



Effective Technical Communication: Posters

Edwin Olson
University of Michigan



Poster Basics

1. Bait 'em

- ▶ A poster should draw the eye-- attract your prey from across the room.
- ▶ Something visually stunning, and perhaps a bit unexpected/confounding.
 - Almost always a large image



2. Hook 'em

- ▶ Your prey has approached your poster, but they're not yours yet!
- ▶ What's the juicy morsel that is exciting?
 - Your title / figure caption that convinces them you've done something neat, even if only at a simplified level.

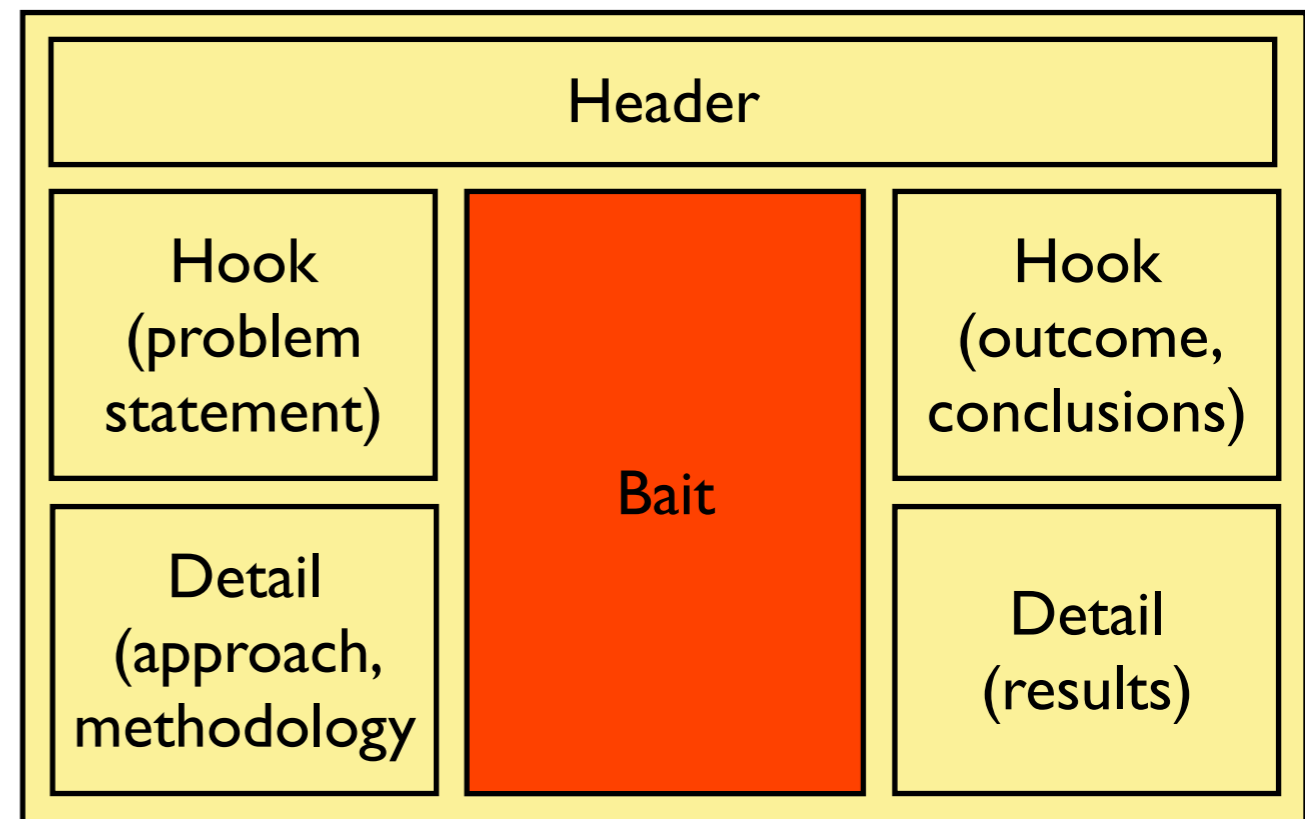
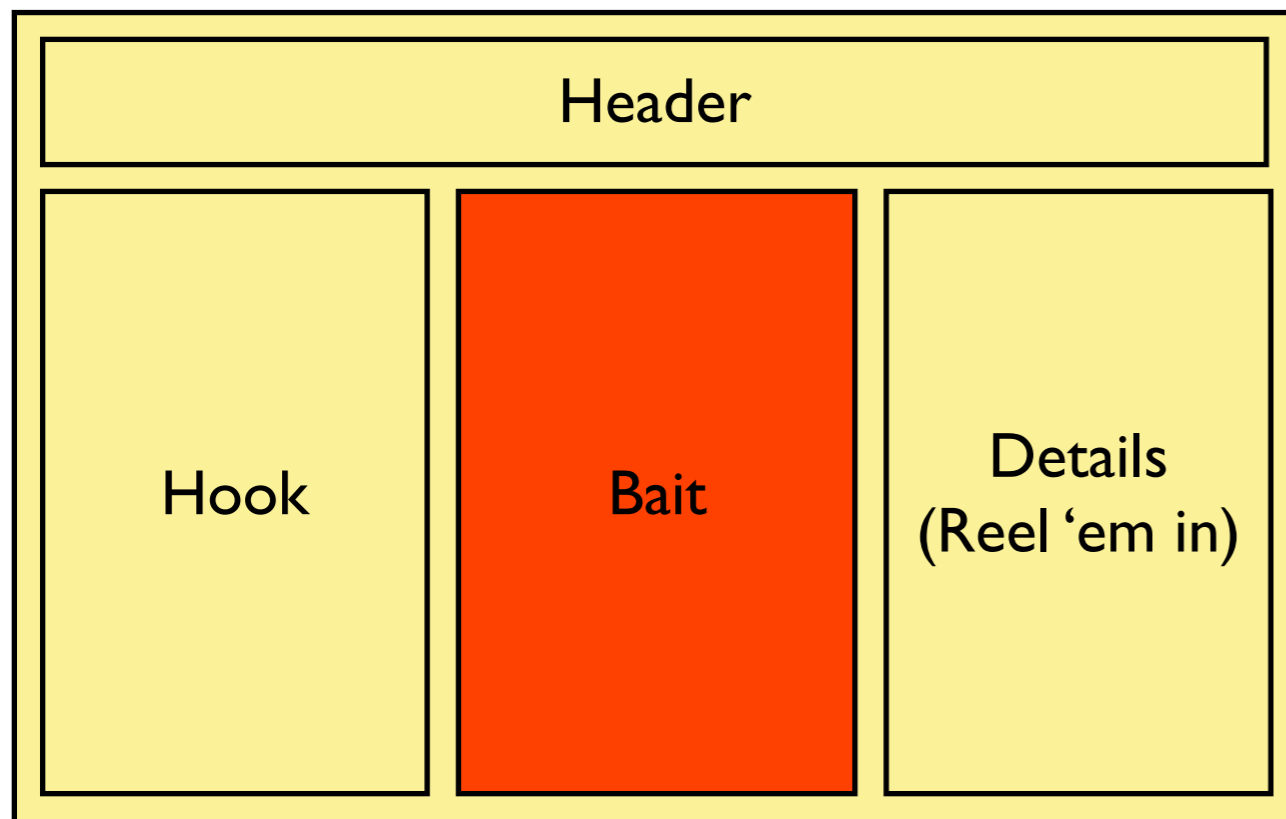
3. Reel 'em in

