

IPRO 355

Enhanced Vision System for Construction Safety

**Project Plan
9/19/08**

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1. Abstract

The purpose of our team is to save lives and prevent accidents involving construction equipment damaging underground utilities. We seek to do this by introducing the Enhanced Vision System, or EVS. The goal then for this semester is to design and build this system for displaying the location of buried utilities to the operators of construction vehicles. This includes producing a proof-of-concept prototype as well as designing the final product that we would produce. As this project is not merely an IPRO, but also an EnPRO, we are also considering how to turn this idea into a successful business venture. To this end, we will be performing research and creating a business plan.

2. Background

- A) We currently do not have a sponsor or customer. We have used industry contacts with Walsh construction to obtain interviews
- B) Construction accidents are serious matters which must be addressed: 5,000 construction work-site deaths occur annually in the United States, causing annual losses of \$250 million in damages, payments to the injured/bereaved, and lost productivity. We have examined studies of the causes of these accidents and found that a significant number of accidents (around 40-60%) that occurred due to a worker striking a buried underground utility could have been prevented through some sort of advanced way of displaying the locations of the utilities to the worker.
- C) Current methods of indicating the location of buried utilities include sprayed paint and flags, which can be washed away or picked up and moved. Currently, no technology to replace these methods is currently being used, which may be due to patent concerns or technological limitations.
- D) This is the third semester that this IPRO is running, but the IPRO has only been studying the current problem since last semester. In the previous semester, we defined the problem and performed primary research to identify the scope of the problem. We also obtained materials for making a prototype and began work on the prototype itself. Additionally, we performed some market research and created a business model and plan.
- E) Several moral and ethical concerns have been raised, although we will only identify a few here. As we have already conducted and will continue to conduct interviews with people who maintain and operate heavy machines, we have developed a set of guidelines for interviews. These guidelines include explaining that the interview is voluntary and that the interviewee may stop answering at any time, as well as a guarantee of the interviewee's privacy. At the same time, the interviewee may alert us to some unsafe action which was conducted or which we believe will be conducted. Do we then have a moral duty to inform a supervisor of this knowledge, even though that would break our previous guarantee of privacy?
- F) N/A

3. Objectives

- Technology Team
 - Build prototype
 - Obtain parts (completed last semester)
 - Interface with the sensors (partially completed last semester)
 - Write the program that displays the information to the user (will have to be redone from the previous semester's work)
 - Design final product
 - Determine product requirements such as CPU speed, hard drive size and type, etc.
 - Select products that fulfill above needs
 - Choose vendors that sell above products
 - Build mock-up
 - Decide on product design
 - After selecting appropriate hardware, obtain materials to construct mock-up
 - Fabricate mock-up
 - Evaluate flaws or other changes to be made in the final productivity
- Business Team
 - Features, Benefits, Advantage, and Cost matrix (FBAC matrix)
 - Identify the features that our product will have
 - Enumerate what benefits those features will provide to our customers
 - Determine what advantage, if any, each feature has over the competition or currently used technology
 - List any added costs of having each feature
 - Industry analysis
 - Determine our competitors (our research indicates that the companies we identified last semester are not our competition)
 - Determine our suppliers, working in conjunction with the tech team
 - Identify potential distributors
 - Perform Porter's 5 forces analysis
 - Perform SWOT analysis on ourselves as well as our competition
 - Business
 - Review our business model
 - Refine our pricing strategy
 - Run financial projections
 - Identify potential risks
 - Revise business plan
 - Consider patent issues

