Module 6 Journal

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CS 499 Computer Science Capstone

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## Part One: Two emerging technologies of personal interest.

## Nanosensors and the Internet of Nanothings (IoNT):

First, nanosensors are tiny devices at the nanometer scale designed to detect and transmit information about specific chemical or physical properties. They can be made from various materials, including biological components like bacteria or non-biological materials like carbon nanotubes. Additionally, IoNT involves the deployment of nanosensors that can communicate and share data with each other and with external devices through Internet of Things (IoT) networks. These nanosensors, operating at the nanometer scale, can be embedded in various environments, including the human body, to monitor and transmit real-time data (Garcia-Martinez, 2016).

I believe that computer scientists are essential for developing algorithms that can handle the integration of data from nanosensors with data from other IoT devices. This involves data fusion, analysis, and extraction of meaningful insights. Besides, designing a scalable and efficient network architecture that accommodates both traditional IoT devices and nanosensors is a significant challenge. The integration of nanosensors into the IoT could revolutionize healthcare. Real-time monitoring inside the body can lead to early disease detection, personalized treatment plans, and improved patient care. IoNT can enhance the capabilities of smart homes and cities. Nanosensors embedded in buildings, infrastructure, and everyday objects can provide detailed data for efficient resource management and enhanced living conditions.

Overall, the combination of nanosensors and IoT facilitates highly detailed environmental monitoring. This can contribute to sustainable practices, pollution control, and the conservation of natural resources. The integration of nanosensors into the broader IoT ecosystem can accelerate scientific research by providing detailed, real-time data in fields such as biology, chemistry, and materials science.

## Next-generation battery:

Next-generation batteries, based on materials such as sodium, aluminum, or zinc, aim to address the limitations of current energy storage technologies. These batteries are designed to deliver high capacity, scalability, affordability, and safety. Unlike traditional lead-acid batteries, they avoid the use of heavy metals and caustic chemicals. Zinc-air batteries, in particular, have shown promise in storing significant amounts of energy, making them suitable for applications ranging from powering remote villages to supporting grid-scale renewable energy projects (Carbeck, 2016).

I think computer science plays a significant role in the development of systems for monitoring and managing data related to battery performance. This includes real-time monitoring of energy storage levels, efficiency, and overall health of the battery systems. In addition, algorithms are crucial for optimizing the charging and discharging cycles of next-generation batteries. Computer scientists contribute to developing algorithms that enhance the efficiency and lifespan of these batteries. Next-generation batteries need to seamlessly integrate with smart grids to provide efficient and reliable energy storage solutions. Improved energy storage technologies enable more effective integration of renewable energy sources like solar and wind into the grid. This contributes to a reduction in reliance on fossil fuels and supports a transition to cleaner energy systems. Furthermore, the deployment of these batteries in remote areas, as seen in the examples mentioned, can have a transformative impact on communities without reliable access to electricity. In fact, next-generation batteries play a key role in supporting the transition to a low-carbon or carbon-neutral energy system. This has broader implications for mitigating climate change and reducing carbon emissions. The widespread adoption of next-generation batteries contributes to a significant transformation in societies, providing reliable and sustainable energy solutions.

In summary, next-generation batteries have the potential to revolutionize energy storage and have far-reaching impacts on multiple aspects of society. From enabling access to electricity in remote areas to supporting the transition to cleaner energy systems, the integration of advanced batteries is a critical component of a sustainable and technologically advanced future. The role of computer science in optimizing, monitoring, and managing these energy storage systems is integral to their successful implementation.

## Part Two:

### Status Checkpoints Artifact 1

* In the ClickedItemActivity.java, I aim to extend the functionality of the app by implementing innovative features or functionalities. This may involve using advanced mobile programming techniques, frameworks, or libraries to enhance the user experience or provide additional value to users. (Course Outcome 3)
* Practical Enhancements for ClickedItemActivity.java:
* Implement a feature that allows users to interact with the displayed item, such as adding comments or reviews.
* Enhance the user interface with more dynamic and interactive elements, like animations or gestures.
* Provide options for users to customize the displayed item's details or appearance based on their preferences. In this case, users can choose to display item’s text size (small, medium, or large).

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| 1 | Artifact 1: Software Design & Engineering  Weigh Tracking App |  |
| 2 | Working on Initial Enhancements |  |
| 3 | Submitted, Awaiting Instructor Feedback |  |
| 4 | Working on Final Enhancements |  |
| 5 | Upload to ePortfolio |  |
| 6 | Finalized ePortfolio |  |

### Status Checkpoints Artifact 2

* Practical Enhancement: Further optimization and evaluation of sorting algorithms, particularly quicksort, to improve their efficiency and performance.
* Course Outcome Alignment: This enhancement aligns with Course Outcome 1, as it aims to demonstrate proficiency in sorting algorithms and their optimization, which can support diverse audiences in making informed decisions by enhancing computer system and application performance.

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| 1 | Artifact 2: Data Structures and Algorithms  Sorting Algorithms in VectorSorting.cpp |  |
| 2 | Working on Initial Enhancements |  |
| 3 | Submitted, Awaiting Instructor Feedback |  |
| 4 | Working on Final Enhancements |  |
| 5 | Upload to ePortfolio |  |
| 6 | Finalized ePortfolio |  |

### Status Checkpoints Artifact 3

* For the ProjectTwoDashboard.ipynb artifact, I can align practical enhancements and intended course outcome 3: Building a full-stack application using different programming languages (e.g., Node.js for the back-end), demonstrate the ability to work with multiple programming languages to create a full-stack application.
* Implement a backend using Node.js, Express, and MongoDB to handle data storage and retrieval.
* Create RESTful API endpoints in Node.js to communicate with MongoDB, allowing the Dash application to fetch and update data.
* Adjust the current MongoDB operations in your Python code to utilize the API endpoints provided by your Node.js backend.
* Ensure that the Dash application interacts with MongoDB through your Node.js server rather than directly.
* Set up communication between your Dash application and the Node.js backend. Dash can make HTTP requests to the Node.js server to fetch data or send updates.
* This outcome aligns well with the development of a data dashboard using Dash, which involves integrating Python (Dash) for the front-end with MongoDB as a NoSQL database on the back-end.

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| 1 | Artifact 3: Databases  International Animal Shelter Project  ProjectTwoDashboard.ipynb |  |
| 2 | Working on Initial Enhancements |  |
| 3 | Submitted, Awaiting Instructor Feedback |  |
| 4 | Working on Final Enhancements |  |
| 5 | Upload to ePortfolio |  |
| 6 | Finalized ePortfolio |  |

# References

Carbeck, J. (2016, June 23). *These next-generation batteries could end energy poverty*. Retrieved from World Economic Forum: https://www.weforum.org/agenda/2016/06/next-generation-batteries/

Garcia-Martinez, J. (2016, June 23). *World Economic Forum*. Retrieved from Here's what will happen when 30 billion devices are connected to the internet: https://www.weforum.org/agenda/2016/06/nanosensors-and-the-internet-of-nano-things/