to agree on was a clear separation between background theory on topics, such as relevant formulas and theorems, and practical information on a topic, such as component datasheets.

Appendix A

How To Use Uki

This chapter outlines and addresses the various front end and back end features of Uki, such that future IQP groups may effectively work with the existing website. Much of the documentation necessary to use Uki can be found on the MediaWiki website instruction pages referred to in each part of this section.

A.1 Local Settings

In order to change the configuration of MediaWiki, LocalSettings.php is the typical file which must be edited. Typical MediaWiki extensions require editing of this file in order to enable the extension. For further documentation on the usage of this configuration file, see the MediaWiki help page at http://www.mediawiki.org/wiki/Manual:LocalSettings.php .

A.2 Extensions

Extensions are methods of adding features to MediaWiki. The currently installed extensions on Uki can be found on the Special:Version page of Uki. More extensions can be found on the MediaWiki website, and specific instructions on installing and configuring an extension are typically found on the page associated with it.

The most prevalent extension currently installed is the Open Web Analytics extension, which provides integrated access to the Open Web Analytics toolset within Uki itself. Other extensions currently in use include ParserFunctions and Variables, which respectively allow the usage of conditional statements, string functions, and variables in wiki markup itself. These have been included to allow expanded and more dynamic functionality in specially formatted pages and templates.

A.3 Server/Database Operations

Uki is currently hosted on a virtual Ubuntu server within the CS department and managed by Michael Voorhis. IQP team members, when applicable, should have access to the server via SSH at uki.wpi.edu in order to allow proper website maintenance.

The backend of Uki is stored in a basic MySQL database, and is accessible remotely via a phpMyAdmin install. IQP team members in charge of server operations should be given the login credentials for this service should they need access to it.

To ease communications to and from the Uki website, the virtual server has been given the capability of sending and receiving emails on admin@uki.wpi.edu, and sending emails from no-reply@uki.wpi.edu. This allows proper password resets to be possible should a user forget their password. Furthermore, the admin@uki.wpi.edu email address allows emails to be sent to the current Uki IQP team.

A.4 Site Organization

This section addresses the current status and rationale behind the organizational structure of Uki. As the website evolves, it is expected that community feedback will improve upon this organizational layout. Such organizational structures include categories, namespaces, portals, and talk pages. Articles are broken up into basic categories, which are outlined on portal pages. Portal pages act as a type of homepage for a given group of topics.

