

EET 399 – CET Capstone Project & EET 499 – CEN Capstone Project

**Department of Technology
Spring 2009**

Instructor:

Prof. Vigs Chandra, PhD

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<http://people.eku.edu/chandrav>

Office:

405 Whalin Technology Complex

Class schedule:

EET 399: Section 001, CRN 22570; TR: 6:00 – 7:55 pm, in Room 407/400

EET 499: Section 001, CRN 22571; TR: 6:00 – 7:55 pm, in Room 407/400

Office Hours:

MW: 8 - 10 am, MTWR: 4 - 6 pm. If my office door is open at other times I will most likely be available for discussion. Come right in.

Credit hours:

3

Prerequisite:

EET 399: Instructor approval and Sophomore (30 – 59 hours) or higher standing. Only for students who are enrolled in the 2-year AS or AAS degree in Computer Electronics.

EET 499: Instructor approval and Senior standing (90 or more hours). Only for students who are enrolled in the 4-year BS degree Computer Electronic Networking.

COURSE DESCRIPTION:

EET 399: A project and research oriented course which serves as a capstone experience for Computer Electronics Technology (CET). The design, implementation, analysis, and troubleshooting of electronic and computer technology related systems, is emphasized.

EET 499: A project and research oriented course which serves as a capstone experience for Computer Electronic Networking (CEN). The design, implementation, analysis, and troubleshooting of networking, computers and electronics technology related systems, is emphasized.

TEXTBOOK:

A. Required:

Publication Manual of the American Psychological Association (5th Edition),
American Psychological Association, ISBN: 1557987912

B. References:

1. Practical Electronics Handbook, 6th Edition; Ian Sinclair & John Dunton; Newnes; ISBN: 0750680717
2. Hardware Hacking Projects for Geeks, 1st Edition; Scott Fullam; O'Reilly Media, Inc.; ISBN: 0596003145
3. Getting Started in Electronics; Forrest M. Mims III; Master Publishing, Inc.; ISBN: 0945053282
4. Build Your Own All-Terrain Robot, 1st Edition; Brad Graham & Kathy McGowan; McGraw-Hill/TAB Electronics; ISBN: 007143741X
5. Electronic Sensor Circuits & Projects; Forrest M., III Mims; Master Publishing, Inc.; ISBN: 0945053312
6. Electronics Projects For Dummies; Earl Boysen & Nancy C. Muir; For Dummies; ISBN: 0470009683
7. Practical Electronics for Inventors, 2nd edition; Paul Scherz; McGraw-Hill/TAB Electronics; ISBN: 0071452818
8. Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP; James Lee, Brent Ware, Addison-Wesley Professional; ISBN: 020177061X
9. Wireless Hacks: Tips & Tools for Building, Extending, and Securing Your Network; Rob Flickenger & Roger Weeks; O'Reilly Media, Inc.; ISBN: 0596101449
10. Wi-Fi Toys: 15 Cool Wireless Projects for Home, Office, and Entertainment; Mike Outmesguine; Wiley; ISBN: 0764558943
11. Car PC Hacks; Damien Stolarz; O'Reilly Media, Inc.; ISBN: 0596008716
12. The Practice of System and Network Administration, 2nd Edition: Thomas Limoncelli; Addison-Wesley Professional, Inc.; ISBN: 0321492668
13. Network Warrior; Gary Donahue; O'Reilly Media, Inc. ; ISBN: 0596101511
14. How to License Your Million Dollar Idea: Everything You Need To Know To Turn a Simple Idea into a Million Dollar Payday; 2nd Edition; Harvey Reese; Wiley; ISBN: 0471204013

COURSE OBJECTIVES:

1. To define a technical problem in terms of a project for which solutions can be determined.
2. To demonstrate technical skill while solving problems in areas related to computer systems, network and electrical/electronic circuit design.
3. To perform independent research, as well as work effectively in teams.
4. To systematically organize and plan the completion of a project including conducting research, laboratory experimentation, testing and troubleshooting.
5. To demonstrate an in-depth knowledge in areas related to computer systems, networks, control systems, automation, electrical and electronic systems.
6. To articulate results of the project in the form of written technical reports, oral presentations and demonstrations.

