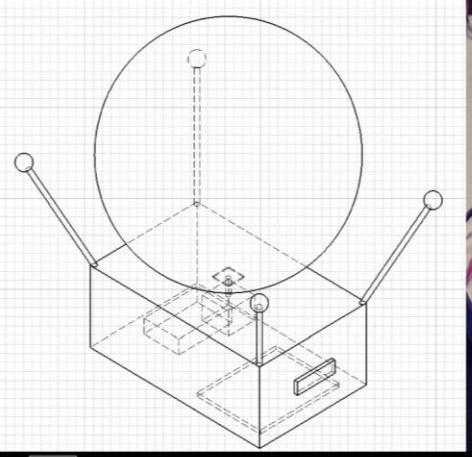
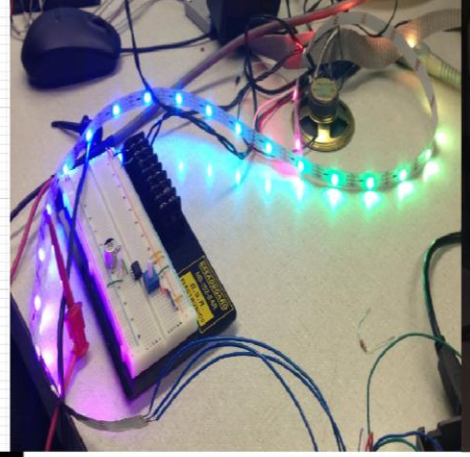

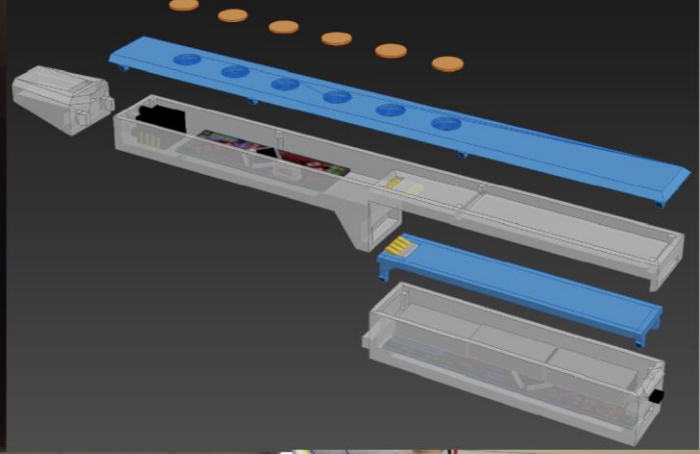
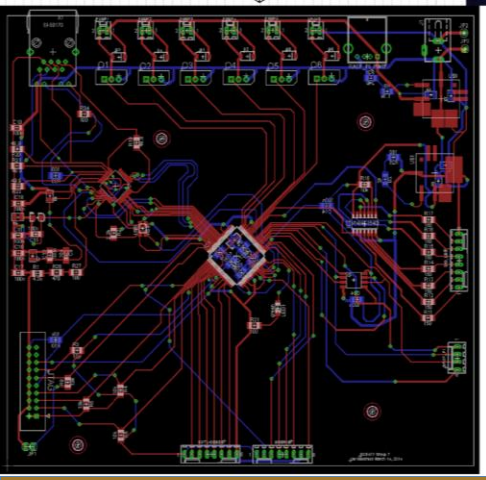


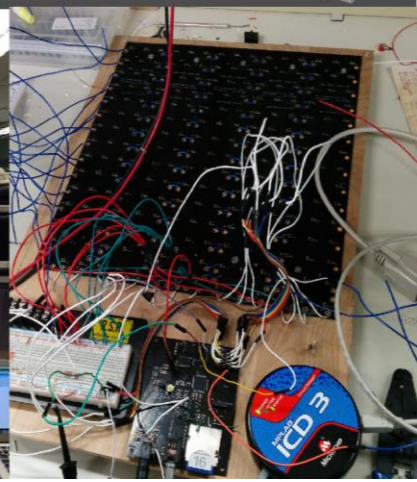

INTRODUCTION TO ECE477

PURDUE UNIVERSITY

OUTLINE

- Course Overview
- Communications
- Staff and TAs
- Schedule and Calendar
- Policies
- Grade Determination
- Sample ECE477 Projects
- Project Specific Success Criteria
- Action Items to Get Started
- Mandatory Lab Hours

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COURSE OVERVIEW

- Purpose and Objectives:
  - To provide students with a practical, hands-on design project to apply their electrical engineering knowledge
  - To simulate conditions students are expected to experience in industry and/or research settings
- Teams:
  - Teams of 4 (team members chosen prior to semester)
- Projects:
  - Chosen by student teams (must be of interest to 2+ members)
  - Embedded design projects (utilize MCU, FPGA, or CPLD)
  - Project success evaluated through use of project-specific success criteria (PSSCs)