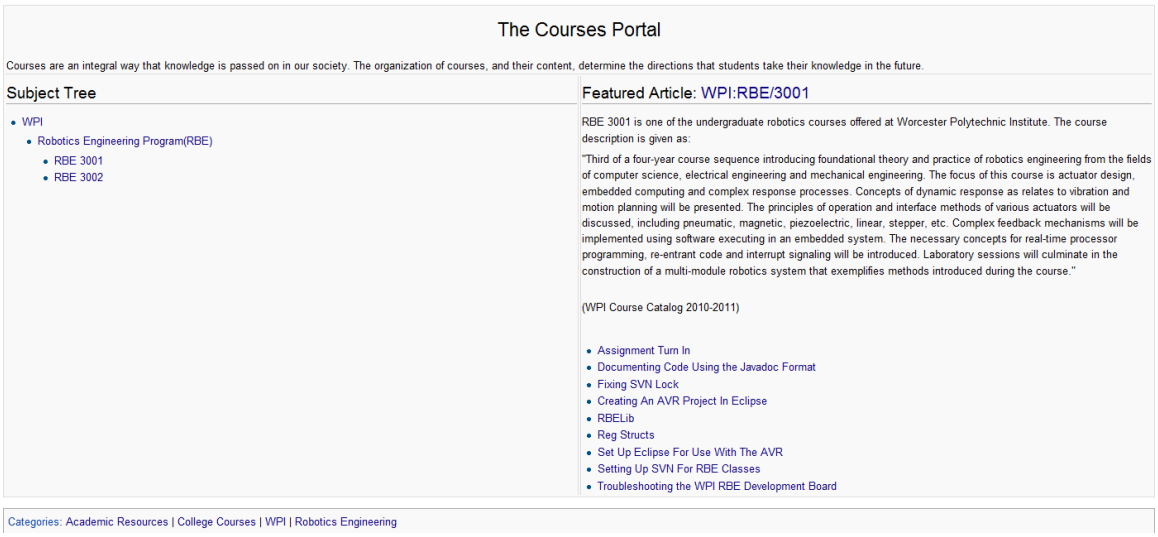


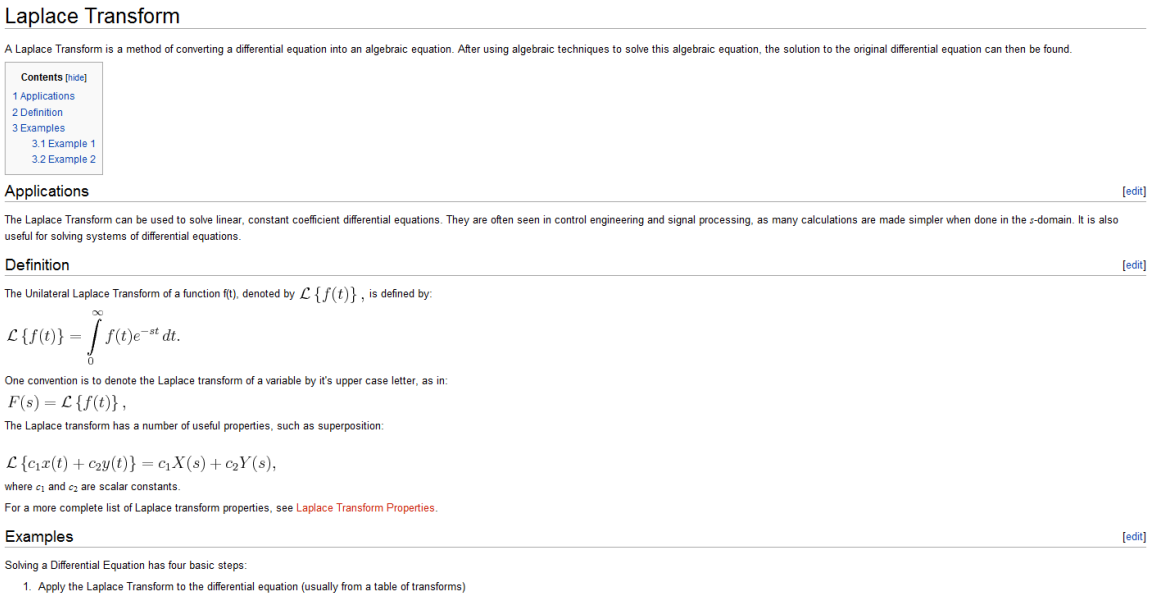
Figure A.1: A typical portal on Uki

A.4.1 Portals

Uki is organized in such a way as to allow an interested user to browse a subject of interest and see a broad range of information pertaining to that subject. One set of organizational structures which are designed to work towards that end are the portals. Each portal pertains to a specific subject, and contains a small description of the subject, a tree of relevant articles, and a featured article. The portals are designed to allow rapid access to the most relevant information for a topic, and should be modified and maintained with that goal in mind.

A.4.2 Namespaces

Namespaces provide a form of super-category for content within Uki. Virtually all articles within Uki are in the default namespace. The Portal namespace was created in order to allow the creation of such pages as a distinct entity from normal articles. For most purposes in Uki, no additional namespaces should be needed. However, for additional reference on this topic, extensive information is available on the MediaWiki help documents.



Laplace Transform

A Laplace Transform is a method of converting a differential equation into an algebraic equation. After using algebraic techniques to solve this algebraic equation, the solution to the original differential equation can then be found.