COURSE REQUIREMENTS:

1. Complete and submit all project progress reports and final report in a timely manner.
2. Complete the weekly online capstone journal entries
3. Participate in the group research paper presentation
4. Implement the capstone project and demonstrate it in class on the prescribed date.
5. Maintain a 3-ring binder or folder for organizing class materials.

EVALUATION:

Overview of the capstone project:

Each student should select a project from an area of the CET/CEN major (*electricity & electronics*, such as PLC based automation; *computer systems*, such as microcontrollers or hardware configurations or data backups; *networks*, such as security or wireless communications) which is of interest to you. It is possible to select topics which bridge these areas as well.

Enhancements in the safety or accessibility of existing equipment using novel electronic or computer networking based systems may be considered. While individual projects are strongly preferred, for considerably larger, multi-multidisciplinary projects students may form groups of up to two students.

You may seek the guidance of computer electronics faculty members, and use the laboratories in the department to complete your project. The project is meant to be something of a synthesis experience, where you draw on from several courses in the department while generating a topic for independent research and implementation. It is not structured in the regular lecture-laboratory format, rather more as an independent study one. This is a tremendous opportunity for you to develop an integrated research and laboratory type activity in an area of your interest. We hope it will be the most meaningful class you have taken in expanding your knowledge, based on what you want to research and build as part of this course.

Each student will be evaluated as follows:

- Progress reports – 20%
- Group research presentation – 20%
- Final project demonstration & presentation – 25%
- Final project report – 20%
- Weekly capstone journal (online) – 10 %
- Portfolio (binder) – 5%

Progress reports:

- 3 written progress reports are to be submitted. These are intended to serve as steps along the way to help you stay on schedule with regards to the final project.
- After each written progress report has been submitted (on designated Mondays), please stop by my office the next class period for discussions regarding your progress report. This feedback is to stay on track with regards to the timeline for the overall project.
- 1st Progress Report: Submit a project proposal, with a list of possible topics for your project. For this identify the general area (electricity & electronics, etc.) in which you want to work, and a sub-area within it, such as PLC based automation. If you already have a pretty good idea for the project topic within the sub-areas list it here. Alternatively identify the sub-areas you would like to work in providing as much detail as possible about your interests and experience working that type of technology. Outline the scope of the project here as well. The topic should neither be too broad (attempting to cover too much) nor too narrow. Approval from me is required before proceeding with any

- implementation. If a suitable topic for the capstone project has not been identified, the proposal will need to be revised and resubmitted at the earliest.
- 2nd Progress Report: Identify at least two, preferably three, technical conference/journal papers related to your project topic and submit annotations (brief paragraph summarizing each paper in your own words) for each. Include how each identified source could be of use in developing your project. In addition, for any one of the articles create a bulleted list of the main points and sub-points. This list will be used for the discussing your research paper with the group and the paper you selected could be the one the group elects to present jointly to the entire class. Books and magazines may also be used as additional sources. This annotated bibliographic information will form a common base of knowledge for use by all students, and will be posted in Blackboard (unless you let me know otherwise). For identifying sources of technical articles, a good reference source is the Academic Search Premier Database available through the online ECU library databases at., <http://www.library.ecu.edu/new/index.php>. An online tutorial video on finding articles related to open source software using online ECU databases is available at: http://www.people.ecu.edu/chandrav/Ref/online_search_ECU_libraries.wmv.
 - 3rd Progress Report: Identify progress to date, problems encountered, approximate percentage of project completed, and any ongoing issues. If possible include tentative pricing of the equipment needed to complete the project outside of what is available in the laboratories.