- ▶ Now they're reading your poster.

4. Release 'em

- ▶ Poster judges have other posters to see. Practice your 30 second and 2 minute pitch. Respond to questions.
- ▶ Leave on a high point. Thank them for their interest.

Parts of a poster (e.g.)



Header

- Title
 - ▶ Pithy but descriptive
 - ▶ Interesting
- Author List
 - ▶ Which order? There's a protocol to learn for your discipline! Could be:
 - Alphabetical
 - In (decreasing) order of contribution.
 - Advisor's name last, or sometimes omitted. Ask!
- Affiliation Logos
 - ▶ Get the *right* logos. Make sure they're high quality: no jagged edges!
 - ▶ Get the transparency right!
 - ▶ Avoid NASCAR syndrome.



Bait 'em

- Goal: lure them in
- Your budget:
 - ▶ A quick glance from across a room. About a second.
- A big provocative picture
 - ▶ “That looks neat! Even if I don’t understand what it is!”
- A series of pictures that tells a story
 - ▶ Great for algorithms that can be described as a sequence of steps.



Obstacle Avoidance and Mapping in Robotics
Megan Leininger

Objective

- Mapping
 - Map a local area around the robot.
- Obstacle Avoidance
 - Safely navigate the robot indoors and outdoors.

Method

- Mapping
 - LIDAR Data and Trigonometry
 - Creates a local occupancy grid.
- Obstacle Avoidance
 - Wavefront Algorithm
 - Wave propagates from destination into a cost map.
 - Gradient Descent
 - Each obstacle contributes a cost vector.