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1 Applications
2 Definition
3 Examples
3.1 Example 1
3.2 Example 2

Applications [edit]

The Laplace Transform can be used to solve linear, constant coefficient differential equations. They are often seen in control engineering and signal processing, as many calculations are made simpler when done in the s-domain. It is also useful for solving systems of differential equations.

Definition [edit]

The Unilateral Laplace Transform of a function f(t), denoted by $\mathcal{L}\{f(t)\}$, is defined by:

$$\mathcal{L}\{f(t)\} = \int_0^\infty f(t)e^{-st}\,dt.$$

One convention is to denote the Laplace transform of a variable by it's upper case letter, as in:

$$F(s) = \mathcal{L}\{f(t)\},$$

The Laplace transform has a number of useful properties, such as superposition:

$$\mathcal{L}\{c_1x(t) + c_2y(t)\} = c_1X(s) + c_2Y(s),$$

where c_1 and c_2 are scalar constants.

For a more complete list of Laplace transform properties, see Laplace Transform Properties.

Examples [edit]

Solving a Differential Equation has four basic steps:

1. Apply the Laplace Transform to the differential equation (usually from a table of transforms)

Figure A.2: An article from Uki

A.5 Article Formatting

Article formatting conventions are largely up for community discussion within Uki, as their relevant reference pages are wiki pages themselves. Current information on article formatting can be found on the Help pages within Uki, and a discussion of results from user data gathering is in the recommendations section.

A.6 Analytics

Installed alongside Uki as a web analytics resource is an installation of Open Web Analytics (OWA). This tool provides statistics on page visit counts, redirect sources, account creations and logins. Funnel visualizations can be created to determine percentages of users that are led from one section of a website to another through various desired routes. Furthermore, OWA provides full logging of mouse movements and clicks for every article in Uki. These can be replayed to see the actual mouse movements of a user when viewing an article or navigating the website. On any OWA statistics page for an Uki page, the Domstreams link provides a list of such page view recordings.

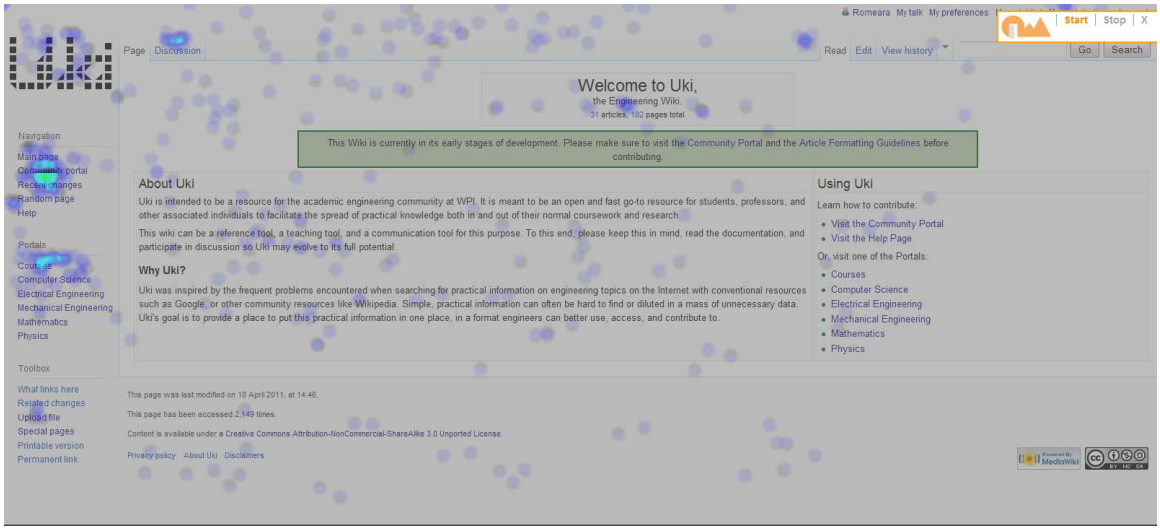

Figure A.3: Heatmap Overlay of Uki Main Page

For more overall usage data, the Heatmap Overlay option provides color-coded overlays showing popular click targets on the page.