Group research presentation:

- For the purpose of encouraging sharing of research information related to the broad area your project is in, once each project topic has been decided, groups (of 2-5 students) will be formed around similar themes.
- Different “Online Groups” will be created in Blackboard, where group members can post articles of interest using the “File Exchange” feature of Blackboard. Students can post the articles either to their specific groups or for viewing by the entire class.
- Individually each student will research and identify at least two paper related to their project topic, and then meet with the rest of the group to share the ideas from these papers. Online meetings of the group using the “Collaboration” features of Blackboard which include online Chat or Whiteboard can substitute for in-class meetings.
- Together each group will then select one of the papers from all those individually researched for a group presentation.
- The group presentation can be done either using PowerPoint/alternate software. Alternatively, a poster presentation format may be used. Groups may also choose to build or demonstrate a derivative work based on the paper being presented. Post the slides or digital images of your presentation to the Blackboard.
- Maintain a record of the technical topics discussed during the group meetings.
- Submit a memorandum summarizing activities of the group in setting up the presentation.

Final project demonstration and presentation:

- A presentation of your individual project is required and will be graded by me, Computer Electronics Faculty members (Prof. Jeff Kilgore, Dr. Ray Richardson, and Prof. Dale Patrick) and CEN advisory committee members.
- The presentation should be organized into a format which is easy for others to understand. A PowerPoint template will be provided. The presentations allow you to discuss the research project and laboratory activity you have developed during the semester. One of its main purposes is to teach others in the class about topics you have been researching

- and building.
- Plan for a 15 minute or so presentation with a couple of minutes for initial setup time and also for audience questions. Prepare responses for a list of 3-5 possible audience questions.
 - Preferably use presentation software, which will also be helpful in creating a 1 page handout summarizing your work for the class. You may alternatively setup a poster presentation and walk the class through each aspect of the poster.
 - Professional attire is recommended.
 - Discuss your presentation or its outline with me prior to the final in-class presentation.

Final project report:

- An individually written detailed report, approximately 10-15 pages in length (excluding title and appendices), with appropriate bibliographical references [in American Psychological Association (APA) format <http://nutsandbolts.washcoll.edu/apa.html>], is required.
- In general your project should have the following organization:
 - Title page – project title, name, course, date, department, and institution
 - Table of contents – include page numbers for various sections of the report
 - An executive summary or abstract – Summarize in a paragraph or so, the technical problem and your proposed solution. Include a heading ‘Keywords’ and list 3-5 keywords related to your project.
 - Introduction – Indicate the general technical area the problem being solved is set in. The broad area your Background and information about the motivation for undertaking the project. Refer to any relevant background information obtained from your list of references over here. Include applications from industry where similar ideas are being used or which prompted your design; also list alternate designs you considered initially, emphasizing the design which was finally chosen. Use illustrations liberally. If possible illustrate with a sample example, which indicates the necessity of addressing a specific technical problem. Use APA citation for references used indicating the ideas which influenced your project. Provide proper citations for any figures taken from other sources, including those taken from the Web.
 - Problem Statement section - Specifics of the technical problem your project is trying to solve. Include assumptions, and the conditions under which your design is supposed to function (in-scope specifications).
 - Design section – include your suggested final design with detailed illustrations, circuit diagrams, and the principle of operation of the system. It should also contain a block diagram of your system showing how the different parts of the system are linked together. The design section may contain subsections for the major blocks or tasks that need to be completed. This is the main part of the paper and be as detailed as possible without including any trivial information. If special testing procedures or equipment is needed make a note of it here as well. Include a project schedule, listing the major blocks (tasks) and sub-tasks that had to be completed, designating key tasks as project milestones, along with a schedule of how long each task took to complete. You may compare the anticipated and actual time needed for reaching each project milestone.
 - Implementation section – indicate whether the completed project meets and/or exceeds the in-scope specifications the project. Include a subsection for operational testing, with the procedures used to determine whether it conforms to the specifications. Also, include information about any technical problems which arose

during the course of the project, as well as how you solved them. Offer possible explanations for any portion of the project which did not work as planned. Identify whether the crucial sections of the design are functioning as specified, and which sections required troubleshooting. Indicate which part of the design was the hardest and which how closely did your actual implementation follow the schedule. If needed include a subsection on simulation and calculated results, along with any graphs or tables showing the trends observed. Include simulation and/or calculated results, along with any graphs or tables showing the trends observed. Include digital photograph(s) of the project and refer to it within this section.

