IPRO 321

Project Plan

I. Abstract

Beer is one of the most consumed beverages in the world. The culture of brewing beer is one that continues to attract the attention of people from all walks of life. Beer can be differentiated one from another in terms of their color, alcohol content, smoothness, bitterness, type of ingredients used as well as the recipe used. In a very broad sense, however, beer can be broken up into lagers and ales. The main difference between lagers and ales is the kind of yeast used and the conditions under which the fermentation is carried out. In this project, an attempt will be made to produce a beer that is on the continuum between lagers and ales: the German Altbier. The Altbier has a unique combination of flavor, aroma, bitterness and smoothness. The central objective of this project is to take on the challenge of creating the Altbier. This will be accomplished by bringing together students from a broad range of academic backgrounds whose different skills sets will be applied to the task at hand.

II. Team Charter

A. Team Information

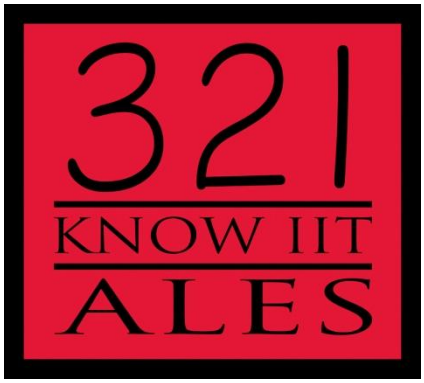
Details

See Appendix for names, majors, strengths, expectations.

Team Identity

Name: KnowIITAles

logo:



Motto: Brewing Towards Happiness

B. Team Purpose and Objectives

Team Purpose

IPRO 321 is a group of students brought together through a common interest in zymurgy; we look to gain practical and professional experience in experiments and scale-up design, academic research, and project management.

Objectives

To gain a working understanding of zymurgy

To produce a quality product

To apply the concepts of chemical engineering to creating a quality beer

Enter the National Homebrew Competition and possibly win some awards

Compare existing home brewing setups and try to improve upon them

Cooperate in working towards common goals while maintaining academic and behavioral integrity

C. Background

History

Currently, IPRO 321 has no corporate sponsor but Professor Ramani is the IPRO's advisor along with IIT students with experience in the field.

Technical Issues

This project contains many high level aspects of chemical engineering (ChE) and as such, it will require the ChE seniors in the class to bear the greatest load in terms of design. In order to facilitate the process, other students will have to learn basic concepts from the ChE seniors and attempt to apply them as quickly as possible to capitalize on the group's knowledge.

A major aspect of the brewing of beer is chemical reaction engineering by which the various reactions occurring can be controlled. Furthermore, the fermentation of beer involves the action of the enzymes in yeast which are affected greatly by the temperature of the reaction. In order to maintain the temperature in a non-isothermal reaction, we need to understand the underlying mechanics of the reaction and compensate for the factors that move the system away from the steady state.

Our plan to accomplish this is to design a temperature controller which will maintain the temperature at the optimum temperature for brewing our beer. We will use LabView (a computer program used for simulating experimental conditions) to obtain temperature measurements and to act as a proportional integral derivative (PID) controller. In addition to our temperature controller, we will use a high level computer program (MATLAB) to perform statistical calculations on the data that is acquired.

The other side of the project requires a physical construction of our fermentation drum and cooling system. This will require investigation of the actualization of our PID controller as well as a design which improves upon what is traditionally available. It will be necessary to incorporate knowledge of heat transfer and heat exchanger design to create an ideal wort chiller and an effectively insulated container for the fermenter.

Ethical Concerns

Due to the mixed nature of this IPRO, not all students are of legal drinking age in the state of Illinois. Because of this it is necessary to ensure that only those of age are able to consume the final product despite complaints from the younger students.

Due to the large size of the IPRO and the unique nature of the divisions that were conducted, we must avoid the unauthorized use of information from the other sections. Furthermore, we must ensure that we do not inhibit their own efforts in order to increase our group's chances of producing a superior product.