During implementation, some bugs were encountered in certain MediaWiki specific tracking options in Open Web Analytics. Until these problems are fixed, the offending lines of code have been commented out of mwplugin.php in the Open Web Analytics extension directory of Uki. These do not reduce the basic functionality of OWA in Uki, but rather prevent obtrusive error messages from appearing during normal usage.

The Open Web Analytics dashboard is only accessible to users with administrative privileges on Uki, and can be found on the Special:Open Web Analytics page under Special Pages.

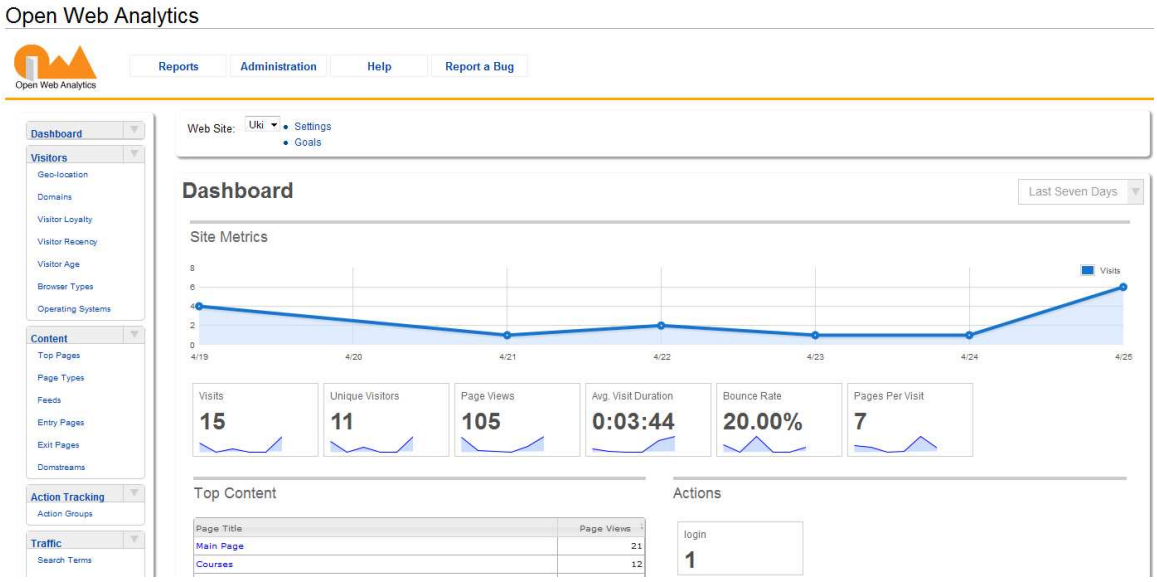

Figure A.4: Dashboard for Open Web Analytics

Appendix B

Focus Group Data

Topics and Pages:

- Op Amps (requested by all three sessions)
  - Basic equation
  - Basic example
  - Ideal characteristics
- Basics for ME, ECE, CS
- Course page with links to topics
- detailed VEX installation instructions
  - AKA How to set up
- Have motor spec sheets with torque and power
  - make them search-able
  - also have resistor color codes, etc.
- Have controls info: real applications and practical info

  - PID tuning: atomic function tips, leveled program design
  - Practical analysis and design
- troubleshooting
  - Use Wiki to replace mywpi discussion groups
  - VEX blinking light codes
  - Troubleshooting components
- For RBE 2001 include:
  - Stress Analysis
  - Statics
  - Dynamics
- For RBE 3001 include embedded systems
- Have course sheets or descriptions that list hidden requirements
- Have an outline or course tree that lists and prioritizes robotics prerequisites
- Include algorightms, beginners guide to program (design), C - Java relations
- Robotics Major info page/rate the major
  - Have news, discussion, and memoirs
  - Goal is to provide info to prospective students
  - perhaps this should be on the department web site instead?
- Give Joe a page for state of the lab stuff and lab procedures
- have a section about robotics books or recommended readings
  - perhaps include on the course pages?