- Conclusions – Summarize the status of the project. State whether the completed project meets the in-scope specifications and project objectives. Provide suitable explanation for any sections which are not fully functional. Compare the working project to similar commercially available systems. Are there any key findings or implications which can be useful in extending its functionality further. Reiterate how your project solves the stated problem noting its significance.
- References – A bibliography section listing at least 5 - 10 references in APA format.
- Appendices – Include any manufacturer datasheets, detailed program code, 'HOWTO' (a step-by-step operating procedure), oscilloscope plots, program code, list of the materials and equipment used as applicable. Label the appendices A, B, etc.
- Spell-check your report. Possibly have a friend or family member read over your paper for typographical errors, and overall organization.
- A special note on using of text from web sources – please make every attempt to paraphrase the author rather than quoting verbatim. While it is tempting to cut-and-paste information from outside sources please refrain from doing so, except while using appropriate citations.
- If the project involves ideas which could be of benefit to a wider technical audience consider publishing your paper in a national (such as NAIT, the National Association of Industrial Technology) or international conference (IEEE). This will be helpful for students later seeking admission to graduate school. We will be glad to work with you on any such endeavor. Such local, regional and nation presentation puts our department in the spotlight.

Weekly Capstone Journal (online):

- Since the class does not meet on every assigned class period it is important to designate specific days of the week which you will be able to set aside for working on the capstone project. Maintain detailed weekly entries in the Journal (online Blog) section of Blackboard. These will be viewable only by the specific student and the instructor.
- On occasion prompts will be posted in the discussion board requiring specific responses. Some journal entries will require your observations, summaries and comments about guest speakers and field trip(s) for the class.
- Each weekly entry should comprise at least a paragraph, approximately 50-250 words in length, and include specifics about the progress on the project such as reporting ongoing issues, commenting on any interesting online sources you found relevant to your project, documenting any insights or ideas you had, listing any contacts established, and in general any work being made toward the project that week.

Portfolio:

- Maintain a 3-ring binder containing written documentation regarding your project.
- Organize the binder into sections related to online information sheet and weekly capstone

journal, progress reports, group work, field-trip reports, reference material such as technical papers reviewed, technical brochures, correspondence with product vendors, a copy of the final presentations, drafts of project report, etc.

- Include a notes copy in the binder where you have recorded your ideas and jottings related to the project, with dates. Entries can be penciled in and arranged in chronological order.
- Your portfolio will also be evaluated for completeness at the time of the final project presentation.

Note: Resources of the computer electronics Laboratories (Basic Electricity, Microprocessors, PLCs, Networking) will be available for students while working on the capstone project during the EET399/499 designated class periods.

Also, faculty members of the computer electronic networking program have kindly agreed to serve as “consultants” to your capstone project. You may discuss your project, initial ideas and working strategies with them. Their contact information is given Technology faculty is given:

- **Prof. Jeff Kilgore**
☎: (859) 622-1204
Email: jeff.kilgore@eku.edu
Office: Whalin 402
- **Dr. Ray Richardson**
☎: (859) 622-1200
Email: ray.richardson@eku.edu
Office: 327
- **Prof. Dale Patrick**
☎: (859) 622-1198
Email: dale.patrick@eku.edu
Office: Whalin 200B
- **Dr. Tim Ross**
☎: (859) 622-3232
Email: tim.ross@eku.edu
Office: Whalin 302
- **Dr. Steve Fardo**
☎: (859) 622-1184
Email: steve.fardo@eku.edu
Office: Whalin 301B

Attendance Policy:

There are only nine in-class meetings planned including two days for the final presentations. Please plan to attend all these sessions. After the second unexcused absence, each unexcused absence will cause four percent deduction from the overall percentage. Your grade will be an automatic F if you have five (5) or more unexcused absences.