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COURSE OVERVIEW

- Laboratory Space:
  - EE063
  - 24/7 access available via electronic door lock
  - TA office hours held here
- Laboratory Equipment:
  - Permanent equipment (To remain in ECE477 lab areas)
  - Student laboratory equipment (hand tools, development boards, etc) available for check-out and use
- Mandatory Laboratory Times:
  - Held on Wednesdays
  - Students are required to show up in lab at the start of their TCSP session
  - Used to assess progress, provide feedback, and improve student/staff communication
  - Attendance will be taken and is MANDATORY (students may miss up to 2 sessions unexcused and still pass the course)

COURSE OVERVIEW

- Lectures:
  - Provided by Prof. Meyer, Prof. Thottethodi and George Hadley (occasional guest lecturers)
  - Held Mondays and Wednesdays 3:30-4:20pm in MSEE 184
  - Consult course calendar for lecture dates and topics
- Midterm and Final Presentations:
  - Formal presentations given before classmates and staff
  - Opportunity to showcase design and/or prototype, detail progress
- Weekly Progress Updates:
  - Used to detail individual design activities and progress
  - An important part of student grades and a REQUIRED COURSE OUTCOME (60%+ average required on progress updates to pass course).
  - Evaluated many times throughout the semester.

COURSE COMMUNICATIONS

- Individual Emails:
  - Used to communicate with particular staff members or TAs
  - Available in the About/Staff section of the course site
- ECE477 Course Email (ece477@ecn.purdue.edu)
  - Primary method of communicating issues, grades, course information, etc.
  - Monitored by multiple ECE477 staff members
- ECE477 Course Website
  - https://engineering.purdue.edu/ece477
  - Tested with Firefox, Chrome, IE, and Safari
  - Mobile device support not presently implemented
  - Please address any website issues to George Hadley (ghadley@purdue.edu)

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COURSE COMMUNICATIONS

- Project Websites:
  - Website template available for teams by default
  - Created and maintained by ECE477 student teams
  - Primary method of sharing and communicating design and project progress with the world
  - Should be hosted in the webspace provided by course staff

COURSE STAFF

- Professor David Meyer (meyer@ecn.purdue.edu)
  Professor-In-Charge
- Professor Mithuna Thottethodi (mithuna@purdue.edu)
  Professor
- Doctor Mark Johnson (mcjohnso@purdue.edu)
  Senior Design Corporate Relations
- Joseph Bougher (bougher@purdue.edu)
  Digital Systems Laboratory Engineer
- George Hadley (ghadley@purdue.edu)
  Course Development, Course Coordinator

- Additional staff details can be found on the About/Staff section of the course website

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COURSE TAS

- George Toh (ytoh@purdue.edu)
  Head ECE477 Teaching Assistant
- Richard Marcus (rmarcus@purdue.edu)
  Senior ECE477 Teaching Assistant

- Additional staff details can be found on the About/Staff section of the course website

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COURSE WEBSITE

- About – General course overview, staff information, history
- Course – Assignments, lectures, documents, policies, processes
- Teams – Information about current teams and links to websites
- Archive – Information about past teams and links to websites
- Sponsors – Information for corporate sponsors
- Incoming – Information for students looking to register for ECE477
- Contact – Course account email link for communications

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COURSE SCHEDULE/CALENDAR

- Weeks 1-4: Concept Development:
  - Functional Project Proposal: *"Our idea seems sound… what do we need to get started?"*
  - Functional Analysis: *"How will our project be used? What are our project's requirements?"*
  - Electrical and Software Overviews: *"At a high level, how will our project function?"*
  - Component Analysis and Bill of Materials: *"What parts does our project need to use?"*
  - Ordering/Acquisition of parts, tools, and prototyping hardware

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COURSE SCHEDULE/CALENDAR

- Weeks 5-9: Design:
  - Mechanical Overview: *"What will our project look like? What form factor does it need to fit within?"*
  - Software Formalization: *"What software components will our design use? How will we verify and test the software?"*
  - Printed Circuit Board Layout
  - Midterm Design Review
  - PCB Submission and Verification

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COURSE SCHEDULE/CALENDAR

- Weeks 10-15: Testing and Integration:
  - Legal Analysis: *"What steps must be taken to ensure our project can be legally sold to our customers?"*
  - Reliability and Safety Analysis: *"What risks are associated with use of our product? What parts are most likely to fail?"*
  - Ethical and Environmental Analysis: *"What resources does our project use? How can we responsibly manage our project's life cycle? What ethical issues does our project present?"*
  - User Manual: Guide to your project for the end user
- Week 16: Demos, Final Presentations, and Final Documentation

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COURSE POLICIES

- The Golden Rule: ECE477 course staff are the final arbiters of all course policies
- The Golden Guideline: In the event of an ECE477 issue (team issue, absence, course issue, etc.), always Always ALWAYS contact course staff
  - Email is preferred (easier to recall a well-documented paper trail)
- All ECE477 course policies are subject to the above rule and guideline, even where not explicitly stated
- Course policies are available for viewing and download from the ECE477 course website

COURSE POLICIES

- Lab Equipment and Usage Policy:
  - Common sense (don't intentionally break things, no food/drink/drugs/alcohol, etc.)
  - Safety (wear proper safety gear, 2 people in the lab at all times when soldering or using power tools, etc.)
  - Certain lab equipment can be checked out of the lab (consult the Digital Systems Laboratory Engineer for details)
  - Lab equipment must be checked back in at the end of the semester to avoid academic penalties
  - Do not sabotage, steal from, or otherwise interfere with other ECE477 teams (members, workspaces, projects, etc.)

