Assign Final Project

An ECE 544 "classic":
..\videos\Beam Stabilization by Differential Thrust.mp4

Final Project

- You will work in teams of 3 for an ECE 544 project
- You may work in teams of 3 or 4 for a combined ECE 544/558 final project but there must be sufficient work for all team members
- Your project proposal must be approved by the instructor
  - Approval based on difficulty and whether I think you can complete it in the ~4 weeks you have to complete it
- You must present your project progress in class
- You must demonstrate your project in class
- All of the team members are expected to be in the classroom to present their part of the project for both the progress report presentations and demo night. Arrange exceptions ASAP!
- Your project must be at least as difficult as any of the projects done in ECE 544 and ECE 558
- You must manage the project w/ GitHub

Target System – ECE 544 Project

- Your project must include an SoC-based design that contains:
  - An embedded system (Microblaze or other)
  - Custom logic in FGPA fabric (besides the embedded system and peripherals)
  - Software
- You must demo on the Nexys A7. We will bring a couple of boards & Pmods to class
  - Additional expansion through Pmods, etc. is fine
  - Proto-strip or proto solder boards for external components
  - Additional peripherals connected to the board (ex: VGA monitor, wheels, motors, sensors, radios, etc.)
  - You must provide test equipment, external hardware, etc.
- The relative complexity of the hardware and software components of the project should be about the same

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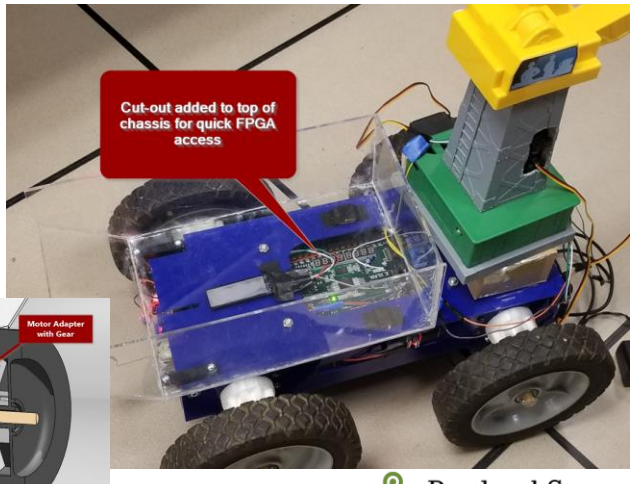
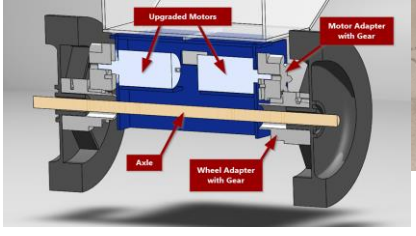
Winter 2018 "Wall of Fame" Winner

Daniel C., Alex V., Roman K., Maksim P.
Wally 2.0 – A Trash Collecting Robot





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Target System – ECE 544/558 Project

- Your project must integrate an Android app (or apps) developed using Android Studio with a Nexys A7-based embedded system
- Your project must include an SoC-based design that contains:
  - An embedded system (Microblaze or other)
  - Custom logic in FGPA fabric (besides the embedded system and peripherals)
  - Software
- You may include additional SBC and/or microcontrollers (RPI, PIC, …)
- The relative complexity of the hardware and software components of the project should be about the same
- Your demo should show off both the Android and embedded system capabilities…ECE 544/558 projects will be given additional demo time

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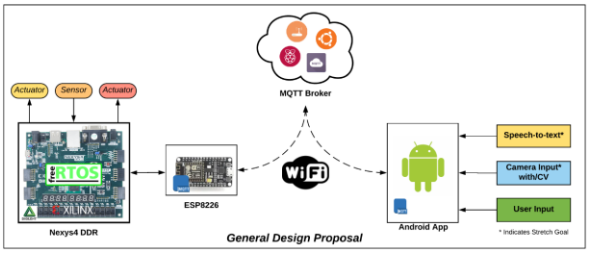
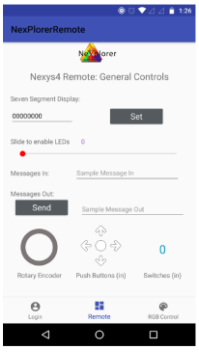
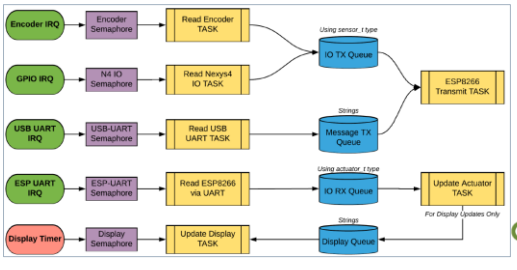
Spring 2018 "Wall of Fame" Winner

NeXplorer Remote

Vishakha Bami, Andy Elliott, Suryansh Jain







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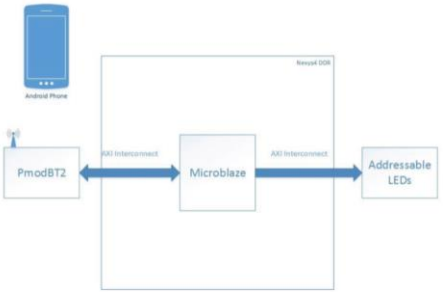
Android + Microblaze + Nexys A7

NATAKU
- Fall 2016 -
Deven Bawale, Srivatsa Yogendra, Tejaswini Vibhute

"Nataktu is an Android app that listens to music via the Android device's microphone, connects to a Nexys4 DDR FPGA board via Bluetooth and sends appropriate RGB values to the board which are subsequently sent to a strip of addressable LEDs. The LEDs glow in response to the music being played considering factors such as amplitude and pitch of the music. The word 'Nataktu' is Sanskrit for 'dancing lights'."