Grades:

| | | | | | |
|----------|---|---|-----------|---|---|
| 100-90% | = | A | 69.9-60% | = | D |
| 89.9-80% | = | B | Below 60% | = | F |
| 79.9-70% | = | C | | | |

Saturday, March 7 - Mid-term grades will be viewable online by accessing EKU direct. (EKUDirect/StudentService/Midterm Grades - Student records)

Monday, Jan. 19 - End of Add/Drop period: Last day to drop a full-semester course without a "W" appearing on your university transcript; last day to register for or add additional full-semester courses. It is the last day for a full tuition refund. It is also the last day to convert "Pass-Fail" or "Audit" classes to a normal grade and credit option. Completed forms must be returned to: Registrar's Office (SSB 239), or Corbin, Danville, or Manchester EKU offices.

Friday, Mar. 20: (Friday of the 10th week of semester) – Last day to withdraw full-semester classes or withdraw from the university.

Tuesday, May 12 – Final grade available online (EKUDirect/StudentRecords/Official Grade Report).

BS degree students in the College of Business & Technology (CBT), including CEN majors enrolled in EET499 are required to register for and attend the CBT Professional Skills Conference, Friday, April 3, 2009. While registering juniors should select BTS 300-006, CRN# 24467 and seniors should select BTS 400-006, CRN# 24468. Alternate BTS300 events are available for only juniors as well.

STATEMENT OF DISABILITY:

ADA

If you are registered with the Office of Services for Individuals with Disabilities, please obtain your accommodation letters from the OSID and present them to the course instructor to discuss any academic accommodations you need. If you believe you need accommodation and are not registered with the OSID, please contact the Office in the Student Services Building Room 361 by email at disserv@eku.edu or by telephone at (859) 622-2933 V/TDD. Upon individual request, this syllabus can be made available in an alternative format.

☺ The work you do in this class, and the grade you earn, should reflect your personal abilities, and accomplishments. Individual progress and project reports are required from each student. I encourage you to discuss your project with other students. However any work you submit must be your own.

☺ Any suggestions for improving the content or presentation of the course are most welcome.

Exit Exam Information for 2009 Graduates

- BS and AAS computer electronics programs students graduating in spring or summer 2009 semesters should schedule their exit exams with me in the final two weeks of the semester. For students graduating in fall 2009, the exit exam is to be completed in December 2009.
- The open-book, open-notes, exit exam consists of an online assessment and a performance assessment.
- Each assessment in turn consists of three sections – Networking; Computer Systems; and Electricity and Electronics.
- The online assessment has 20 objective type questions in each area, and the performance (hands-on laboratory) assessment requires students to complete at least one task in each area.
- A separate Blackboard course will be made available with more information regarding the exit exams during the last few weeks of the semester.
- For students who need to schedule their graduation in 2009 please access the College of Business & Technology (CB&T) academic advising website:
<http://www.cbt.eku.edu/academicadvise/default.php#Graduation>

Course Calendar

EET399/499: Capstone Project in CET/CEN

- *Most Thursday* class (6 – 8 pm) class meetings are *open-lab* hours. You may use any of the laboratory facilities by getting prior approval from the faculty member supervising the laboratory.
- *Final project demonstration and presentation* to be held *Tuesday., April 28* and *Thursday, April 30*. Bring in portfolio for grading the day your demo/presentation is scheduled.
- *Final project report* is due by *noon, Friday, May 8* (Finals week)