COURSE POLICIES

- Project Hardware:
  - Prototyping Hardware: any hardware you use to prototype aspects of your design
  - Final Hardware: hardware used to satisfy PSSCs, grades, and course outcomes
  - Q: Can we use <x> to prototype our design?
    A: Sure, go right ahead.
  - Q: Can we use <Arduino or similar, trivial breakout board, etc.> in our final design?
    A: Probably not.
  - Q: We're unsure if <piece of hardware> is allowed, what should we do?
    A: Contact course staff

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COURSE POLICIES

- Online Collaboration Policy:
  - use of github, Sourceforge, Google Code, etc. is allowed BUT:
    - All students must maintain an online progress report using provided formatting
    - All students must maintain a project website hosted on the provided server space
  - Open source and third-party libraries may be used, provided they are properly attributed
  - Accepting patches and modifications from third parties to team member source code is explicitly forbidden
    - Cheating and other academic dishonesty will result in automatic course failure (so don't do it)

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GRADE DETERMINATION

Team Components (40% of total) distribution of team components:		Individual Components (60% of total) distribution of individual components:	
Project Success Criteria Satisfaction*	20.0%	Weekly Progress Update Reports*	20.0%
System Integration and Packaging	20.0%	Individual Contribution	20.0%
Design Review*	15.0%	Design Component Report*	15.0%
Final Presentation*	15.0%	Professional Component Report*	15.0%
Final Project Archive*	15.0%	Class Participation	10.0%
Concept Development Assignments	10.0%	Mandatory Lab Session Attendance	10.0%
ECE477 Educational Report	5.0%	Midterm & Final Peer Reviews	5.0%
		Design Review and Final Presentation Peer Evals	5.0%
** items directly related to outcome assessment*			
Bonus Components (Add to grade total)			
Early completion bonus		+2% per week early completed (prior to final exam week)	
Design Showcase bonus		+2% for poster and participation in the Design Showcase	

- Covered in further detail in the Grade Determination Policy, located in the Course -> Policies section of the website

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GRADE DETERMINATION

- Late Policy
  - Deliverables in this class are like project deliverables to a customer
  - A late penalty of -10% per day will be assessed for any items turned in after the deadline
  - If an assignment is more than 3 days late, course staff will have final determination on whether to grade the assignment or not

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GRADE DETERMINATION

- Learning Outcomes: (must be satisfied in order to pass the course)
  I. An ability to apply knowledge obtained in earlier coursework and obtain new knowledge necessary to design and test a microcontroller-based digital system
  II. An understanding of the engineering design process
  III. An ability to function on a multidisciplinary team
  IV. An awareness of professional and ethical responsibility
  V. An ability to communicate effectively, in both oral and written form

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GRADE DETERMINATION

- Failures, Conditional Failures, and Incompletes
  - Students are responsible for their actions in ECE477; some actions may lead to failing grades
  - Be aware of your academic situation in ECE477 and other courses before considering post-graduation plans or accepting job offers
  - In some situations, students may be assigned an incomplete (I) or conditional failure (E) in lieu of a failing grade (F)
  - Report all University-eligible absences (death, illness, family emergency, etc.) to course staff

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GRADE DETERMINATION

- Cheating and Academic Dishonesty
  - Not tolerated at Purdue
  - Automatic failure from ECE477, possible disciplinary action
  - All cases of academic dishonesty will be reported to the Office of the Dean of Students
- In Summary…
  - Don't.
- A professional does not take credit for the work of somebody else

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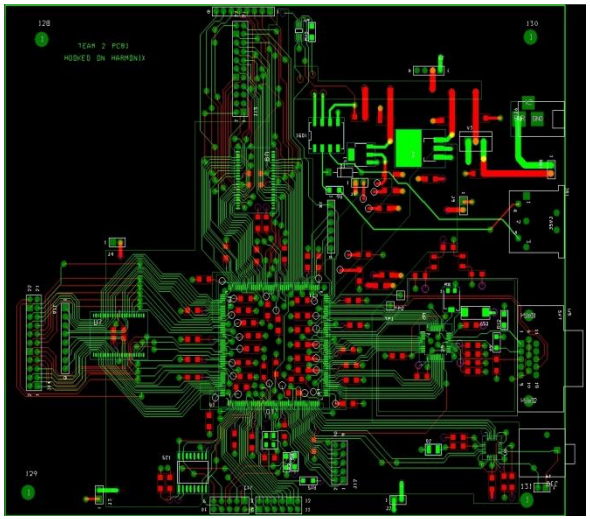
Sample ECE477 Projects