Finding Objects

Image of the Area → LIDAR Scan Returns

Height Map of Area → Occupancy Grid

Avoiding Objects

Wavefront Algorithm → Gradient Descent Algorithm

Results

- Mapping
 - Basic map constructed
 - Map from tilted LIDAR data constructed.
- Obstacle Avoidance
 - Wavefront Algorithm
 - Performed well overall
 - computationally expensive
 - Gradient Descent
 - Performance issues indoors
 - Faster algorithm

Conclusion

- Mapping
 - Works well provided good position data.
- Obstacle Avoidance
 - Functions indoors and outdoors with minimal performance bottlenecks.

Thank you to Ryan Mottish and Pradyep Rangasahas, for all of the support and guidance throughout the semester.

Hook 'em

- Goal:
 - ▶ Tease them with an interesting conclusion, idea, result
- Your budget: about two sentences.
- Tools
 - ▶ Title plus a bullet or two
 - ▶ Can use your abstract
 - ▶ A more involved figure

Graph-based Segmentation for Colored 3D Laser Point Clouds

Johannes Strom Andrew Richardson Edwin Olson
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<http://april.eecs.umich.edu>

Abstract
We present an efficient graph-theoretic algorithm for segmenting a colored laser point cloud derived from a 3D laser scanner and camera. Segmentation of raw sensor data is a crucial first step for many high level tasks such as object recognition, obstacle avoidance and terrain classification.

Method Overview

- Co-reference actuated lidar and camera
- Build point mesh, compute surface normals
- Grow segments from colored mesh
- Segments join on acceptable surface normal and color differences

Performance Evaluation

Camera image from the "table" dataset with objects that are candidates for good segments. Best result for 3D segments extracted using difficult-to-use image only method.

Segmentation using only a color difference criterion. Failure to segment floor and trash bin correctly. Segmentation with only a surface normal criterion. Floor wall confusing segments.

Clear segmented mesh using proposed method. Input suitable for higher level classification method. Novel view synthesis: raw data allows colored scenes to be viewed from alternate angles.

Masked out image from the "hill" dataset, making it hard to segment using color only. Segmentation result using proposed method. Shows our method works both indoors and outdoors.

Best Result

Segmentation using the proposed method fails at segments correctly. Segmentation using the proposed method showing the average color of each segment.

Contributions

- Method for combining color information with actuated laser data to produce colored 3D cloud
- Extension of graph-theoretic segmentation to propose segment unions based on spatial geometry
- Dynamic segment union criterion based on color and surface normals that produce quality segmentation
- An efficient $O(N \log(N))$ segmentation process
- Effective segmentation for indoor and outdoor scenes

Reel 'em In

- Goal:
 - ▶ Sell them on it.
- Your budget: about 2-4 minutes.
- Tools
 - ▶ It's the poster *and* you. (But poster should suffice if you're grabbing a coffee.)
 - ▶ Greet them.
 - “Any Questions?” NO!
Walk them through your idea and results. 30 second pitch.
 - ▶ Explain your data.

april robotics laboratory

Online Probabilistic Pursuit of Adversarial Evaders

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APRIL Laboratory Computer Science and Engineering University of Michigan
<http://april.eecs.umich.edu/> {jstrom, rmorton, kegreil, ebolson}@umich.edu

Abstract
We describe a new probabilistic method that solves the adversarial pursuit-evasion problem without the need for costly adversarial searches (e.g., minimax). In particular, we show how a random-walk model of evaders can be transformed into a model that reflects the behavior of an adversarial agent. Our approach allows pursuers to characterize their opponents' turning, allowing faster capture times in the case of sub-optimal evaders. We demonstrate our algorithm's performance on a number of benchmark problems, and verify our implementation on a robot.

Method Overview

- Probabilistic belief over evaders' locations
- Update belief using random motion model
- Model capture likelihood using our model
- Branch & bound search for max captures

Adversarial Model

- Parameterize adversary's skill with single S parameter

$$P(\text{capture}) = (P_{cr})^S$$

- **Assumption:** higher S means more computational power, more likely to escape (if possible)
 - $S = 1$: random adversary
 - $S = \text{infinity}$: optimal adversary

Best Response: Adversarial
For adversarial evaders, pursuers (yellow) maximize expected capture by learning up.

Best Response: Random
For random evaders, pursuers (yellow) maximize expected capture by splitting up.

Capture Times

Correctly estimating the adversarial parameter leads to faster capture times.

Capture times improve as more pursuers are added to the team.

Contributions

- Efficient capture of adversarial evaders
- Novel, general purpose adversarial model
- Future work: dynamic skill estimation

Estimating Evader Skill

A capture time minimum at S indicates the true S for a minimal evader searching to a depth of L .