4. Methodology

Color code: Entire Team Technology Team Business Team

Timeframe:	Deliverables/Plans
09/15 – 09/19	<ul style="list-style-type: none"> Interviews (Sam, Melissa, David, Kevin, Jeff, Mike, Chuck) Project plan (Jeff)
09/22 – 09/26	<ul style="list-style-type: none"> Input data source finalization (Kevin, Chuck) Begin software and programming (Jeff, Chuck) Integration of data inputs (Jeff, Chuck) Review of site operator interview. (Sam, Melissa, David) Begin Market research and competitive analysis, and product feasibility analysis. (Leo,Sara)
09/29 -10/03	<ul style="list-style-type: none"> Finalize our Midterm Plan (Tech Team) Semi-final list of final product hardware options (Mike) Enclosure details discussion (Kevin, Mike w/Tech Team) Start first draft of business plan (Business Team) <ul style="list-style-type: none"> Interview Results Market analysis (Leo, Sara) Value Proposition (Tom, Melissa) Business Model (Leo,Sara) Updated FBAC. (Sam, David)
10/06 – 10/10	<ul style="list-style-type: none"> Overlay of subterranean utilities onto 2D overview map (Jeff, Chuck) Enclosure details and specs final draft (Kevin, Mike) Obtain money needed for enclosure materials (Jeff) Final product hardware decision (Mike w/Tech Team) Budget for hard materials needed to build final product (Mike) Complete the first draft of the business plan. Competitive analysis (Leo, Sara, Tom) SWOT Analysis (Leo, Sara, Tom) Porters Five Forces (Leo, Sara, Tom) Mid-term review week
10/13 – 10/17	<ul style="list-style-type: none"> Enclosure materials acquisition (Kevin, Mike) Final product mock-up discussion (Mike, Kevin w/Tech Team) Business Model review and start 2nd draft
10/20 – 10/24	<ul style="list-style-type: none"> Enclosure fabrication (Kevin, Mike) Mock-up final specifications / design (Mike, Kevin) Obtain money needed for mock-up materials (Jeff) Suppliers, factory or aftermarket installation. (David, Sam, Melissa) Preliminary financials. (Sara, Leo) Work out financial scenarios and at the same time start risk analysis. (Sam, Tom, Leo, Sara) Work on Exhibit poster and brochure
10/27 – 10/31	<ul style="list-style-type: none"> Mock-up materials acquisition (Kevin, Mike) Review 1st draft of financials and start 2nd draft. Incorporate risk analysis to match business model(s) and financial scenarios. (Business team)

	<ul style="list-style-type: none"> ● Exhibit poster and brochure due
11/03 – 11/07	<ul style="list-style-type: none"> ● Mock-up fabrication (Kevin, Mike) ● Refine business plan. <ul style="list-style-type: none"> ▪ Final FBAC. (Sam, Tom) ▪ Updated competitive analysis. (Sara, Leo, Tom) ▪ Updated comprehensive business model. (Sara, Leo)
11/10 – 11/14	<ul style="list-style-type: none"> ● Programming and software for prototype finalized (Jeff, Chuck) ● Final prototype testing (Jeff, Chuck) ● Updated financial analysis. ● Updated risk analysis.
11/17 – 11/21	<ul style="list-style-type: none"> ● Discussion of IPRO Day presentation material / capabilities (Tech Team) ● Discussion of abstract / brochure details (Tech Team) ● Photos taken to be used for abstract / brochure; poster ● Incorporate financial analysis into business plan. ● Legal liability issues review (David, Sam, Melissa)
11/24 – 11/28	<ul style="list-style-type: none"> ● IPRO Day Presentation Details Final (Tech Team) ● Abstract / brochure details finalized and submitted (Jeff) ● IPRO Poster for project details finalized and submitted (Jeff) ● Patents and Intellectual property review (Leo, Tom, Sara)
12/01 – 12/05	<ul style="list-style-type: none"> ● Submit final Market analysis, business model, business plan, and financial analysis for upload on IPRO day (12/3) ● Burn Final report on CD due on 12/4 (Sam)

5. Project Budget

Submitted through iGroups, but presented here for reference only.