Potential Applications

If successful, this could be a IIT made beer sold to or manufactured by the BOG for the IIT community. IIT's dining services has already been contacted by our group and they are open to the possibility of selling the beer product within the school's main campus.

Critical Documents

Because this is a new IPRO project, there are no critical documents to report here. Most of our information will come from the first-hand experience of those who actively brew their own beer.

D. Team Values Statement

Desired Behavior

Coherent communication through timely email responses

Strong, consistent attendance

Creation of a friendly environment through respectful treatment of teammates

Willingness to share relevant ideas and research material

Compliance to formal scientific research citation formatting

Effective time management skills

Follow through with promises

Take the project seriously

Desire to take initiative

Conflict Resolution

In addressing problems the group will make sure that active listening is used, information is gathered and issues are clearly identified, possible solutions will be brainstormed, and a solution will be negotiated. Problems will be firstly addressed by talking with a peer or a subgroup leader. If the problem is not resolved, then it will be addressed by the team leader and, finally, the IPRO advisor, Professor Ramani. Problems will be prevented through open communication with other teammates, by meeting deadlines to the best of our abilities, and by relying on collective teamwork to complete large tasks. To reinforce these points, peer reviews will be conducted at multiple points throughout the semester.

III. Project Methodology

A. Work Breakdown Structure

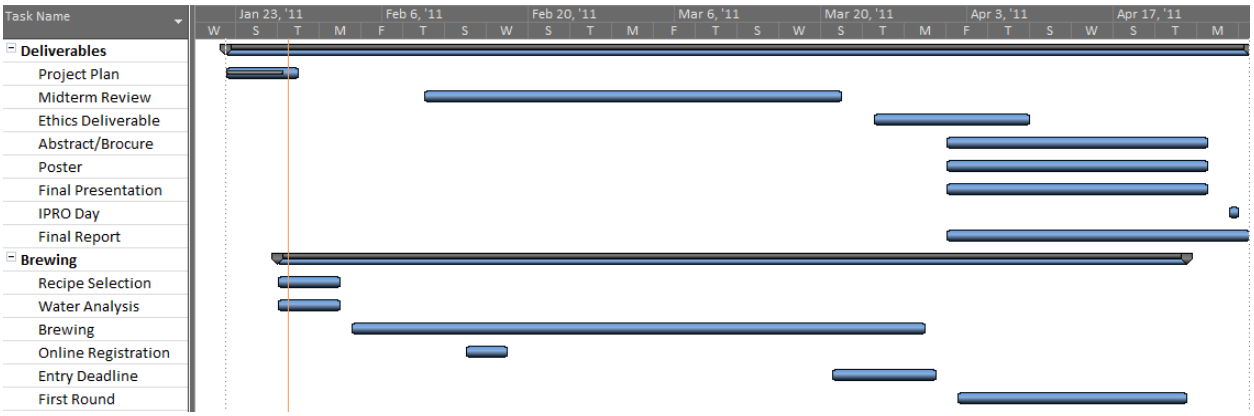
Team Structure

Due to the large number of people in IPRO 321, three teams were created that would each be responsible for brewing a beer of their choice. While each team's beer recipe will therefore be different, the general brewing process, regulations, quality assurance, consumer market, and many other aspects of the project will be the same. Due to these similarities, it was decided that the non-ChE members of the IPRO will act as communication lines between the teams. They will do so by splitting up between the teams and working among them as any other member. On a predetermined date, they will meet up after class to discuss what has been accomplished so far and to pose any questions that have come up to the other groups. They will then bring back what they have learned to their respective groups. This will allow quick and effective transfer of ideas and information between groups.

In the KnowIITAles, members were initially split based upon member preference into three subgroups reflecting the major tasks currently faced: brewing, quality assurance (QA)/regulations, and marketing. Within each subgroup, members were given different research tasks based upon what is needed. The brewing subgroup was responsible for looking up information on Altbiers, equipment, and possible recipes. The QA group was responsible for research on current regulations on making and distributing beer and the desired water content

to help ensure a good tasting beer. Finally, the marketing team was responsible for researching the requirements and the National Homebrew Competition (NHC), determining what flavor beer people enjoy through surveys and research of local establishments, and determining what protocol must be followed to allow the beer brewed to be served at IPRO day. These subgroups and tasks are only for current research being done and will change as the information needed changes.