Experimental Setups

- 1 of 3 Simulation Maps
- Robot with Human Evader
- Outdoor Test Site

Computational Cost

It achieves greater depth than minimax given the same CPU time.

Abstract

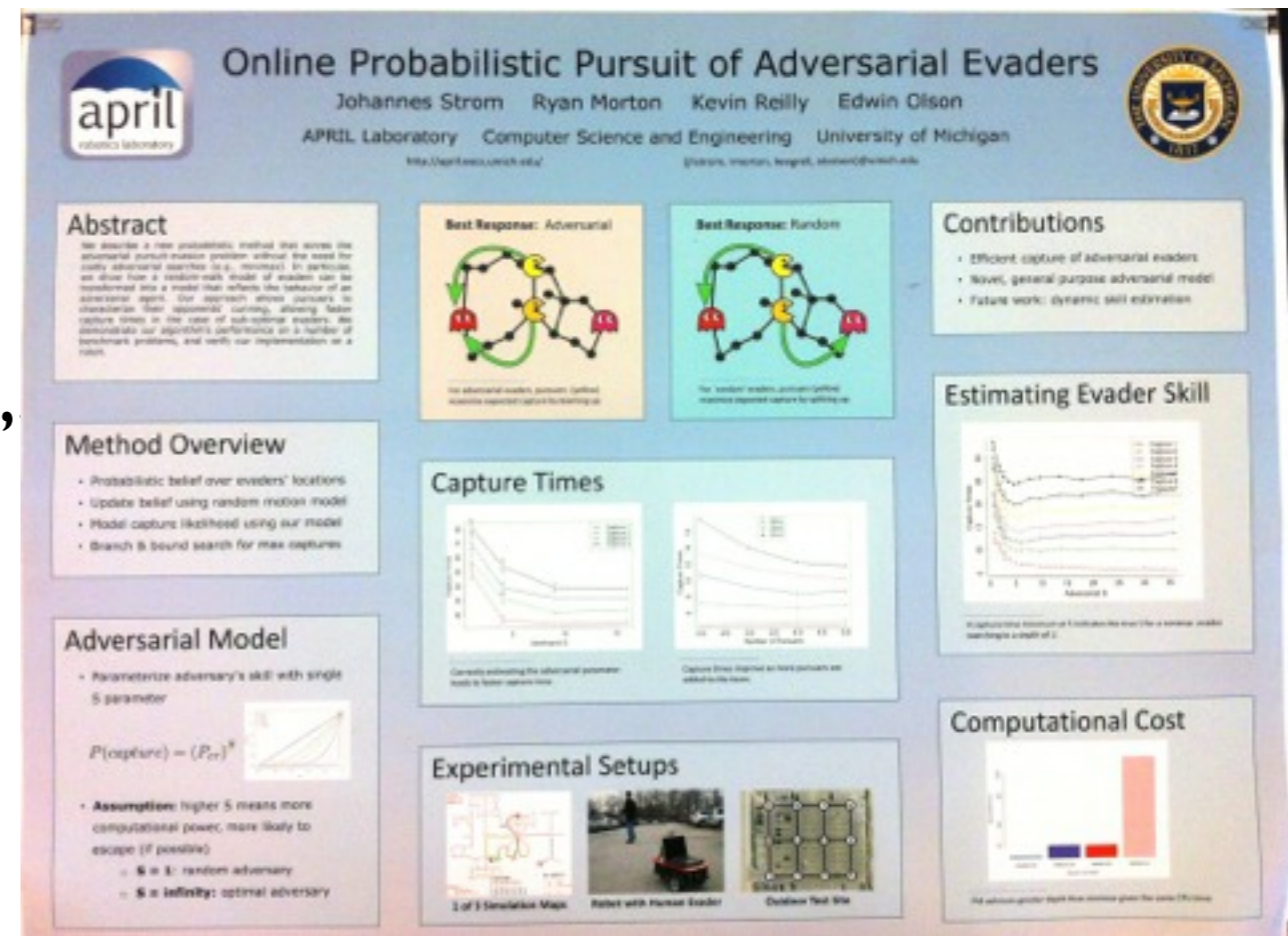
- Almost always answers four questions:
 - ▶ What's the problem?
 - *What is this poster about?*
 - ▶ Why is it interesting?
 - *If it's not interesting, then who cares?*
 - ▶ Why is it hard?
 - *If the problem is easy to solve, then who cares?*
 - ▶ What did we do about it?
 - *Should generally describe a **claim** that is evaluated by the work.*
- A large block of text is impenetrable.
 - ▶ A bullet-form abstract is okay on a poster.