| Week | Date | Due Dates |
|------|-------------------------------|--|
| 1 | <u>Tu., Jan. 13</u> | <i>In-class meeting</i> Syllabus |
| | Th., Jan. 15 | Complete online information and online journal entries by the weekend |
| 2 | Tu., Jan. 20 | |
| | Th., Jan. 22 | Complete online journal entry by the weekend |
| 3 | Tu., Jan. 27 | Written progress report 1 Project proposal, select topic title and outline scope of the project |
| | Th., Jan. 29 | Complete online journal entry by the weekend |
| 4 | <u>Tu., Feb. 3</u> | <i>In-class meeting</i> Oral report – project title and outline Organize similar projects into groups. Exchange group address information Using online EKU library resources for researching technical information |
| | Th., Feb 5 | Complete online journal entry by the weekend |
| 5 | Tu., Feb 10 | Group meetings (online/phone/lab). Maintain list of topics discussed. |
| | Th., Feb 12 | <i>In-class meeting</i> Guest speakers: J. Hurley and P. Bhat, at Keane, Inc. on managing technology services, and deployment of a widely used approach called the Information Technology Infrastructure Library (ITIL). Graduating students interested in networking positions may bring resumes. Discussion on project scheduling software. Complete online journal entry by the weekend |
| 6 | Tu., Feb 17 | Written progress report 2 – Summary of at least two technical conference/journal papers (3 preferred), related to your project topic |
| | Th., Feb 19 | Complete online journal entry by the weekend |
| 7 | Tu., Feb 24 | Group meetings (online/phone/lab). Maintain list of topics discussed. |
| | Th., Feb 26 | Complete online journal entry by the weekend |
| 8 | <u>Tu., Mar. 3</u> | <i>In-class meeting</i> Group presentation and optionally a demonstration of mutually agreed upon research topic. Submit summary of group meeting notes. |
| | Th., Mar. 5 | Complete online journal entry by the weekend |
| 9 | Tu., Mar. 10 –Th., Mar. 12 | <i>Holiday – Spring Break</i> |
| 10 | <u>Tu., Mar. 17</u> | <i>In-class meeting at Hummel Planetarium (4:30 PM - Tentative)</i> Field-trip to Hummel Planetarium – Electronic Control Center and starlight show, by Mr. James Hughes |
| | <u>Th., Mar 19</u> | <i>In-class meeting (tentative)</i> Guest speaker: Mr. Justin Roberts at General Electric (GE), Inc., on networking systems, Unix, Backup technologies, co-ops, certifications and/or Mr. Hank Gevedon, at Proto Place, Inc. on patenting projects. Complete online journal entry by the weekend |
| 11 | Tu., Mar. 24 | |
| | Th., Mar. 26 | Complete online journal entry by the weekend |
| 12 | Tu., Mar. 31 | Written progress report 3 – Identify progress to date, problems encountered and resolved, approximate percentage of project completed |
| | Th., Apr. 2 | Complete online journal entry by the weekend |
| | F, April 3 | Professional skills conference |

| Week | Date | Due Dates |
|------|------------------------|--|
| 13 | Tu., Apr. 7 | |
| | Th., Apr. 9 | Complete online journal entry by the weekend |
| 14 | <u>Tu., Apr. 14</u> | <i>In-class meeting</i> – Information regarding presentations including those in the college of Business & Technology Capstone presentation Deciding order of final project presentations Discussion regarding preparation of the final project report |
| | Th., Apr. 16 | Complete online journal entry by the weekend |
| 15 | Tu., Apr. 21 | (optional) Draft of final project report |
| | Th., Apr. 23 | Complete online journal entry by the weekend |
| 16 | <u>Tu., Apr. 28</u> | <i>In-class meeting</i> 1 st set of presentations along with student portfolios March 28 (3:30 – 5 pm) – CB&T Capstone presentations |
| | <u>Th., Apr. 30</u> | <i>In-class meeting (Wed.)</i> 2 nd set of presentations along with student portfolios |
| 17 | M, May 4 – F, May 8 | <i>Finals Week</i> No Final <i>Final project reports due by noon, Friday</i> <i>Saturday, May 9: ☺ 2008-09 Spring Graduation Ceremony ☺</i> <i>EKU Alumni Coliseum (EKU Basketball venue), 9 am – 11:30 am</i> |