Samuel J Bobb

Engineering Portfolio

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PHOTO / SAM BOBB

An *inukshuk*, 14 inches tall It took my brother a day of testing and revision to build this *inukshuk* on a camping trip in Canada, but it was still standing four months later when I returned and took this photo. Stone landmarks like this were originally used for navigation by the Inuit people of the North American Arctic region and traditionally have a human form.

The Process

The Toolkit As I read, listen, and explore, I strive to acquire more problem solving tools. These tools include technologies, algorithms, contacts with knowledgeable people, specialized software, and hardware. The more tools I have, the more ways I can attack a problem.

Testing and Revision In problem solving, I use that toolkit to quickly develop a list of possible solutions. Rapid cycles of testing and revision allow me to arrive at a smart, effective solution with efficiency.

Problem Solving Tools

Electrical Engineering

- Digital and analog circuit design and development
- Control systems and industrial automation
- Embedded systems, microprocessor programming
- Sensing and motor control

Project Management

- Logistics management
- Systems engineering
- Technical team coordination

Art and Graphics

- Adobe Photoshop, InDesign, After Effects, Premiere
- Web and print design
- Video production

Information Technology

- Linux server administration (Debian, Ubuntu, CentOS)
- Network architecture, switching, firewalls
- Linux, Apache, MySQL, PHP (LAMP) server deployment
- Video processing and delivery
- Virtualization and cloud computing

Web Development

- HTML, CSS, PHP, jQuery
- Adobe Dreamweaver
- Open-source content management systems including Drupal

General Dynamics Electric Boat – Groton, Connecticut

PHOTO / GENERAL DYNAMICS ELECTRIC BOAT / RELEASED FOR PUBLIC USE BY THE U.S. NAVY

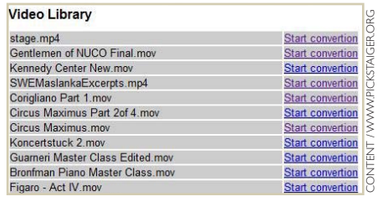
Virginia-Class Attack Submarine The *USS Missouri* (SSN 780) is among those designed and built at Electric Boat for the United States Navy.

Web Application Development

Pick-Staiger Concert Hall – www.pickstaiger.org

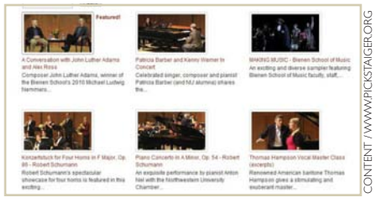
Problem Pick-Staiger's online video library of music performances outgrew a single-page list. Posting new videos was a complicated process for staff, resulting in errors.

Result I built a web video application that automates staff tasks, improves video delivery, and adds visitor features.



CONTENT / WWW.PICKSTAIGER.ORG

Staff can convert, tag, and post videos with just a few clicks from any web-connected computer.


CONTENT / WWW.PICKSTAIGER.ORG

I conducted testing to identify layout and features of the video library and video pages.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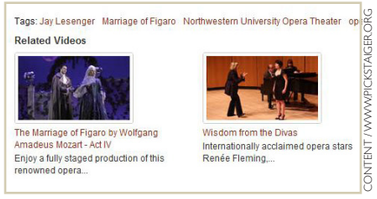
With bit rate switching, the player measures a visitor's bandwidth and chooses the best quality that allows smooth playback.



CONTENT / WWW.PICKSTAIGER.ORG

Related Videos shown under the video player encourage visitors to explore the library. Related Videos are generated from tag similarity.

New Features

- Video library offers search, related items, and RSS feed
- Open-source video delivery avoids expensive proprietary software licenses
- Tags and Related Videos helps visitors discover new content
- Visitors can share videos by using social media integration

Site Statistics

- 67 videos and growing
- 250 public content pages
- 4,700 unique visitors per month

Technologies

- Content management: Drupal 6 on Apache, PHP, MySQL, Debian 5
- Video delivery: lighttpd h264 module and JW Player
- Video encoding: FFmpeg, Python web interface

CONTENT / WWW.PICKSTAIGER.ORG

Event Management and Navigation Rebuilding the site provided an opportunity to improve existing features and add new ones. I created a flexible event management system to meet the evolving needs of Pick-Staiger staff and implemented horizontal menus to simplify navigation.

Pick-Staiger Concert Hall at the Bienen School of Music, Northwestern University, Evanston, Illinois

Design Competition

Problem Design an autonomous robot to compete head-to-head with opponent robots. Robots collect and shoot balls to make goals.