Bullets

- Bullets must exhibit parallel structure
 - ▶ A complete sentence is formed by the bullet header and *each* bullet item.
- Examples:
 - ▶ The goals of this project are:
 - Develop algorithms to detect colored balls
 - Understanding principles of computer vision
 - We implemented our own Union-Find algorithm
 - ▶ The goals of this project are to:
 - Develop algorithms to detect colored balls
 - Understand principles of computer vision
 - Explore methods for accelerating the Union Find algorithm

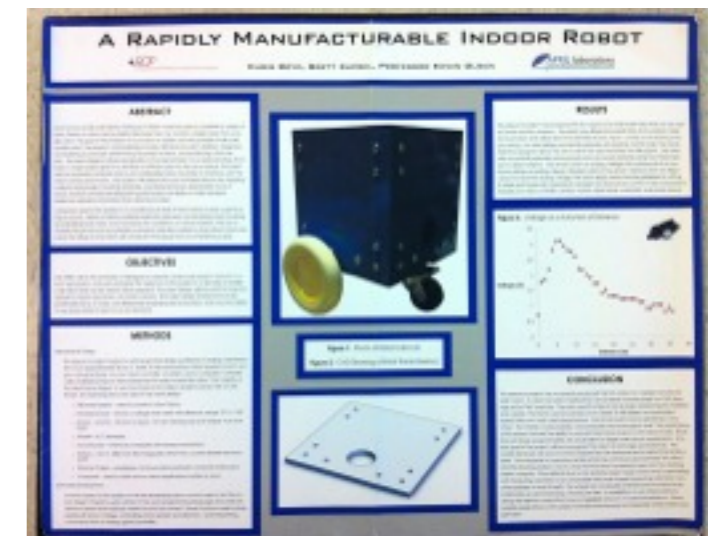
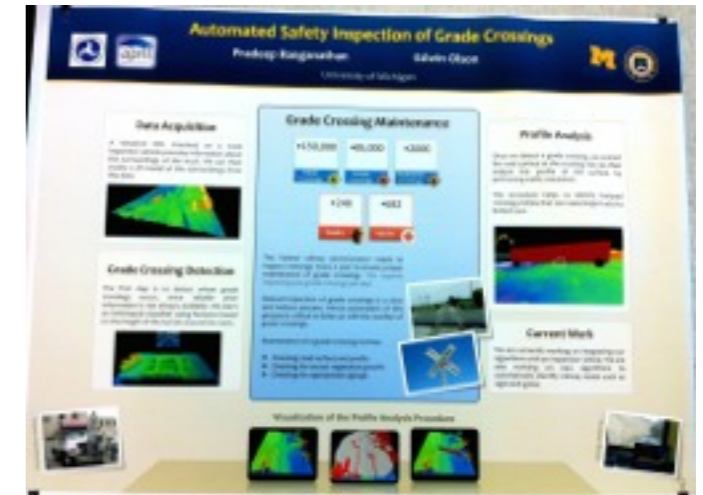
Results/Evaluation

- The “meat” shot
 - ▶ A photo/cartoon/block diagram
 - ▶ Immediately and intuitively conveys that “the method works”
- The “squiggly line” plot
 - ▶ Generally used to compare proposed method versus an alternative method
 - ▶ Gives a feeling of rigor, and a scholarly understanding of related work.



Graphic Design Basics

- **White space:** the empty (“negative”) space is just as important as the filled space. More white space emphasizes what remains. More white space is generally “classier” and “more elegant”.
- **Shading and blocks:** Background blocks provide a sense of organization and lead the eye. But go too far and the blocks are distracting!
- **Eye flow:** Be able to predict how an eye will trace over the poster.
 - ▶ Is your intended flow a natural flow?
 - ▶ Z-shapes

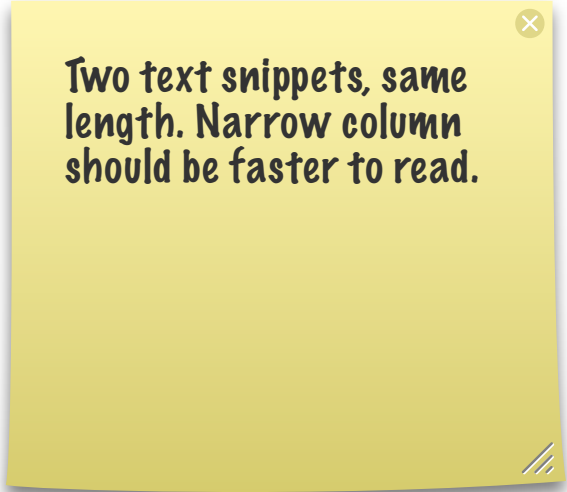


Graphic Design

- **A cohesive design:** Avoid the “10 sheets of paper tacked to posterboard” look.
- **Use a light color:** Easier to get a better print quality.
- **Make reading easy:** Minimize text and maximize reading speed.



