ENGR 1501-002: Cryptocurrency Mining: Impact, Policy, and Skills - Spring 2024

- Instructor: Jacob McDaniel (jrm5qk@virginia.edu)
- Course Faculty Sponsor: Aaron Bloomfield (aaron@virginia.edu)
- Lecture times: Mo 4:00-4:50PM
- Location: Rice Hall 011
- Office Hours: TBD

Course Description:

A mere decade after its inception, cryptocurrency mining has evolved into a dynamic and increasingly significant industry, bearing wide-ranging implications for the environment, local and international policies, and the global economy. Due to its decentralized nature, the outright banning of cryptocurrency mining is nearly impossible to enforce, and when such efforts do succeed, they often yield unintended consequences. Now that cryptocurrency mining is an enduring presence, the question becomes: How can responsible engineers address its challenges? This one-credit, pass/fail course is specifically designed to offer students an in-depth exploration of the cryptocurrency mining sphere, with a particular emphasis on its environmental impact and potential mitigation strategies, considerations in international and local policy, and the acquisition of valuable skills applicable to the cryptocurrency mining industry.

Requirements:

This course requires no previous experience or knowledge about cryptocurrency mining. While having taken CS 4501 (Cryptocurrency) may provide you with useful background information, it is not a prerequisite, nor will the material overlap. There is no textbook for this course, all materials will be provided on Canvas. Students are expected to attend class and actively participate in discussions.

Availability**:**

The primary method for getting questions answered is by emailing the course instructor (NOT the faculty sponsor). Please email the course instructor ahead of time if you wish to attend office hours. There is also an anonymous feedback tool through Canvas for course feedback and recommendations that can be used anytime throughout the semester. Any feedback is greatly appreciated.

Grading Policy:

Grading breakdown is subject to change, with appropriate notice, to deal with unforeseen circumstances.

The final grade will be pass/fail. A minimum of 70 is needed for a passing grade. Attendance is required. The grade breakdown is listed below:

Category	Weight
Quizzes Four (4) quizzes will be given in class on Canvas. Non-cumulative, lowest quiz grade dropped.	40%
Participation (attendance, discussions): Students are expected to attend class and participate in group discussions	30%
Final Project Students are expected to give a detailed presentation of a green mining farm proposal, implementing concepts and ideas learned throughout the semester.	30%

Schedule:

This syllabus is subject to further change or revision, as needed, to best realize the educational goals of the course. Necessary revisions will be announced in class or on course materials with fair prior notice.

Week	Date	Main Topic(s)	Task
1	1/22/2024	Class Orientation / What is cryptocurrency?	Before: Read Syllabus
2	1/29/2024	History and different types of cryptocurrency mining	During: Beginning of class survey
3	2/5/2024	Current Layout of the mining space - individual, commercial, and enterprise	

		mining	
4	2/12/2024	Crypto Mining's current environmental impact – energy use, e-waste	During: Quiz 1
5	2/19/2024	Environmental impact mitigation strategies - Home/individual miners	
6	2/26/2024	Environmental impact mitigation strategies - Commercial/enterprise	
7	3/4/2024	*Spring Break*	---
8	3/11/2024	International and local policy on crypto mining – How different counties deal with mining	During: Quiz 2
9	3/18/2024	International and local policy on crypto mining – How different US states deal with crypto mining, taxes	
10	3/25/2024	Mining Software history, GNU violations, and major firmware developers	
11	4/1/2024	How to design a successful mining farm – pros/cons of different housing, cooling, brands, etc.	During: Quiz 3
12	4/8/2024	How to design a successful mining farm – Security/viruses, repairs/maintenance, custom firmware, etc.	
13	4/15/2024	Hands on day – hardware and software exploration	During: Quiz 4
14	4/22/2024	Presentations	

15	4/29/2024	Presentations / Last day of class!	During: End of class survey

Project Description:

During the course, students will work in teams for a final presentation. The goal of this project is to present a mock proposal for a viable green mining farm by utilizing skills and information learned throughout the class. The group must identify and explain reasons for choosing for each of the following:

- Location: How friendly is the local environment towards crypto mining? What does annual temperatures/humidity look like during different parts of the year? Are there any special local or national regulations to be wary of at this location?
- Source of power & estimated environmental impact: Which green energy source did you choose? What will the environmental impact be for your power source and life of equipment? What will your estimated $/kwh rate be for your operation?
- Equipment housing type, cooling method, and heat reuse: Where will your operation be located? Adaptive reuse, outdoor containers, or new structure? If new, estimate environmental impact. Will your operation be air, immersion, or hydro based? Does your operation have a heat reuse strategy?
- Brand/model/quantity: Which brand and model did you select? How many units does your operation have room for? You should provide income and electricity cost estimations for a single miner as well as all of them together.
- Estimated upfront costs, and estimated maintenance costs: Provide a breakdown of all major involved costs broken down into categories: upfront and ongoing.
- Estimated revenue & return on investment: How long until your operation hits breakeven? How will conservative vs. hopeful estimates of the cryptocurrency prices change those numbers? How much money would you need to raise to get your operation started?

Late Policy:

All assignments are due in class. The lowest quiz grade is dropped to account for any unavoidable absences. Please contact the course instructor for legitimate extenuating circumstances that prevent you from being present for more than one quiz. If you are unable to attend class on the day your group is presenting the final presentation, please contact the course instructor as soon as possible.

Honor Code:

We expect the students to follow the Honor Code. All quizzes should be individual work. No collaboration between different groups for the final project is allowed. Please contact course

staff when you are unsure. The penalty for honor violation is an F in the course, *and* potential reporting to the Honor System.

Disabilities**:**
The University of Virginia strives to provide accessibility to all students. If you require an accommodation to fully access this course, please contact the Student Disability Access Center (SDAC) at (434) 243-5180 or sdac@virginia.edu. If you are unsure if you require an accommodation, or to learn more about their services, you may contact the SDAC at the number above or by visiting the student health website at https://sdac.studenthealth.virginia.edu/.

Special Circumstances**:**
Students with special circumstances (athletics, extra time required on exams, final exam conflicts, SDAC considerations, etc.) need to let me know during the **first two weeks of class**.

Religious accommodations**:** Students who wish to request academic accommodation for a religious observance should submit their request to the course instructor by email as far in advance as possible. Students who have questions or concerns about academic accommodations for religious observance or religious beliefs may contact the University's Office for Equal Opportunity and Civil Rights (EOCR) at UVAEOCR@virginia.edu or 434-924-3200.
Your Well Being**:** The Engineering School proudly serves as a safe space for its students and aims to promote their well being. If you are feeling overwhelmed, stressed, or isolated, there are many individuals here who are ready and wanting to help. In addition to the course instructors, you can seek help through the Engineering Undergraduate office (Thornton A122), or Courtney MacMasters (xar7nf, 243-5180) who is the SDAC accessibility specialist in the Engineering school.

Alternatively, there are also other University of Virginia resources available. The Student Health Center offers Counseling and Psychological Services (CAPS) for its students. Call 434-243-5150 (or 434-972-7004 for after hours and weekend crisis assistance) to get started and schedule an appointment. If you prefer to speak anonymously and confidentially over the phone, call Madison House's HELP Line at any hour of any day: 434-295-8255.

If you or someone you know is struggling with gender, sexual, or domestic violence, there are many community and University of Virginia resources available. The Office of the Dean of Students, Sexual Assault Resource Agency (SARA), Shelter for Help in Emergency (SHE), and UVA Women's Center are ready and eager to help. Contact the Director of Sexual and Domestic Violence Services at 434-982-2774.