Senior Design Project Topics

with Risk & Impact Ratings

EECE401 Senior Design I

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Fall 2010

Design Project Topics

- Northrop Grumman
  - Autonomous Buoy Energy System (ABES)
  - Portable Perimeter Detection and Monitoring (PopDAM)
  - Paramilitary Ruggedized Solar Energy Harvest (PaRSEH)
  - Pedometer Energy Harvester and USB/CL Power Hub (PEHUP)
- Honeywell
  - TBD
- FERC or Consumer Energy
  - TBD
- Students
  - Gerard Spivey (J-Bert)
  - Alix Martin (Defense against common mode failure)

Autonomous Buoy Energy Systems A(BES)

- Background
  - UUV's frequent Use in Commercial, , military, and research purposes
  - Extension of mission lengths is needed
  - A method of harnessing energy while deployed is required
- Problem (Objectives)
  - Design, build, and test a transfer of energy system from a buoy energy source to anchored UUV
  - Components
    - Power conversion
    - Buoy tether interface
    - Backup battery
    - Communication between anchored UUV and the energy source substation
- Requirements
  - Deliver 28Vdc from solar panels to a battery capacity of 100WHr in less than 24 hours
  - Maintain electrical integrity in underwater environment
- Deliverables
  - Detailed design with modeling and simulation
  - Prototype
- External Project Advisor
  - Gregory West and Allen Kelly

Portable Perimeter Detection and Monitoring (PopDAM)

- **Background**
  - Blind spot detection and recognition of friend vs foe in closed perimeter for soldiers
  - Proximity alarms and monitors in unknown neighborhood would reduce casualties
- **Problem (Objectives)**
  - Present plan and produce some portion of demonstration prototype for a back-pack contained wider proximity alarm and monitoring system
  - Integration of established technologies
  - Power consumption must be minimized or solar powered
- Requirements
  - A suite of sensors for various forms of detection (motion, sound, temp, vision, etc)
  - Detection range: 15 – 30 ft
  - Operating Temp: -10 – 25 Celsius
  - Night time image detection
  - Classification of friend and foe
  - Wireless communication
  - Batter Power: 12Vdc, 100AHr
- **Deliverables**
  - Demonstration Prototype
- **External Project Manager**
  - Gregory West/Allen Kelly

Paramilitary Ruggedized Solar Energy Harvest (PaRSEH)

- Background
  - A handy recharging system from solar power for electronic devices such as GPS, Night vision goggles, and communication equipment
- Problem (Objectives)
  - Rugged solar energy harvesting and charging system
  - Management of power: available sunlight vs stored power conditions
  - Charging capacity indicator
- Requirement
  - Rugged, quick deployable solar collector with nominal battery reserve
  - Multiport Power Output with priority selection of port
  - Operating Temp: -10 – 40 Celsius
  - Power Outputs: 5V USB, 12V Automobile Jack, Rechargeable for C, D, AA, and AAA cell sizes.
  - Power Management and Indicator
- Deliverables
  - Design of the system and demonstration prototype
- External Advisor
  - Gregory West and/or Allen Kelly

Pedometer Energy Harvester and USB/CL Power Hub (PEHUP)

- Background
  - Body power from pedometer type energy sources presents possibilities as energy harvest for the active and young
- Problem (Objectives)
  - Energy harvest from body power for recharging electrical accessories
  - Portable Power source
  - Detect and convert human motion into usable electrical energy
- Requirements
  - Generation of 5Vdc @50 – 100mA (or 12V version)
  - Charge battery up to 5 WHr
  - Operating Temp: -10 – 40 Celsius
  - Delivery of Power: Nominal to a USB device, Large to battery reserve
  - Provide enough external indicator of power condition
- Deliverables
  - Demonstration prototype with 5V USB or 12V Cigarette Outlet
- External Advisor
  - Gregory West and/or Allen Kelly

Cheap J-Bert

- Background
  - A cheaper version of a system is needed that has the ability to determine the confidence level (via “bit error rate” / “eye pattern”)of a receiver of a noise added (“jitter”)transmission line under LVDS technology.
- Problem (Objectives)
  - Full spec systems are expensive
  - A simple LVDS check may be possible with a cheaper system
- Requirements
  - Identify mismatch bits under white noised transmission line with LVDS specification (probability?)
  - Capable of generating and transmitting pseudo-random noise (quantifiable measure?) through the loop in the data rate of (???) Mbps or Gbps
- Deliverables
  - A simple LVDS check system
  - Simulation Results and Comparison with the implemented system (?)
- External Advisor

Defense against Common Mode Failure

- Background
  - Safety Critical Application (as in Digital Instrumentation and Control in NPT) needs redundancy, diversity, separation, and indepence
  - Hardware/Software Diversity is needed to defeat the common mode failures
- Problem (Objectives)
  - A training and education system for hardware/software diversity
- Requirements
  - At least 2 types of hardware with different architectures
  - At least 2 principles of software for the same functionality
  - At least 2 methods of causing common mode failures
- Deliverables
  - Training and education system
- External Advisor

Lunar Satellite (LunaSat)

- Background
  - A customer is interested in flying a simple, low-cost spacecraft (call it LunaSat) near the Moon.
  - The attitude of a spacecraft is its orientation in space, or more precisely, is a transformation between a body frame and a reference frame.
- Problem (Objectives)
  - A simple system to control and determine the attitude of LunaSat is needed.
  - Design such a system, and demonstrate the design on the ground using simulations and/or a prototype
- Requirements
  - Can't use magnetic field or GPS (near the Moon).
  - Use Sun, Star, Earth, and/or Moon observations.
  - Only very coarse accuracy needed … several degrees.
  - Should not need simultaneous observations
- Deliverables
  - Simulation and/or prototype for demonstration
- External Advisor
  - Dr. John Rowe, Honeywell

Risk Rating

- Risk Impact
  - How does the project impose risks in technical, cost, and schedule aspects in completing and delivering.
  - How am I prepared for the project's technical requirements?
  - How is the project well defined and quantified?
  - How does the project positively/negatively impact the technical aspect of problem solving and design experience, and reputation and future growth?
- Rating
  - 3: High Consequence
  - 2: Moderate Consequence
  - 1: Low Consequence
  - 0: No Consequence
- Project Evaluation Chart

Impact Rating of the Projects

- Name:
- Today's Date:

Projects and Teams

- 1. Development of a Protable Perimeter Detection and Monitoring System (Elijah, Monique, and Nosakhare)
- 2. Development of a Pedometer Energy Harvester (Fernando, Jawando)
- 3. Development of an Economical Transmission Line Bit Error Rate Tester (Gerard, Ode)
- 4. Development of a Training System for Defense against Common Mode Failure (Alix, Jaglal, King)

Order of Business

- Initial Design Requirement (Oct 27 class)
  - Presentation
  - Issues
  - Compromises
- Current State of Arts (Nov 3)
- Initial Solution Approach (Nov 3)
  - Presentation of above 2 subjects (Nov 3 class)
- Writing a proposal (by Nov 10 class)
- Keep working on Solution (through the semester)
- Proposal Presentation (W December 1, 2010) before internal/external reviewers
- Proposal Submission