- Equipment - \$230
 - This will be used to purchase the parts that will be used to prototype our product. We may need to purchase hardware with which to interface our sensors, a screen to display information to the user, and possibly a camera for obtaining a live-feed.
- Travel - \$60
 - This money is to pay for transportation to job sites and equipment yards, where the team will interview the people who might install, use, or maintain our product. This must be done in person as much of the explanations involve demonstrating something on the machine itself.
- Participant Support - \$60
 - These funds are to be used to take contacts who arrange the interviews out to lunch as a thanks for their help. This amount is for two such lunches, which is our predicted number of interviews.
- IPRO day - \$100
 - The IPRO day funds will be used in connection with creating the IPRO day presentation and/or exhibit. In the past, such funds have been used to purchase models for demonstrating our concept and batteries to run the microprocessors.
- Mock-up - \$50
 - These funds will be used for the raw materials that will be used for creating a mock-up of the final product. A facsimile of the product is needed to test for ergonomics, demonstrate ruggedness, and verify dimensions.

6. Team Structure and Assignments

Team Members:

- David Connelly
 - Position: Business Team Leader
 - Year: 4th
 - Finance/Construction Management
- Jeff Mizek
 - Position: Tech team, Team Leader
 - Year: 3rd
 - Major: Electrical Engineering
 - Concentration: Systems and Control
- Chuck Sticha
 - Position: Tech Team Leader
 - Year: 4th
 - Major: Information Technology and Management
 - Concentration: Network Security; Systems Administration
- Sara Sustersic
 - Position: Business team
 - Year: 4th
 - Major: Business Administration
 - Concentration: Finance, Marketing
- Leo Bassett
 - Position: Business team
 - Year: 4th
 - Major: Business Administration
 - Concentration: Finance
- Tom Montgomery
 - Position: Business team
 - Year: 5th
 - Major: Architecture
 - Concentration: N/A
- Melissa Lee
 - Position: Business Team
 - Year: 4th
 - Major: Biochemistry
 - Concentration: N/A
- Kok Ann Gan
 - Position: Business Team
 - Year: 4th
 - Major: Biology
 - Concentration: N/A
- Kevin O'Leary
 - Position: Tech Team
 - Year: 5th
 - Major: Business Applied Science
 - Concentration: Construction Management
- Michael Beemsterboer
 - Position: Tech Team
 - Year: 4th

- Major: Architecture
- Concentration: N/A

Team Member Skills:

- David Connelly
 - Primary Skills
 - Real life experience in the Construction Industry and heavy equipment operation
 - Business Plan writing, budgeting, construction methods and procedures.
 - Contacts in construction industry.
 - Secondary Skills
 - Excel applications
 - Object Oriented Programming
 - Written and communication (presentation) skills
- Jeff Mizek
 - Primary skills
 - Electronics, microcontrollers, robotics, RF
 - C, Java, assembly programming
 - CAD experience
 - Secondary skills
 - Photoshop
- Chuck Sticha:
 - Primary skills
 - Networking, Wireless (802.11x), Bluetooth (802.15), and network administration
 - Hardware knowledge; A+, Network+, and Security+ trained
 - Many years in retail / customer service management and planning
 - Secondary skills
 - Java, PHP, Perl, HTML, XHTML, CSS
 - Web application and development
- Sara Sustersic
 - Primary skills
 - Business plan writing and editing
 - Market research
 - Financial modeling and budgets
 - Secondary skills
- Leo Bassett
 - Primary skills
 - Business plan Writing and Editing
 - Financial projections and Project Budgeting
 - Contacts in Steel Industry
 - Secondary skills
 - Sales Experience
 - Presentation Skills
- Tom Montgomery
 - Primary skills
 - Photoshop/Illustrator
 - CAD
 - Secondary skills
 - Web Design

- Melissa Lee
 - Primary Skills
 - Writing, editing, speaking, research
 - Team leading
 - Task management
 - Biological subjects
 - Secondary Skills
 - General communication skills
 - Cold-calling
- Kok Ann Gan
 - Primary Skills
 - Project plan writing
 - Business plan writing
 - Secondary Skills
 - Excel
- Kevin O’Leary
 - Primary skills
 - ESRI / Archview
 - Equipment experience
 - Secondary skills
 - Construction
 - Knowledge of industry contacts
- Michael:
 - Primary skills
 - CAD
 - Photoshop
 - Secondary skills
 - 3ds Max