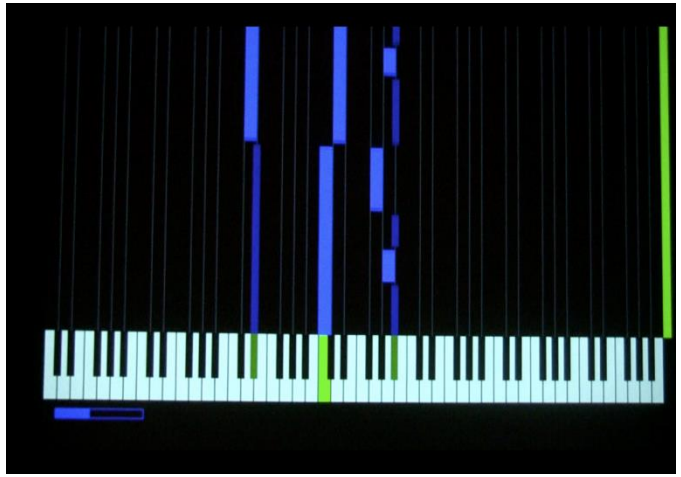
ECE 477 Digital Systems Senior Design Project – Fall 2007
Team 2: Hooked on Harmonix



4-layer Printed Circuit Board (PCB)

Synopsis: The user selects one of several MIDI tracks stored in Flash memory, and the corresponding file is parsed outputting bars of appropriate length to a standard computer monitor. Performance from a standard MIDI keyboard is judged and graded when the song is finished.

Hooked on Harmonix is a learning tool that teaches the user valuable piano skills while providing an entertaining experience at the same time.



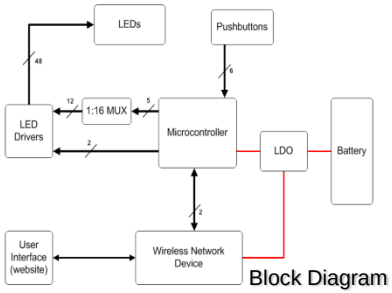
User input from standard MIDI keyboard is compared to stored MIDI song file

Final Printed Circuit Board (PCB)

I/O Ports (from left): Audio Output, VGA output, MIDI input, power input

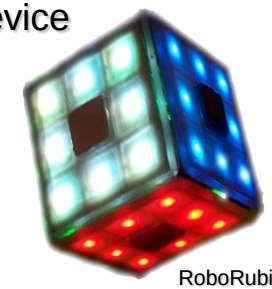
ECE 477 Digital Systems Senior Design Project – Spring 2008

Design

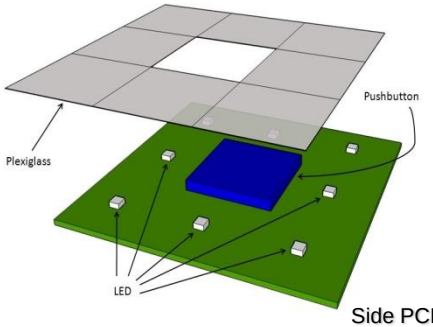


Block Diagram

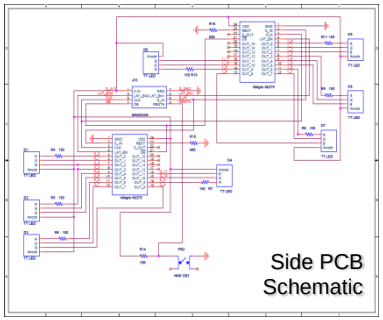
Device

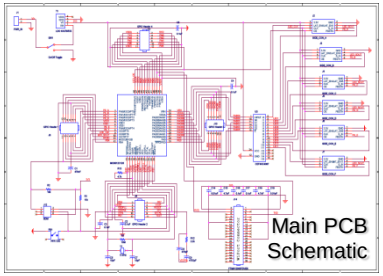

RoboRubik

RoboRubik is a self-contained automated Rubik's Cube solver. You can scramble and solve it just like a normal Rubik's Cube. If you get stuck, you can get hints as to what your next move should be. RoboRubik comes with an embedded user interface accessed through any device with wireless networking ability. It's a fun and simple way to learn about and play with one of the most beloved puzzles in the world.