B. Schedule



C. Expected Results

Details of Expected Activities

We plan to work on controlling the temperature of the fermentation in order to create our altbier. This combines the need for chemical engineering expertise while keeping in mind the safety precautions necessary for brewing beer.

Until further information acquired about the budget for the project, it is unknown how we shall brew the beer. Two proposed ideas are to use two separate containers to brew it or to use one larger container to produce one batch.

This IPRO shall work towards working toward understanding the process of zymurgy through research into current methods and recipes. These findings will be reported by the research team through short presentations or summaries.

Expected Data

Because of the process by which we will maintain the temperature constant in order to produce the altbier, we will have a large sample of temperature data collected from our fermenting unit.

We will need to analyze the potential water sources to ensure that they are consistent with the general heuristics for the mineral content found in water used to brew beer.

We will also take quality control samples from which we can determine the alcohol content of our brew as well as checking for any unwanted chemical components that may affect the quality of the beer.

It will also be necessary to obtain the specific gravity of the product in order to make sure that it is within an accepted range.

Potential Products

Our IPRO aims to produce a carbonated beverage that will be served to individuals of the appropriate age for refreshment as well as a social lubricant. Unfortunately, we cannot sell the beverage in the state of Illinois.

Potential Outputs and Deliverables

The output will be two different types of beer. The deliverables will be project plan, midterm review, ethics deliverables, abstract/brochure, poster, final presentation, and final report. In addition, we will be submitting a sample of our beer for the 2011 National Homebrewing Competition.

Challenges and Risks

One of the biggest challenges involved in producing the altbier is being able to accurately control the temperature at which the product ferments. If the temperature is not carefully maintained, the ultimate result will not be what is expected and therefore not what was advertised.

Another challenge is the necessity of a high level of sanitation in the brewing vessels. Because of the chemical composition of the fermenting liquid, there is a danger of producing a large colony of bacteria within the vessel that contaminate the brew while posing serious health risks if it goes unnoticed.

A risk that we are taking which most brewing companies don't have to deal with is the question of the mineral content of the water we are using to brew our beer. This could potentially alter the taste and outcome of the final beer flow.

Proposed Solution

In order to solve the problem of the temperature controller we will consult with professors in order to create a robust computer program to handle many potential situations in a favorable manner and maintain the temperature in a an acceptable range.

The only real solution for the problem of sanitation is to thoroughly clean the fermentation vessel to ensure that there is no contamination in our fermentation vessel.

There is no solution to the potential problem of the water quality due to the time constraints. Therefore we shall use whatever water seems to be the best for our purposes. The mineral content of the water can be spiked (or lowered) using appropriate chemicals as needed.

D. Project Budget

Equipment and Materials Cost

$3,200

Justification: Significant amount of equipment and materials will be required for successful completion of this project. Most of the equipment to be bought can be used by other IPRO groups in succeeding semesters. A detailed breakdown can be provided upon request.

Publication and Communications

$180

Justification: Upon successful production of the product, we will have to market the product. We also intend to make brochures that shows how the brewing process was carried out

Student Stipends

$700

Justification: $ 2000 is requested for Chris Arges, a graduate student with experience in beer brewing who will assist with this IPRO. Since there are three teams for this IPRO, the cost was divided among the three teams. There is no TA for this class, and the class s large wth 3 independent sub-projects. Hence, Chris's help and availability will be invaluable.

Plant Tours and Transportation

$400

Justification: It is desired to embark on a plant tour at a local brewery with the entire group. This will be a unique educational experience and will lead to better appreciation of the brewing process. At least one trip will be made. All members of this subteam will be invited (25 students).