Result We won first place in the competition out of 24 Northwestern student teams.

PHOTO / DAN BOBB

To avoid errors during the excitement of competition, we created a setup jig and documented startup procedures.

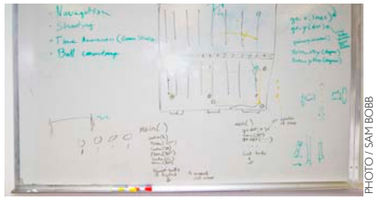


PHOTO / SAM BOBB

We conducted strategy planning sessions for game play logic and appropriate robot behavior.

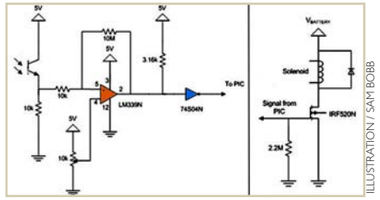


ILLUSTRATION / SAM BOBB

Modular circuit design allowed for easy troubleshooting, testing, and revision.

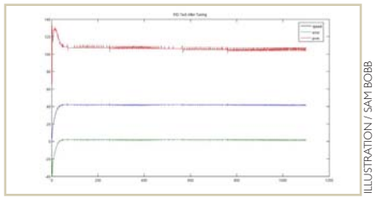


ILLUSTRATION / SAM BOBB

We ran tests and collected data to determine optimal PWM frequency and to tune the PID controller for the motors.

My Contributions

- Circuit design
- Microprocessor programming
- Performance testing
- Logic design
- Control system design
- Mechanical construction and circuit assembly

Project Details

- PIC 18F4520 processor
- 5 line sensors, 2 ball sensors, 2 motor encoders, 1 laser targeting system, 2 impact switches
- Differential steering
- PID controller with pulse width modulation for motor speed control
- Solenoid driven ball shooter
- 1100 lines of C code

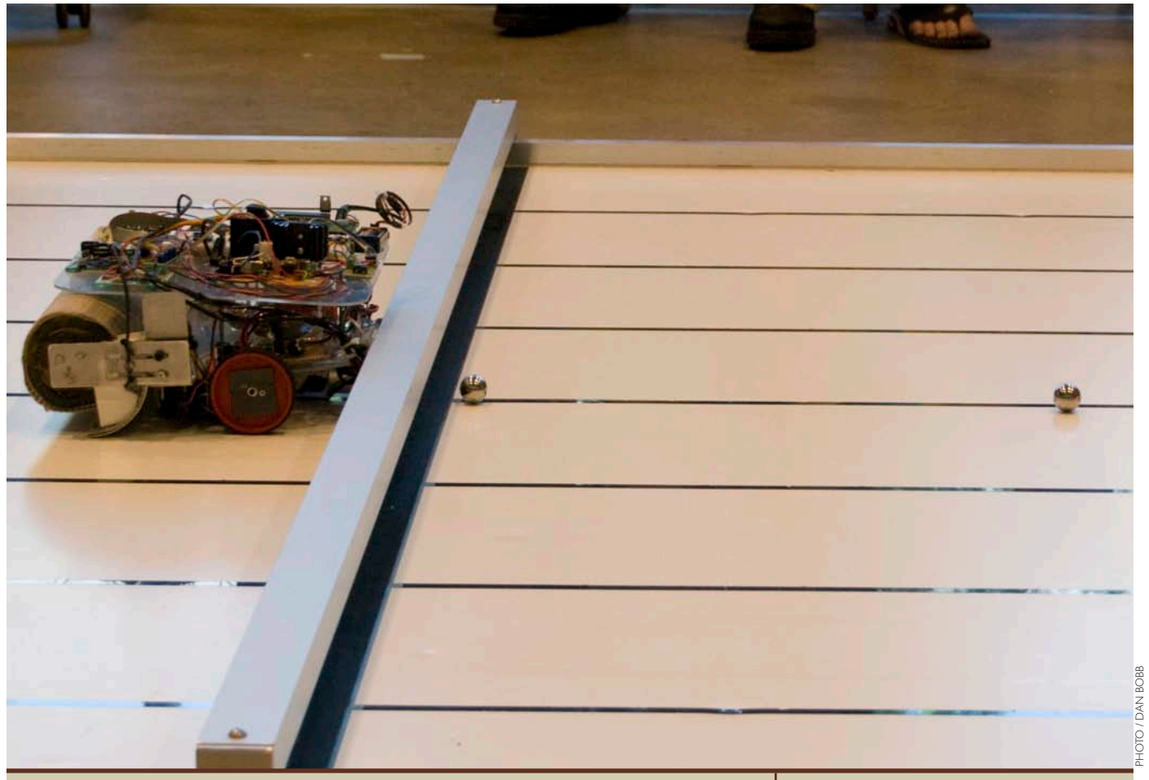


PHOTO / DAN BOBB

Robot During Competition After finding the goal by measuring laser reflections and checking for an opponent blocking the goal, our robot shoots a ball, keeps track of game play time, and makes decisions on shooting based on the remaining time.