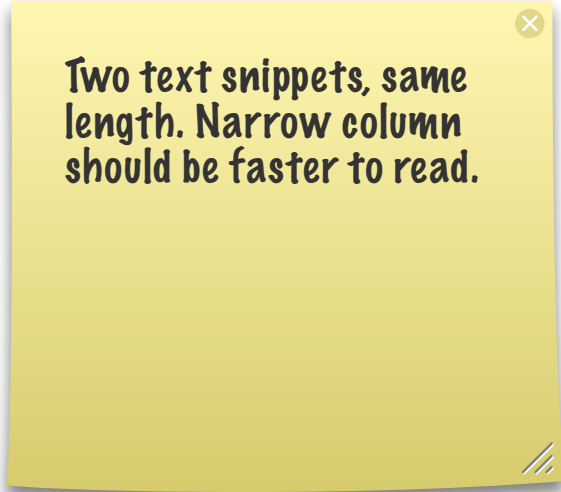
An experiment (I)



Two text snippets, same length. Narrow column should be faster to read.

An experiment (I)

John Adams (October 30, 1735 (O.S. October 19, 1735) – July 4, 1826) was an American Founding Father, lawyer, statesman, diplomat and political theorist. A leading champion of independence in 1776, he was the second President of the United States (1797–1801). Hailing from New England, Adams, a prominent lawyer and public figure in Boston, was highly educated and represented Enlightenment values promoting republicanism. A Federalist, he was highly influential and one of the key Founding Fathers of the United States. He came to prominence in the early stages of the American Revolution.




Two text snippets, same length. Narrow column should be faster to read.

An experiment (2)

An experiment (2)


James Madison, Jr. (March 16, 1751 (O.S. March 5) – June 28, 1836) was an American statesman and political theorist. He is hailed as the “Father of the Constitution” for being instrumental in the drafting of the United States Constitution and as the key champion and author of the United States Bill of Rights. He was the fourth President of the United States (1809–1817). He served as a politician much of his adult life. Like other Virginia statesmen, he was of the landed gentry; he inherited his plantation known as Montpelier, and owned hundreds of slaves during his lifetime to cultivate tobacco and other crops.

Near Misses




Undergraduate Research Opportunity Program

AUTONOMOUS ROBOT RECHARGING



James Naughton
jnaught@umich.edu



APRIL laboratory
Autonomy · Perception · Robotics · Intelligence · Learning

Director: Prof. Edwin Olson

Michigan Engineering

Abstract

One major problem in autonomous robotics is battery life. The battery limits the amount of time the robot can be actually autonomous; once the battery is low humans need to interact to recharge the robot. My research explores and implements creative ways to make the recharging process human-free. My task is to design, build, and test a recharging station the robot can dock with and be charged from. I must also program the robot to recognize it is low on batteries, go to and dock with the station. Through an extensive brainstorming process I have found that a cradle design resulting in a pressure contact of the charging terminals on the robot and the station is the best. I have also found that the use of a protruding pipe from the station can help the robot identify the station. I designed the parts to be created by a CNC router so that they may be easily duplicated for manufacturing. This research will lead to a more efficient lab by making recharging the robots one less task to worry about. This will also allow for the constant movement of robots, a goal of the head of the lab.

Objectives

- Design, build, and test a robot recharging station
- Program the robot to identify the station without the aid of humans
- Program the robot to drive to and align with the station
- Create a docking system that produces a quality connection between battery terminals and charging source
- Keep the design efficient and cost effective
- To always have robotic movement in the lab through autonomous recharging
- To develop a system for manufacturing recharging stations and connectors efficiently and easily.
- To create a connection system that can easily be mounted onto the current robot without major adjustments.
- To ensure there is no possible way a cross terminal connection can be made to protect the battery and those around the robot

Methods

First use AutoCAD to create design ideas and to model how the robot will interact with the recharging station. Then construct a prototype of the recharging station to gather interaction data between the robot and the station. Use this data to update the prototype. Then gather laser data on the identifying tower and use this data to write a program that fits real time data to the tower thus identifying the station. After completing the program to identify the station use that program to write a program making the robot drive to the station. Once the robot is fully charged send a signal to the robot telling it to undock from the station. Once the robot undocks make sure the robot goes back to the task it was performing before the charging sequence.