Miscellaneous

Overhead cost: about 10% of the cost of equipment and materials is allocated to cover shipping & handling costs as well as other miscellaneous costs that may arise.

Total Budget

$4,800

E. Designation of Roles

Team Leader: Ricardo Rodriguez. He will ensure that the group is making progress as the semester progresses. He will also be responsible for helping the team overcoming obstacles that they are confronted with.

Assistant team leader: Tobiah Isbell. He will assist Ricardo Rodriguez as necessary.

Moderator and Minute Taker: Andrew Raddatz. He will take notes and summarize the discussions of each class meetings so that it will be available for the team members to refer to it later and/or will be available for the team members who could not show up to a meeting. He will also upload presentations, research documents, etc. in file-sharing applications like Google Docs so that they are readily available to the team members.

Agenda Maker: Ricardo Rodriguez, Jaya B. Singh and Kolade Adebowale. They will make the agenda for the two class meetings every week. This will guide the team to work on the right things at the right time and will keep the team organized.

Time Keeper: Bonnie Au. She will take attendance of the team members; keep track of the meeting start time and meeting end time.

IV. Appendix

Name	Major, Year	Strengths	Desired new skills and knowledge	Expectations	Contact Information
Paul Adamczyk	ChE, 4th	Process Controll Organization MS Excel	Learn intricacies of beer brewing Apply process control fundamentals to a real life problem. Build team working skills.	A thorough understanding of beer brewing.	padamcz1@iit.edu [redacted]
Kolade Adebowale	ChE, 4th	Strong oral and written skills good team player decent computer skills	Better communication and computer skills I also hope to be able to be able to apply classroom knowledge to real world applications.	I hope we can work as a team to develop a good product which could be sold.	kadebowa@iit.edu [redacted]
Alanzi Faisal	ChE, 2nd	Ignoring directions	A better knowledge of the joy of alcohol and teamwork.	I expect to learn how to listen to people and follow their directions.	falanz1@iit.edu
Abdalmohsen Alhassan	ChE, 4th	Lab experience, Communicating with others, Leadership, Experience with design concepts. Computer applications such as: MATLAB, LabVIEW, HYSYS	Finding a different way to design a process	Being able to work with non-ChE students and learn from them.	aalhassa@iit.edu [redacted]
Sam Amelio	ChE, 2nd	Strong technical mindset and good at solving problems. I generally quite good at communicating through written media. I have hands-on experience with pipe several aspects of pipe fitting, including cutting and threading galvanized iron pipe. I also have worked with a filtration setup and took data for it.	I would like to improve my problem solving skill, learn to work more effectively as a team, and strengthen my verbal communication skill.	I have never had an IPRO before so I do not have really have any expectations thus far.	samelio@iit.edu [redacted]
Bonnie Au	BME, 4th	Organized Efficient	I hope to gain knowledge of beer brewing	I expect this IPRO to successfully brew beer for IPRO day.	bau@iit.edu
Minsung Choi	ChE, 4th	Good listener Process control Process design My specialization is biotechnology so that I could have some idea about bioreactors related with brewing.	Communication skills and knowing how to operate real process.	I want to develop my communication skills, and also want to know how to work together.	mchoi2@iit.edu [redacted]
Andre Colmenares	ChE, 4th	Logical thinking problem solving layout/graphic design chemical engineering	Work as a team with other chemical engineers Learn to apply my chemical engineering knowledge in real world applications Become a better public speaker.	To learn about the brewing process and how to work as a team with many chemical engineers.	acolmena@iit.edu arcer63@gmail.com [redacted]
Keller George	ChE, 1st	MATLAB Analytical Chemistry	MATLAB	Better understanding of process engineering To makes practical use of theoretical knowledge Hopefully tasty beer	kgeorge1@iit.edu Dassahjules@gmail.com [redacted]
Whitney Horn	ChE, 3rd	Creativity Research Marketing and design	The skills that I desire to develop would be critical thinking and design process skills.	I expect to learn the process of making beer so when I am an official chemical engineer I can make my family and friends my own specialty formulated beer from my very own basement.	whorn@iit.edu [redacted]
Amjed Husein	ChE, 2nd	Not listening to directions Ignoring superiors	How to fill out simple online forms.	I expect to be able to benchpress 240 lbs.	ahusein1@iit.edu
Tobiah Isbell	ChE, 2nd	Good with MS Office	Would like to develop MATLAB skills	New knowledge about beer brewing and MATLAB	lionbeholder@hotmail.com [redacted]
Grahm Johnson	ChE, 2nd	Good with my hands/building things designing things	I want to work at being inclusive rather than exclusive	I know there will be mistakes and hiccups along the way, but I	gjohnso3@iit.edu [redacted]