- Include inverse kinematics
- List of function calls in WPI library
  - different sources have different lists, create one list with all function calls
- Have pages for MQPs
  - Links to MQP web sites or library database
- List our graduation requirements in plain English
- Links to websites to buy stuff
- How to get free samples
- Recommendations for how and when to use tools
- More documentation for robotics development board.
  - how to set up
  - troubleshooting
- Have a page on MATLAB
  - also Labview
- Have a VEX blacklist - what not to use
  - i.e. chains, ultrasonics, etc.
- Include datasheets
- Have page on sensors
- Common communication protocols
  - SLI, USART

- Projects section would be great for WPI PR
  - maybe on a/the blog?

Topics and Pages:

- More compact articles = better
- Have long articles, but use examples instead of text
  - Emphasis on including examples
- Tag courses that use a page at the bottom of said page, so a page can link back to a course it is used in
- Basics on programming language?
  - lots of tutorials elsewhere, maybe just include a syntax primer
- Have sample code?
- Diagrams as PDF?
- Diagrams with MultiSim printscreen?
  - Easy way to use SVG?
- Any SVG app must be quick to download and install (¡ 2 minutes) without requiring a computer restart
- Refreshers are very useful
- Include formula sheets
- Split articles/topics into theory and practice
- Include examples of simple and complex cases

- Pass on program design for robotics
  - Proper setup of timers, etc
- Perhaps include common mistakes in a course page
- Probably not videos
  - (Sample size of 2)

Contribution:

- People might contribute to prevent people making the same dumb mistakes I did
  - to prevent mistakes that dont teach people anything
- Have professors make writing articles a homework or extra-credit assignment
- Talk to RBE TAs for help and info
  - specifically for the RBE development board
- Post top contributors to encourage contribution
  - perhaps have a (monthly) contest?
- Use prizes as incentives for contribution?
- Work with professors to create a course and exam note sheet
- Get teacher support
  - Give teacher a list of articles
  - Professor assigns list to students
  - Give students a template

Concerns:

- What about moderation?
  - Specifically, prevent exact homework answers form being posted
- Beware of granularity, as in, only showing one way to do something
  - Provide several methods
  - Perhaps it is users responsibility to research several methods?
- Program design more important than language primers and how to implement
  - There are plenty of programming tutorials on the web already
  - Perhaps provide pointers/links to tutorials, provide page(s) on good practices?
- Maybe keep part of the site closed for moderation purposes?
  - such as keeping HW answers off the site
- Use a sticky note system for communication?

Appendix C

Survey Data

What is your relation to the WPI community?	Have you visited before?	Have you ever edited a wiki before?	How does the site look?	How easy is it to find topics?	How easy is it to add content?	How easy is it to find and use the help documentation?	What style of article would you prefer?	Do you have any suggestions for improvement?	What reasons, if any, would motivate you personally to contribute to a wiki?
Undergraduate Student	Yes	No	4	3			Short with links		
Undergraduate Student	Yes	No	3	4			Long in sections	add a robotics section. links to books, solution manuals, useful sources etc. could be very handy on a main page for each section of engineering.	
Undergraduate Student	No	Yes	3	4	4	3	Short with links		
Undergraduate Student	No	Yes	3	3	3	3	Long with examples		
Undergraduate Student	No	Yes	4	3			Long with examples	Most of them are empty right now so it seems useless right now	
Graduate Student	Yes	Yes	3	3	3	3	Long in sections	I would like to see Uki also link to the appropriate sections on Wikipedia	
Undergraduate Student	No	Yes	4	3	3	4	Long in sections		
Undergraduate Student	No	Yes	5	4	4	5	Short with links	Under the mechanical engineering section, I would like to see a section on Dynamics, and more types of drive systems.	To help future students
Graduate Student	No	Yes	4	2		3	Short, practical examples	Provide more practical examples on Uki, just cook book answers and problems do not have any effect in reality.	Better than googling and getting confused, search in Uki is narrowed so a surfer stays within Uki. You get answers to what you need as part of curriculum or personal improvement.