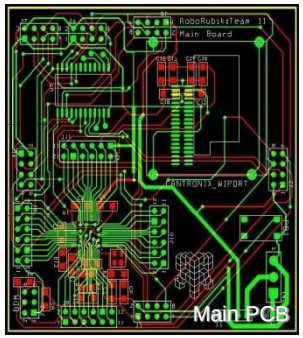


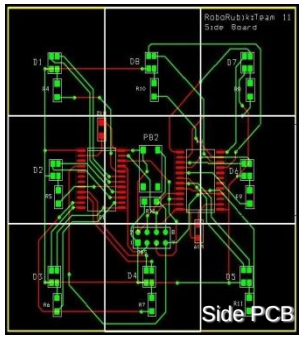
Side PCB Sketch

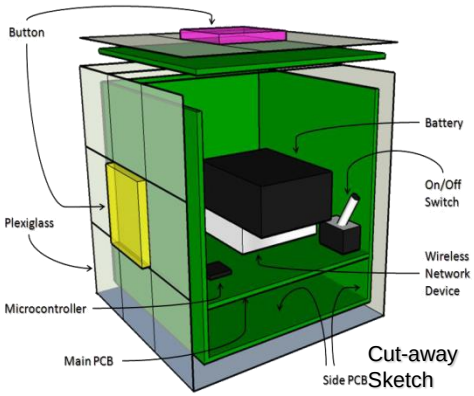

Side PCB Schematic


Main PCB Schematic

Development


Main PCB


Side PCB

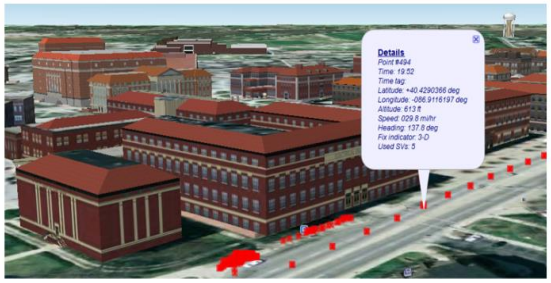


Cut-away Sketch

ECE 477 Digital Systems Senior Design Project – Fall 2011

The Incredible HUD – A helmet-based heads up display

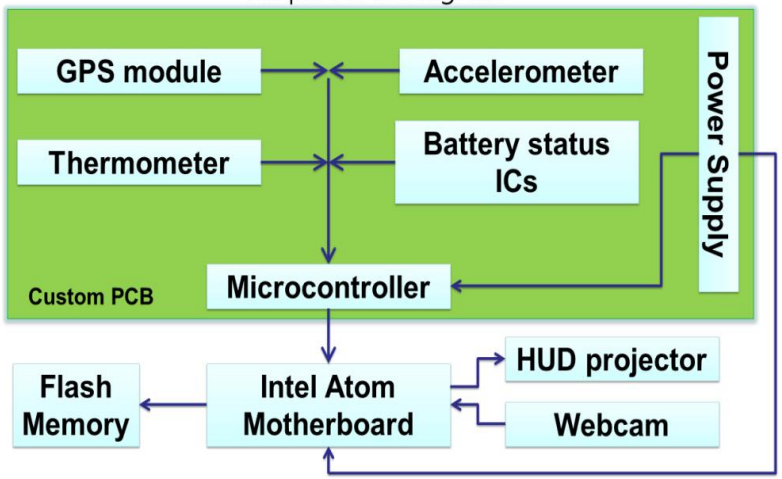
The Incredible HUD is a helmet-based augmented reality system designed for use in extreme sports such as motorcycling, skiing, or skydiving. The system consists of a helmet and a thin backpack unit for information processing. The system projects telemetry data such as GPS, acceleration, velocity, altitude and battery status, as well logging all the data generated. The logged data can be easily viewed using Google Earth.