Project Planning We developed our robot over 20 weeks with a $200 budget.

Teammate Ren Chung Yu

Dance Marathon Relocation

Northwestern University Dance Marathon 2009

Problem Participation in Dance Marathon grew by 50% in two years. A new venue was needed to accommodate this rapid growth.

Result Dance Marathon 2009 was held in a large tent on the east side of the student center and raised $900,000 for charity.

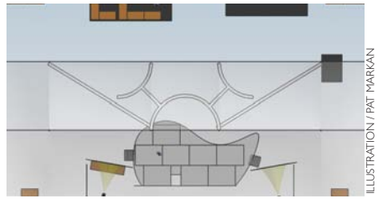


ILLUSTRATION / PAT MARKAN

After analyzing problems from past years, I encouraged our designers to create a stage that maximized opportunity for the crowd to get close to performers.

PHOTO / PAT MARKAN

By selecting a new location, we were able to use a larger tent to meet safety code constraints.

PHOTO / PAT MARKAN

To remedy lighting and moisture problems, I researched and ordered a tent liner to block condensation and diffuse light.

PHOTO / PAT MARKAN

I analyzed possible solutions from our vendors and university officials to provide power, networking, and accessibility to the tent.

My Contributions

- Space planning for crowd management
- Integration of university organizations and design teams
- Troubleshooting during the event

Dance Marathon Details

- Northwestern University Dance Marathon is the largest student-run philanthropy in the country
- Over 700 student dancers raise $400 each to earn the honor of dancing for 30 hours straight

2009 Venue Details

- 7200-square-foot tent
- 20x40 foot stage
- Raised platforms provided space for lighting, sound, DJ, and visitors

PHOTO / PAT MARKAN

Stage Configuration The curved stage provided a wide area for hundreds of dancers to gather. By maintaining the production budget under $45,000 I was able to keep the organizational overhead under 2%.

Collaborators Eri Okuma, Pat Markan, Alec Thorne, Phil Reich, Liz Banks, Northwestern University Staff

Internship: Vehicle Impact Lab

Transportation Research Center, Inc. – East Liberty, Ohio

About TRC An automotive proving ground that conducts durability, emissions, crash, and other tests for cars, trucks, and motorcycles.

Internship Experience For two summers, I assisted in crash testing at the TRC Impact Lab.

PHOTO / NHTSA/DOT

I worked with a team of crash engineers and technicians to perform standardized offset frontal, side pole, and rear impact tests for automotive manufacturers and government organizations.

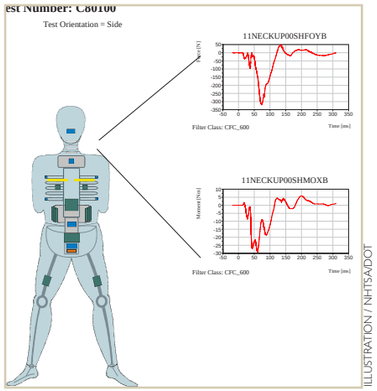


ILLUSTRATION / NHTSA/DOT

After each crash test, I reviewed data to identify anomalies such as dislodged accelerometers, reversed polarity channels, and cut cables.

My Responsibilities

- Installing instrumentation on vehicles
- Seating anthropomorphic dummies
- Checking data

Crash Testing at TRC

- Major automotive manufacturers perform certification tests to license new vehicles
- Manufacturers crash prototype vehicles to test materials, construction, and airbag thresholds
- The National Highway Traffic Safety Administration develops new test procedures by crashing many production vehicles and analyzing the results

PHOTO / NHTSA/DOT

Side Impact Dummy Before Crash Accurate and repeatable instrumentation setup, vehicle placement, and dummy seating is critical for crash testing. Strict standards and extensive documentation ensure the integrity of each test.

Time period June to September 2006 and June to September 2007

PHOTO / SAM BOBB

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This portfolio was designed and created by Sam Bobb with assistance from Professor Stacy Benjamin, Professor Penny Hersch, Dan and Becky Bobb.

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