What is your relation to the WPI community?	Have you visited before?	Have you ever edited a wiki before?	How does the site look?	How easy is it to find topics?	How easy is it to add content?	How easy is it to find and use the help documentation?	What style of article would you prefer?	Do you have any suggestions for improvement?	What reasons, if any, would motivate you personally to contribute to a wiki?
Undergraduate Student	Yes	No	4	5	3		Short with links	Great skeleton! Perhaps a way to show the ”level” of diffuculty or needed background would be useful. Say you’re a 1001 level course student: it’d be practical to be able to hone in on 1001 level information faster and not be overwhelmed be a list of also 3000 level articles. Of course that doesn’t stop anyone from looking at any article, it’s more of a note or guide suggesting level. Perhaps some topics could have a list or search box of courses that denote if the material is taught in that courses, useful for that courses, essential for that course, etc.	IQP credit =p Also to remind the writer about the basics of certain things if he’s gotten rusty. Bonus credit for a student in a class? Prompt students to do a well written article relevant to a class could get added in and the student would get extra credit? Incoming TAs could add articles as part of the TAing application.
Undergraduate Student	Yes	No	3	4			Short and concise		I would contribute to the wiki if there was a subject that I thoroughly understood and I thought it would help RBE majors with their class work or projects.
Undergraduate Student	Yes	Yes	3	4			Long in sections	The topic layouts look good, but the articles need to be written	
Undergraduate Student	Yes	No	4	3			Long with examples		to help others and get help when I needed it
Graduate Student	No	No	3	5	3	4	Short with links		
Undergraduate Student	No	No	4	5	3	3	Long with examples		
Undergraduate Student	Yes	No	3	4	3	3	Long with examples	Get professors more involved, they have good materials and examples on nearly all of the subjects in the wiki.	Desire to help future robotics students.
Undergraduate Student	Yes	Yes	3	4		4	Short with links	At this point, just expanding the topics and such would be very beneficial... it looks like it is off to a great start	Helping others mostly... if i figure out how to overcome an issue, I would feel compelled to add it to the wiki to help others avoid the stress I went through

What is your relation to the WPI community?	Have you visited before?	Have you ever edited a wiki before?	How does the site look?	How easy is it to find topics?	How easy is it to add content?	How easy is it to find and use the help documentation?	What style of article would you prefer?	Do you have any suggestions for improvement?	What reasons, if any, would motivate you personally to contribute to a wiki?
Undergraduate Student	Yes	No	3	3			Short with links	put the portals in a more prominent place. also could have the subcategories accesible through the side bar. (like have the plus sign thing to the left, and if you click it it expands to show the subcategories	i know the frustration of not knowing how to do a homework or a project or even just a problem and scrambling to find info on it. i would contribute so that others have a place to look for that info and also so that if i ever needed to find it again, i would have a quick easy method of accesing it. love this idea, need to get some pages onto it!!!!
Undergraduate Student	Yes	Yes	3	3			Long with examples		Helping people, correcting inaccurate information
Undergraduate Student	Yes	No	4	4			Long in sections	I think if people are going to use it, they need to see the site as a valuable resource first...while wikis are user generated, they initially need either a guaranteed community base or an initial starting point with enough useful information to generate a community base. I feel that if WPI students see that Uki is useful, they'll consult it rather than just google-ing what they need to know, as the contents of the site are tailored to the needs of WPI students, saving time and ensuring relevant results. However, it seems likely that the WPI community won't embrace this site unless there are more articles to pull in people with questions to begin with...right now it's easier to google subjects because there is almost no content on Uki. If course materials reference articles for more examples or information on subjects, or if there are simply more articles available, people will utilize the site and build it from there.	To help others, and not so much for recognition, but rather to have the satisfaction of contributing to the resources available to my fellow students.
Undergraduate Student	Yes	No	3	4	3	3	Long with examples	actual content. right now its kinda empty	nothing, i would just use it
Undergraduate Student	No	Yes	4	4	4	3	Long in sections	more content overall, more robotics content	desire to help others, opportunity to be part of a lasting project
Undergraduate Student	Yes	No	4	4			Long in sections	It seems to have a good selection of content, I just need to grow a pair and post/edit.	A desire to helps other and look for information later.