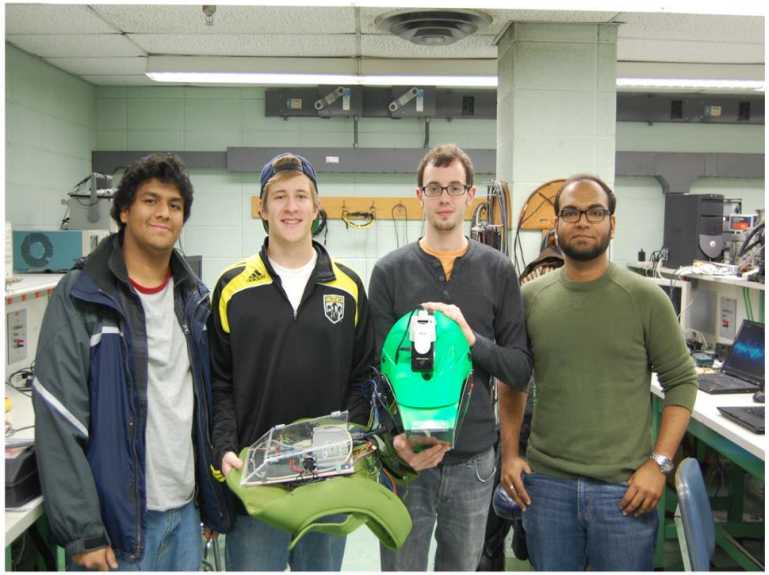


Google Earth Data Log

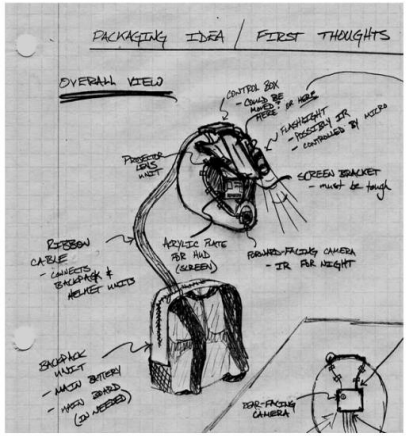
Helmet and Display Modes

Simple Block Diagram

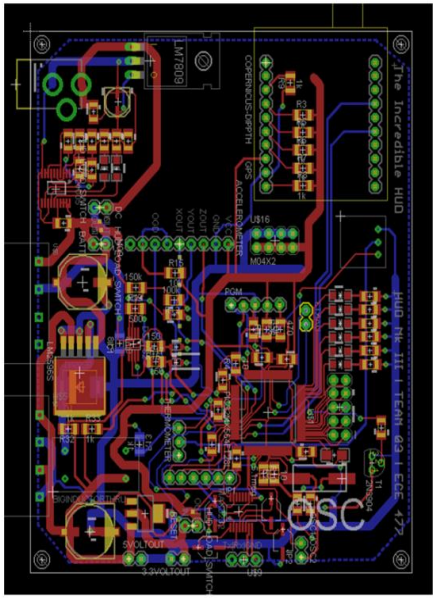




From left to right: Nikhil Sureshkumar, Marcelo Leone, Brandon Blaine Gardner, Aditya Balasubramanian



Initial Concept



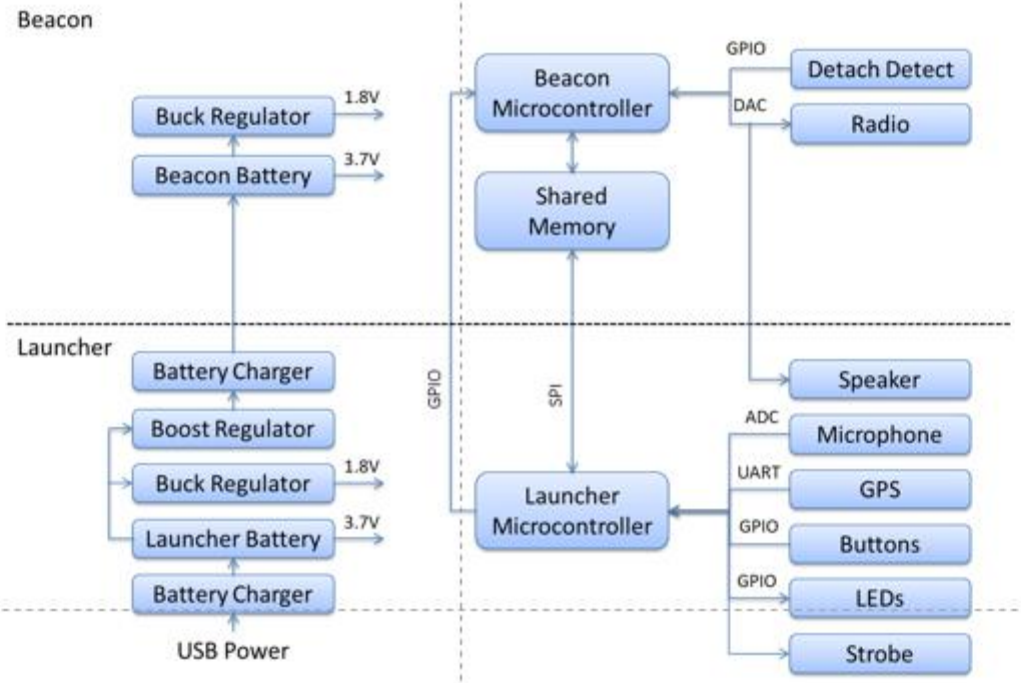
Final PCB Design

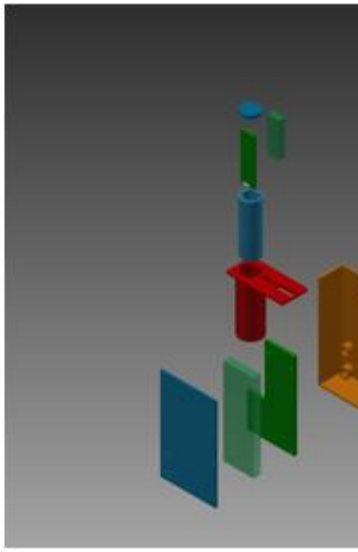
Special Thanks To:
George Hadley and George Toh
Professors Meyer and Dr. Johnson
Chuck "The Wizard" Barnett
Brian Bowman (Resident C# Guru)