For the prototype use scrap wood to easily build a station. After making changes and improvements to the prototype create another by hand. Use copper sheet metal for the connectors to ensure good conductivity and a sturdy but flexible metal for the connecting adapter on the robot. Connect the robot battery terminals to the copper conductors on the robot by wires. Connect the base conductors to a power supply via wire.




Figure 1: This is the robot used in the charging process, the connectors will be attached to the underbelly of the machine. The robot will drive forward over the charging station straddling it to dock then reverse out to undock.

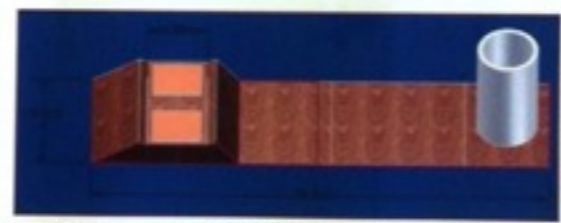


Figure 2: This is the main design. It is 38 inches by 10 inches with a 5 inch connector platform. The identification tower is located on the right side and protrudes upward out of the station to reach the level of the laser.




Figure 3: This is a rendering of the lower portion of the robot connecting with the docking station. The connectors on the robot are located squarely on top of the station's connectors. There is enough pressure that a good connection is made. The robot's wheels are straddling the station allowing the robot to have all three wheels in contact with the ground at all times.

Results

Through multiple designs and trials a final prototype has been developed. This design consist of a ten inch wide by 38 inch long docking station, as seen in Figure 2. The connectors are mounted on a two and a half inch raised platform that is five inches wide. This platform sits a quarter inch below a lip to allow the robot contacts to settle down into the proper location. At the opposite end of the station is the identifying tower. This tower protrudes up out of the station and is visible by the laser range finder on the robot.

The entire time the robot is running an application will be executing on the robot. This application will continuously be searching for recharging stations. Once the battery is in need of recharging a signal will be sent to the robot telling it to find the docking station. With this signal flagged the robot will now use the data from the searching application to recognize the station. Once the station is recognized the robot will run code that drives the robot to the station. The robot will use the normal vector from the wall behind the station to align itself properly; see Figure 4. Once aligned the robot will proceed to drive forward and dock with the station. Once the charging is complete the robot will be flagged and it will undock with the station and continue the task it was executing prior to the charging sequence.

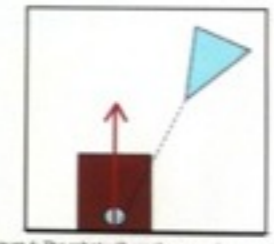


Figure 4: The robot will use the normal vector to the wall to align its self with the docking station. Once the robot is aligned the docking can proceed and the connection can be made.


Conclusion

It is safe to conclude that this charging process will increase efficiency in the laboratory because a robot will always be charged and ready to go whenever it is needed for research or other projects. The pressure connection design is also one that has been proven to work based on tests performed using the robot and prototype recharging station.

The next step in the process will be to thoroughly test the alignment algorithm using a multitude of real time tests. Using data gathered by these tests will allow for restructuring of the algorithm to ensure correctness. After the alignment code is correct the next challenge will be to design an efficient way to produce multiple stations and connectors to be used on multiple robots.


Consideration must also be given to how to prevent a cross terminal connection. Possible ideas include a separating wedge to direct the robot connectors toward the correct connection plate. Another possible idea is using a large diode so current can only flow into the battery and not out of it.

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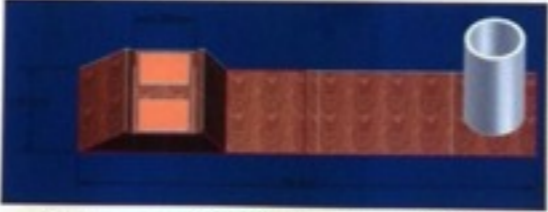


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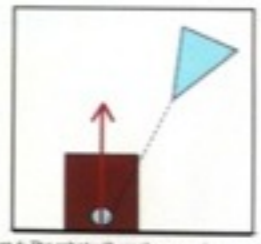


