CS-499 5-1 Journal

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Emerging Technology and Artifact Update

Part One: Emerging, Disruptive, and Game-Changing Technologies

Generative AI and Starlink Internet/Cell Phone exemplify how emerging technologies can reshape computer science and society. These trends have current effects on my career and will have ongoing societal impacts.

Generative AI

* **Identification and Description**:  
  Generative AI refers to algorithms, such as large language models (e.g., GPT), that create new content, such as text, images, or code, based on patterns learned from training data. These systems rely on deep learning and neural networks to generate human-like outputs. Generative AI has gained widespread adoption in fields such as content creation, programming, and research, allowing for unprecedented automation and creativity.
* **Impacts on Computer Science and Career**:  
  Generative AI is reshaping computer science by emphasizing advancements in machine learning, natural language processing (NLP), and ethics in AI. For my career, it offers opportunities to create intelligent systems capable of solving complex problems and generating innovative solutions, aligning with my interest in developing real-world applications of AI/ML technologies.
* **Impacts on Humans, Communities, and the World**:  
  Generative AI improves productivity by automating repetitive tasks and enabling personalized content creation. It has the potential to democratize access to tools for learning, creativity, and communication. There are, however, concerns about misinformation, biases in AI outputs, and job displacement, necessitating careful implementation and regulation.

 (*The Rise of Generative AI | J.P. Morgan Research*, 2023)

Starlink Internet/Phone Service

* **Description and Identification**  
  Starlink is a satellite internet and phone service developed by SpaceX. It provides high-speed connectivity with low latency to remote areas. Starlink, a satellite-based internet and phone service developed by SpaceX, aims to bridge a digital divide in remote areas.
* **Impacts of Computer Science and Career**  
  Starlink is a major breakthrough in networking, telecommunications, and distributed systems. It requires advances in satellite technology, data routing algorithms and distributed systems. It highlights the importance for my career of working on globally connected, scalable systems, and understanding the intersection between networking, databases, cloud technologies.
* **Human Impacts, Communities, and the World**  
  Starlink can transform lives through its ability to provide internet access in remote areas, foster global communication and enable digital inclusion. Communities that were previously isolated because of a lack of connectivity will benefit from better access to healthcare, education, and economic opportunities. Space debris and fair pricing models are still concerns.

(How, 2024)

Achieved Outcomes

1. Outcome 3 (Design and evaluate computing solutions): Demonstrated through database integration and task scheduling in the Embedded Thermostat System, showcasing efficient solutions for real-time data handling.
2. Outcome 4 (Use innovative techniques and tools): Achieved by implementing MongoDB, AWS Lambda, and priority-based algorithms in artifact enhancements.
3. Outcome 5 (Develop a security mindset): Addressed through error handling, input validation, and database query security measures.

Remaining Outcomes

1. Outcome 1 (Employ strategies for building collaborative environments): This will be achieved through more team-oriented projects and demonstrating collaborative practices in project documentation.
2. Outcome 2 (Professional communication): Progress has been made through written documentation and code review presentations, but further refinement is needed to create polished, professional-quality communications for the ePortfolio.

Part Two: Artifact Update

Software Design and Engineering

The Embedded Thermostat System has undergone significant improvements, including:

* Modularization of code for better readability and maintainability.
* Replacement of hardcoded constants with named variables to improve adaptability.
* Enhanced error handling for UART and I2C initialization.

The artifact has been submitted for instructor feedback, and I am currently making final adjustments to address modularity and maintainability concerns. The final version will soon be prepared for upload to the ePortfolio.

Algorithms & Data Structures

The emphasis on the task schedule led to the development of a prioritization-based scheduler for the Embedded Thermostat System. This enhancement optimizes dynamically the execution of tasks, ensuring critical functions are given higher priority in execution cycles. The final test phase ensures that the scheduler works efficiently and reliably in a variety of conditions. Artifacts are on schedule for upload after final review.

Databases

The database-related enhancement involves integrating MongoDB for storing temperature readings and set-point data, along with developing REST APIs using AWS Lambda for CRUD operations. For query optimization and error handling, and I am refining these aspects to ensure secure and efficient data handling. Final testing of database queries and API endpoints is underway, with a focus on real-time performance and robustness. This artifact will be finalized and uploaded following these refinements.

Status Checkpoints for All Categories

Status Checkpoints Table

|  |  |  |  |
| --- | --- | --- | --- |
| **Checkpoint** | **Software Design and Engineering** | **Algorithms and Data Structures** | **Databases** |
| **Name of Artifact Used** | Embedded Thermostat System | Embedded Thermostat System | Embedded Thermostat System |
| **Status of Initial Enhancement** | Completed modularization of code, replaced magic numbers with constants, and implemented error handling for UART and I2C initialization | Completed priority-based scheduler with optimized task execution | Integrated MongoDB and developed APIs |
| **Submission Status** | Submitted for instructor feedback | Submitted for instructor feedback | Submitted for instructor feedback |
| **Status of Final Enhancement** | Final review underway based on instructor feedback | Final adjustments and testing in progress | Final database queries, added error handling, and tested API endpoints |
| **Uploaded to ePortfolio** | Project Link and Code Review video uploaded. | Uploaded | Uploaded |
| **Status of Finalized ePortfolio** | In progress | In progress | In progress |

References

*The Rise of Generative AI | J.P. Morgan Research.* (2023, March 20). Www.jpmorgan.com. <https://www.jpmorgan.com/insights/global-research/artificial-intelligence/generative-ai>

How. (2024, November 9). *Mount Bonnell*. Mount Bonnell. <https://www.mountbonnell.info/boca-chica-blastoff/how-spacex-is-revolutionizing-internet-access-with-starlink>