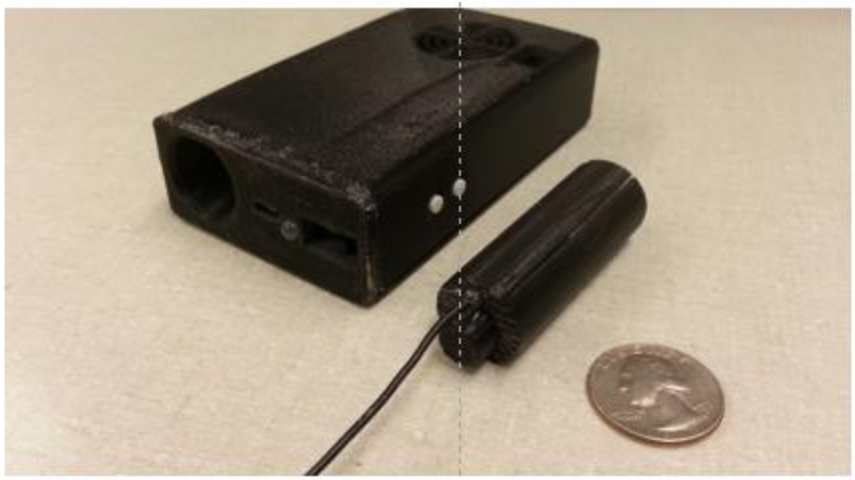
Team04 -- Aerial Distress Beacon

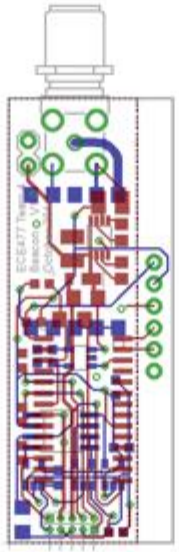
s it?

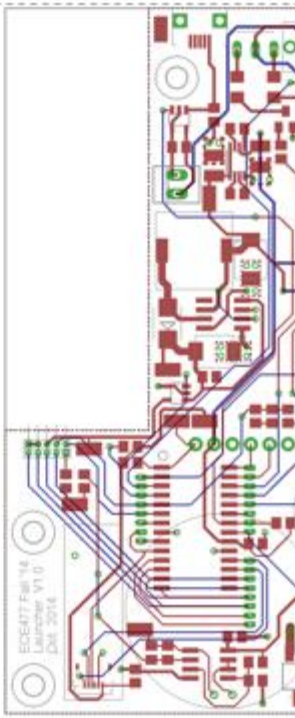
- able transmitter for
  ting emergency services
  emote locations
- nits audio message and
  oordinates
- s enhanced broadcast
  by transmitting from high
  e
- ised of a launcher and a
  able beacon









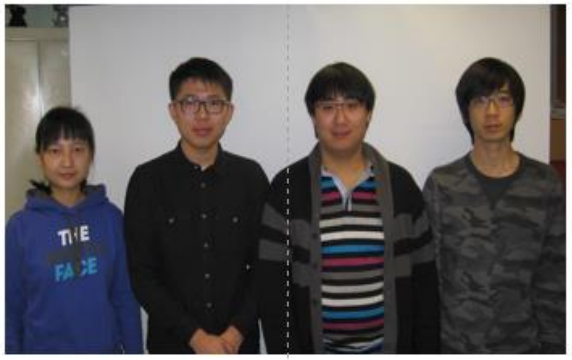


ECE 477 Digital Systems Senior Design Project – Spring 2015

Team 5 / Remote Controlled All-terrain Vehicle

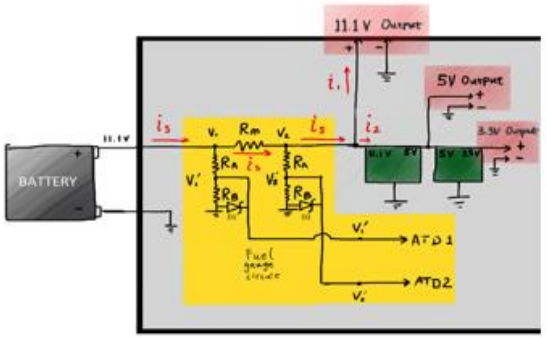
Project Overview:

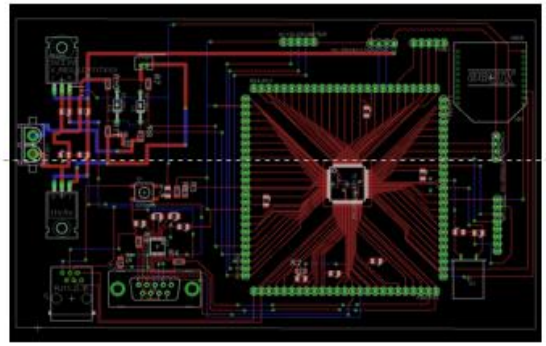
Remote controlled all-terrain vehicle is a project that will allow a vehicle to cross a right angle obstacle. Four mechanical arms will be implemented to pull up and down the vehicle. A self balanced platform was added at the end of our project.