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Joint projects w/ courses besides ECE 558

- I will accept joint projects for other classes you (or your partners) are taking
  - Ex: A system w/ a hardware component (e.g. System Verilog and/or high level synthesis) and an embedded CPU
- You need permission from both myself and your other professor to do this
- The joint project must still meet the requirements of the ECE 544 final project:
  - More complicated than the other projects and homework assignments
  - Be "interesting" to the class
  - Be of sufficient difficulty to support the size of the team
  - Include an SoC demonstrated on the Nexys A7

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Final Project Grading

- Grading will be as follows:
  - Correctly implements functions you committed to– 50%
  - Quality of your presentations – 20%
  - Quality of design report – 15%
  - Quality of code (comments, clarity, etc.) – 10%
  - Degree of difficulty – 5%
- Extra credit (up to 7 pts.) is possible if you go above and beyond your accepted proposal…and if the design report is good, your code is well commented, your demo works, etc.
  - ECE 544 projects that are best implemented in an FPGA are the most likely to receive extra credit (ex: ML, DSP, video,…)
  - ECE 544/558 projects that make use of cloud services (like Firebase) are the more likely to receive extra credit
- **The Final Project is 25% of your final grade in ECE 544 and 20% of your final grade in ECE 558**

Project Proposal

- Project name and team members
- Project description
  - What are you going to build?
  - What are your inputs/outputs?
  - What component(s) will you use?
  - What tools will you use?
- Design approach
  - How are you going to build it?
  - How will you demonstrate success?
  - What are your options if you start running out of time?
- Milestones
  - Target dates to demonstrate that you're making acceptable progress towards completion

Deliverables – ECE 544 Project

- Write-up
  - Project overview including an English description of the functionality
  - Block diagram of your circuit
  - Design details, including a theory of operation, state transition diagrams or equivalent, etc.
  - Results (good and bad)
  - Contributions of individual team members
  - No more than 12 pages please
- Source Code
  - Listings of all of your Verilog files - including test benches
  - Listings of your program source code
  - Block diagram of your embedded system, `.mss` file, `.xdc` file
- `.pdf` of your progress report and demo presentations
- (optional) Video(s) of your demo

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Deliverables – ECE 544/558 Project

- Write-up
  - Project overview including an English description of the functionality
  - Block diagram of hardware and flowchart of application(s)
  - Design details, including a theory of operation, state transition diagrams, code snippets w/ descriptions, etc.
  - Results (good and bad)
  - Contributions of individual team members
  - No more than 15 pages please
- Source Code
  - Archive Android Studio project(s)
  - Listings of all of your Verilog files - including test benches
  - Listings of your program source code
  - Block diagram of your embedded system, `.mss` file, `.xdc` file(s)
- `.pdf` of your progress report and demo presentations
- (optional) Video(s) of your demo

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Some notable "Wall of Fame" winners

- DogBot Object following Robot
  - Saurabh G., Pradeep R. P.
- LED Display Entertainment System
  - Jessica B., Nathan M., Sean K.
- Multi-node Home Security and Alarm System
  - Alex P., Cody O., Lowren L., and Jonathan F.
- IOT based control and automation
  - Parimal K., Chaitaniya D., Joel J., and Nishad S.
- Wireless motor control of Mars Rover
  - Randon S. Aditya P., Venkata V. and Brandon B.

Project Resources Online – a Small Sampling

- www.opencores.org – Open source HDL IP cores
  - Wide variety of functions – not necessarily optimized for FPGA
- www.mbed.org – MBED Development site
- http://www.raspberrypi.org/ - Raspberry PI website
- http://beagleboard.org/ - BeagleBone, BeagleBone Black.
- http://www.elektor-labs.com/ - Project ideas, kits, etc.
- http://www.clubjameco.com/index.php/contents - More project ideas, kits, etc.
- https://androidthings.withgoogle.com/#!/ - Android Things projects

Additional Hardware

- **PROCURE ANY ADDITIONAL HW YOU NEED IMMEDIATELY!!!**
  - EPL store
  - Digikey, Mouser, etc.
  - Surplus Gizmos (surplusgizmos.com)
  - sparkfun.com, adafruit.com and other hobbyist sites (see Circuit Cellar and Elektor)
  - If you purchase online consider paying the extra shipping charges for 2 day or 3 day delivery…it's better than not getting hardware until a few days before your project is due
- Take advantage of the EPL facility…but the equipment is in demand towards the end of the term so leave plenty of time

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Timetable

- Proposal submitted to D2L no later than Sun, 19-May-2019
  - Would be to your advantage to beat this deadline since it will give you more time to work on the project
- In-class progress reports Mon, 03-Jun-2019
  - Describe your project (block diagram would be helpful)
  - Explain your design approach and who's assigned to what task(s)
  - Give a status of what you've completed and what's left to complete
  - Each team will have about ~10 minutes to present
- In-class demos are Mon, 10-Jun-2019 and (if needed) Tue, 11-Jun-2019
  - Each team will ~15 minutes to discuss their project
- Deliverables due to D2L by 10:00 PM on Thu, 13-Jun-2019
  - Please do not miss the deadline - we need time to grade them

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