		performing calculations good people person.	in a group environment I want to learn to deal with other people or groups that work slower or differently than I do.	expect a whole hearted performance as a group, where no one or anything is sacrificed. I'd rather have an "OK" or bad beer by the end of the semester than a failed group dynamic.	
Michael Krolikiewicz	ChE, 2nd	Not following instructions	Control over bodily functions.	I expect lifelong friends.	mkroliki@iit.edu
Ryan Kyle	ChE, 4th	Writing Proofreading Technical Stuff	Lab skills How to brew beer	A positive experience	norforkjr@sbcglobal.net [redacted]
Jordan Llarenas	ChE, 2nd	Not following instructions	Perfection of cursive handwriting.	I expect my handwriting to improve.	jllarena@iit.edu
India Lucas	ChE, 4th	Design Marketing Research	In this IPRO I expect to gain a new perspective on working with others to achieve a common goal	Explore and learn new methods of planning and manifesting ideas, as well as learning a little bit about micro brewing along the way.	ilucas@iit.edu
Kamal Olorunoje	ChE, 4th	Interpersonal skills	The industrial process involved in brewing	Gain as much knowledge as I can	koloruno@iit.edu [redacted]
Heta Panchal	ChE, 2nd	Communicating with groups Researching Designing vague algorithms. I'm not always good at the details, especially when they are concepts which I have not yet learned.	Working with a team of various backgrounds and ambitions Application of concepts I have learned so far. Cross communication between various majors.	I haven't really ever tasted beer before nor do I ever want to. I think it will be interesting to depend on everyone else's senses. I just never have done anything like it before. Develop a greater passion in chemical engineering	hpancha5@iit.edu [redacted]
Andrew Raddatz	ChE, 4th	MATLAB MS Office Adobe products Engineering horse sense	Patience.	A long and difficult but ultimately fulfilling experience.	araddat1@iit.edu [redacted]
Raksha Rajagopalan	ChE, 2nd	Creativity Design Research	I would like to learn how to design the process learn the technical aspects of the project I would also like to learn the marketing aspects of the product produced at the end	I expect to learn better team building skills, working in a team. The use of technical aspects in a project. I want to help in problem solving and designing some aspects of the project.	rrajago6@iit.edu [redacted]
Ricardo Rodriguez	ChE, 4th	Presentation Graphic Design Process Modeling Leadership Building Pilot Scale Models	LabVIEW Optimization	Understanding the brewing process. Hands on experience incorporating our theoretical knowledge learned in class.	rodriguez.chem.eng@gmail.com [redacted]
Jaya Singh	ChE, 4th	Good literature research experience. Knowledge of Physics, Chemistry, Mathematics and Chemical Engineering which are essential to this project. Good knowledge of MATLAB programming. LabVIEW for making virtual instruments like the temperature controller. Some graphic designing experience.	Work efficiently in a large team. Improve presentation skills. Gain knowledge of setting up a small scale engineering process	Brew a good beer. Learn the beer brewing process. Be a better performer in the team.	jbsingh86@gmail.com jsingh23@iit.edu [redacted]
Sami Somo	BME, 4th	Hard working Organized	To learn the chemical processes of beer brewing	Gain more experience in a group setting. Learn to work with a large group to complete a task.	ssomo@iit.edu [redacted]