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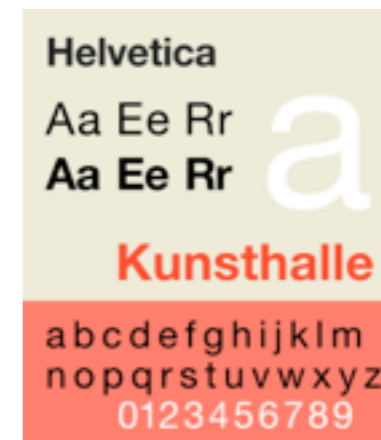
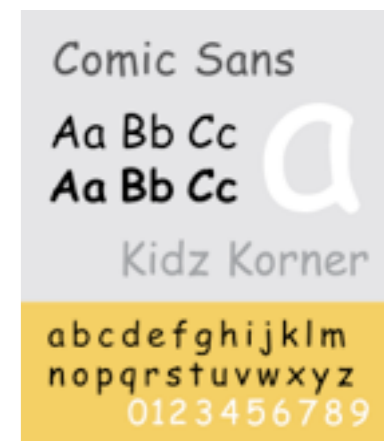
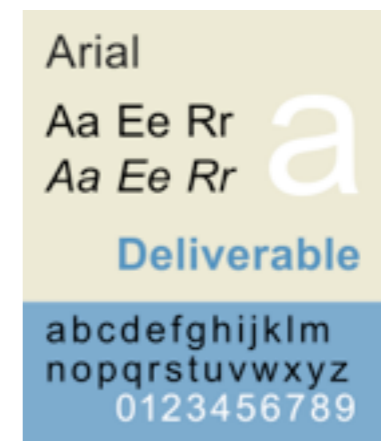


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Fonts

- Use a tasteful, simple font.
 - ▶ Your poster's font shouldn't be making a statement.
- Maximize readability
 - ▶ Serifs, Mixed Case are good
- Avoid “controversial” fonts: Arial, Comic Sans.
- Minimize font variation
 - ▶ Count how many combinations of different styles / sizes you use... aim for three or less.
- Nobody gets fired for using Helvetica.

AaBbCc sans-serif
AaBbCc serif



Equation Type Setting

- Those who know recognize LaTeX-typeset math
 - ▶ An easy way to look more sophisticated
 - ▶ Note: equations on posters should be used sparingly.

$$G(f) = \int_{-\infty}^{\infty} g(t) \exp(-j2\pi ft) dt$$
$$G(f) = \frac{-e^{j\pi f} + e^{j\pi f}}{j2\pi f}$$
$$G(f) = \frac{\sin(\pi f)}{\pi f}$$

Microsoft Equation
Editor

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$$G(f) = \frac{\sin(\pi f)}{\pi f}$$

LaTeX

Production

- Double check the size and aspect ratio requirements.
- Paper
 - ▶ Avoid glossy stock. Glare can be horrific; poster is ruined by a single kink/wrinkle.
 - ▶ Use heavy-weight acid-free paper.
- Full-bleed
 - ▶ Before using a full-bleed design, make sure you can print it!
 - ▶ Or add a margin and TRIM it.

Critique (1/3)

Intelligent Mesh Networking for Multiple Robotic Agents

APRIL Laboratory | JROP | University of Michigan

Presentation by Joshua Alberts

Abstract

Objectives

Methods

Results

Conclusions

AUTONOMOUS ROBOT RECHARGING

James Naughton | APRIL laboratory | Director Prof. Edwin Olson | Michigan Engineering

Abstract

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Online Probabilistic Pursuit of Adversarial Evaders

Johannes Strom | Ryan Morton | Kevin Reilly | Edwin Olson

APRIL Laboratory | Computer Science and Engineering | University of Michigan

Abstract

Method Overview

Adversarial Model

Experimental Setups

Contributions

Estimating Evader Skill

Computational Cost

VISION BASED TRACKING OF AUTONOMOUS ROBOTS

Akash Prasad | Faculty sponsor: Prof. Edwin Olson

APRIL laboratory | JROP | University of Michigan

ABSTRACT

OBJECTIVES

PROPOSED METHODS

RESULTS

CONCLUSION

Automated Safety Inspection of Grade Crossings

Pradeep Ranganathan | Edwin Olson

APRIL Laboratory | University of Michigan

Data Acquisition

Grade Crossing Maintenance

Grade Crossing Detection

Profile Analysis

Current Work

Visualization of the Profile Analysis Procedure

AUTONOMOUS ROBOT RECHARGING

James Naughton | APRIL laboratory | Director Prof. Edwin Olson | Michigan Engineering

Problem

Task

Importance

Challenge

Design

Design 1

Design 2

Design 3

Design 4

Critique (3/3)



Creation Tools

- Presentation tools work pretty well
 - ▶ PowerPoint/Keynote
 - Especially with “snap-to” enabled
 - Use temporary design guides or rectangles to get alignment right.
- Page layout tools can work even better
- Iterate, iterate, iterate.