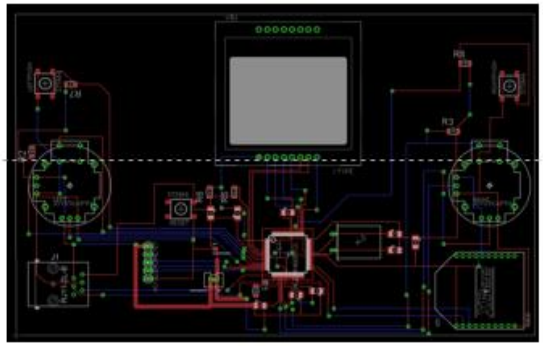


Left to right: Yinuo, Ji, Di, Chengzhang

Self-made Fuel gauge:

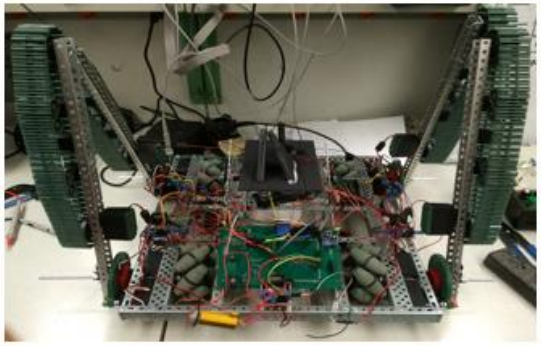


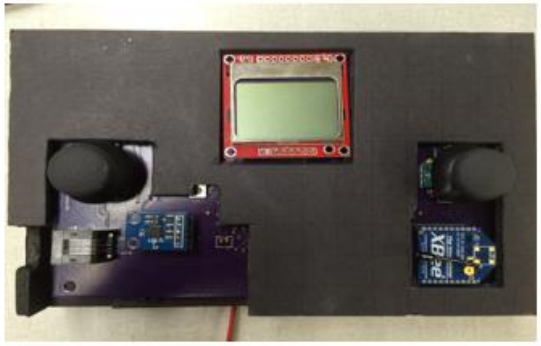




Project Specific Success Criteria:

1. An ability to send serial command stream via Android app by Bluetooth module;
2. An ability to optimize performance that smoothly control speed, direction and climbing movement;
3. An ability to integrate user inputs which includes a variety of sensors both on car and controller
4. An ability to balance a platform in horizontal position by using sensors and servos;
5. An ability to show users the battery life.





Video:
https://www.youtube.com/watch?v=MzVTiRKcUdw

PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- What are PSSCs?
  - Used to measure the degree to which teams have successfully implemented their projects
  - 5 objectives that should be accomplished by the final design (Approved by course staff); begin each PSSC with the phrase “An ability to…”
  - Each PSSC should describe some aspect of the functionality of the final design
  - In order to pass the course, 3 PSSCs must be successfully demonstrated
    - 2 of the PSSCs must focus on hardware built by team
    - 1 of the PSSCs can focus on an external item (such as an app)

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Default Functionality of a Component Rule
  - PSSCs cannot be based on functionality that an aspect of the design is able to do trivially or out of the box
  - Examples:
    - “An ability to transmit data over a wireless connection”
    - “An ability to take pictures with a camera”
    - “An ability to emit light from a light emitting diode”
- Preliminary and Final PSSCs
  - Preliminary PSSCs: Aspects of the project can be demonstrated without full integration; used to pass outcomes
  - Final PSSCs: Must be demonstrated with a fully-integrated project; used to receive points and for early completion bonus credit

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PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Examples of Unacceptable PSSCs:
  - "Interface with the flight controller to achieve stable flight" (Start all PSSCs with the phrase "an ability to")
  - "An ability to design a motor controller for our project" (PSSCs must be based on the capabilities of your end project)
  - "An ability to receive GPS coordinates and send them to the microcontroller" (Default functionality of a component rule)
  - "An ability to filter out high frequency noise from a received RF signal" (Unacceptable if being done by a filter IC; acceptable if performed by a user design)

PROJECT SPECIFIC SUCCESS CRITERIA (PSSCS)

- Common subjects for PSSCs:
  - Communication interfaces (acceptable IF you specify the types of data being transmitted over the interface)
  - User interfaces (define types of data being displayed to the user interface as well as the nature of the UI)
  - Motor control and robotics techniques (GPS waypoint navigation, obstacle avoidance, PID control, etc.)
  - Power techniques (battery monitoring/charging/ notifications, backup power supplies, low power modes)
  - Audio techniques (sound effects, audio synthesis, voice recognition, video/audio/signal processing, FFTs – may be acceptable depending on circumstances of use)

ACTION ITEMS TO GET STARTED

- This week:
  - Meet with your team (if you haven't already)
    - Determine roles, schedules, meeting times, methods of contacting one another, etc.
  - Set up progress reports and course website
    - Use of HTML/CSS/Javascript templates is acceptable
    - Course accounts come with a web template that may be used
    - Access information is available in the download folder for your team

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ACTION ITEMS TO GET STARTED

- This week (cont.):
  - Homework 1 – Final Project Proposal
    - Due Friday at 11:59pm (use website submission tool)
    - Determine and state team member roles and responsibilities (including homework assignment responsibilities)
    - Determine project-specific success criteria (see PSSC Policy for specific course mandates on selecting PSSCs)

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MANDATORY LAB HOURS

- This week (and subsequent weeks):
  - Report to EE063 during your assigned TCSP section
  - Meet the ECE477 laboratory staff
  - Become familiar with the ECE477 lab space, team workbench space, and lockers
  - Have team photos taken
  - Receive TA assignments and discuss office hour availability with assigned TA