What is your relation to the WPI community?	Have you visited before?	Have you ever edited a wiki before?	How does the site look?	How easy is it to find topics?	How easy is it to add content?	How easy is it to find and use the help documentation?	What style of article would you prefer?	Do you have any suggestions for improvement?	What reasons, if any, would motivate you personally to contribute to a wiki?
Undergraduate Student	Yes	Yes	4	4			Long in sections	More of an advisory, wiki's are built on links. Anything that is covered in another article should be linked in every article every time it is referenced. As more articles are added maintaining these links can fall by the wayside.	to help people understand and to create a community standard reference.
Undergraduate Student	Yes	No	3	1			Long in sections	Seems like a very good idea to have this site. Multiple inputs from users with some editors controlling these edits would make uki develop fast, and in consequence it can become a very important source for students. One suggestion in the future would be to add forum like abilities to the site. This way students can help each other quickly and easily for specific problems. It can be made like "cramster", with increased rules on the site to control academic honesty.	My primary reason would be to help others. We also had problems in the past with courses, and having a person to help would had make me happy. Also after putting some effort to help, getting recognized wouldn't hurt.
Undergraduate Student	Yes	No	3	3	3	3	Long in sections	It'd be nice if there was content on there and not just a bunch of click-able headings.	Stuff I'm interested in. Fixing preexisting mistakes.
Graduate Student	No	Yes	4	4			Long in sections	Looks good so far, but still waiting for a dedicated Robotics Engineering section.	Helping people avoid the same mistakes that I have made before, and giving them a place to go for help when they can't get in touch with Professors or TAs.
Undergraduate Student	No	Yes	3	5			Long in sections		especially since I double major, I would bring in relevant information and explanations for ECE topics covered in the RBE curricula which don't have as in depth explanations due to course time constraints
Graduate Student	Yes	No	4	5	4	3	Long in sections		
Undergraduate Student	Yes	No	3	4			Short with links		
Undergraduate Student	No	No					Long with examples		Enjoyment in writing articles, recognition... maybe procrastination...
Undergraduate Student	Yes	No	3	4			Long in sections		

What is your relation to the WPI community?	Have you visited before?	Have you ever edited a wiki before?	How does the site look?	How easy is it to find topics?	How easy is it to add content?	How easy is it to find and use the help documentation?	What style of article would you prefer?	Do you have any suggestions for improvement?	What reasons, if any, would motivate you personally to contribute to a wiki?
Undergraduate Student	Yes	No	1	1	1	1	Long with examples		
Undergraduate Student	Yes	Yes	2	2	2	3	Long with examples	content seem to be easily edited without the check of the site editor. I think someone should check the content edited by users.	
Undergraduate Student	Yes	Yes	3	3	2	3	Long with examples	It should be different from wikipedia, otherwise it will be useless. We should put more content more special to WPI students.	
Undergraduate Student	Yes	Yes	4	4			Long in sections		
Undergraduate Student	No	No	4	4	2	2	Long with examples		
Undergraduate Student	Yes	No	4	2			Short and concise		to spread the knowledge. be able to pass on what i've learned. by the time I graduate, I would love to see Uki as the go-to study tool.
Faculty	Yes	Yes	3	3		2	Short and concise	It is still not clear what types of articles you want. The Computer Science portal looks like it wants to be a subset of some book about CS. Not sure that is what makes sense. I would have assumed this site would provide student to student advice on how to be in CS, either as undergrad or grad. And maybe insights on how WPI functions. But clearly note.	desire to help others.
Undergraduate Student	No	Yes	4	4	4	4	Long in sections	Very good, just needs more participants to flesh out the articles	I would want to help people trying to learn new things

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