6-1 Journal: Emerging Technology and Artifact Update

Part One:

1. **What is the identification and description of each technology?**

   Internet of Things (IoT): Internet of Things (IoT) refers to a network of physical devices which communicate and exchange data with each other over the Internet. These "things" can be ordinary household objects to anything that is sophisticated and used primarily within industries as tools (Lynn et al., 2020). It encompasses various applications and technologies such as but not limited to wearable devices, smart homes, industrial IoT and smart cities(Omrany et al., 2024). Notable enabling technologies related to these are sensors, connectivity, data processing and user interfaces (Lynn et al., 2020; Omrany et al., 2024). The primary goal of IoT is to enhance convenience, efficiency and also automation by enabling real-time data collection, analysis and hence action (Nagajayanthi, 2022).

   Advanced Air Traffic Management Systems: Advanced Air Traffic Management (ATM) systems are sophisticated frameworks which are designed to manage air traffic efficiently and safely. These systems integrate various methodologies and technologies to help optimise the flow of aircraft at airports and within the airspace (Reitmann & Schultz, 2022).

2. **What are the likely impacts on computer science or your career?**

   Advanced Air Traffic Management Systems: Advanced Computer Science techniques (particularly artificial intelligence and machine learning) are integrated into the aviation industry to enhance the efficiency and safety of air traffic by optimising flight paths, managing airspace dynamically and also predicting potential conflicts (Degas et al., 2022). For computer scientists, this comes with the opportunity to develop cutting-edge technology such as AI-driven decision support systems, real-time data processing and predictive analysis (Reitmann & Schultz, 2022). Furthermore, the complexity of these systems demands that cybersecurity measures be stepped up, meaning that there are opportunities for specialists in this domain (Mardiks, 2023). As

someone who is close to the aviation industry and is on the receiving end of air traffic control instructions frequently, I'm constantly aware of how important safety is when we are up in the sky. An enhanced air traffic control management system would strike me as progressive and would increase the confidence that I have in that I can take my passengers up and land safely every time. Additionally, should there ever be an emergency situation, I would feel assured that I have eyes on the ground who can guide me to safety.

Internet of Things: IoT is a transformative technology that connects everyday objects to the internet, enabling them to send and receive data. This connectivity drives advancements in various sectors, including healthcare, agriculture and smart cities (Lynn et al., 2020). For computer science professionals, IoT's rapid growth means that demand for skills in cloud computing, edge computing and AI is increased, meaning that there is significant career potential in these areas (Khanna & Kaur, 2020). From a career standpoint, having already used IoT on my home in Dubai, I'm quite excited about the fact that I can open classroom doors for people at work without even being physically present. I can also switch off lights that have been left on, begin to heat my lunch up and even make sure that my cats are fed if I'm having a particularly busy day. While it may not have anything to do with the career I'm embarking on, I feel that the impact and potential of IoT can change a lot about how effectively we can operate in our daily lives.

3. **How might the two technologies impact humans, communities, or the world?**

Advanced Air Traffic Management Systems: These have the potential to significantly enhance the efficiency and safety of air travel. By incorporating automation and artificial intelligence, air traffic management systems can manage increasing air traffic volumes without overloading human controllers, thereby reducing the risk of human error and improving overall safety (Idris et al., 2020). Advanced Air Traffic Management Systems can also reduce fuel consumption by optimising flight paths and thereby leading to lower greenhouse gas emissions and a smaller environmental footprint (Kopardekar, 2019). These advancements can support economic growth by facilitating smoother and more reliable air travel, which is important for global trade and tourism industries (Mardiks, 2023).

Internet of Things: IoT is transforming a number of aspects of daily lives by connecting everyday objects. This means that they can collect and exchange data between the systems. In smart cities, IoT can improve urban living by optimising traffic flow, enhancing public safety through smart lighting and surveillance systems and also reducing energy consumption(Reitmann & Schultz, 2022). Furthermore, the healthcare industry also benefits from IoT, enabling them to track patients' health in real-time and thereby offering more personalised medical care (Al Khatib et al., 2024). On a personal note, I've experienced various levels of IoT within my housing area in Dubai, where irrigation (due to the dry weather conditions in the desert) and energy conservation were controlled by devices that were connected to computers. It was interesting to see as after some time of us living there, we were able to anticipate our bills better, and that we could always come home to a cool house. We could also keep our cats fed and sometimes even dinner heated up while we were out at work.

4. **Which course outcomes have you achieved so far, and which ones remain?**

So far, I have achieved all five course outcomes spread across my three enhancements. There are no remaining course outcomes to meet. My outcomes have been met through comprehensive documentation in each of my projects, making them open-source and paying attention to industry standards as well as showcasing my abilities in all three areas.

Course Outcome 1 was achieved by making all three of my projects open-source, thereby encouraging collaboration and inviting technical and non-technical people alike to contribute to the project. I also made sure that my code was well-commented so that people knew how to reference the parts of my code they were concerned about. I also mounted two of my enhancements on Docker so that people could easily access my work without having to worry about installing much else. This was something I learned in CS 465 – Full Stack Development.

Course Outcome 2 was achieved in all three enhancements by creating professional-quality communications in the form of comprehensive README documentation and narratives that ensures that anyone, regardless of technical ability, can understand the work I do in terms of its scope and functionality. This makes the project accessible to a wide range of audiences.

Course Outcome 3 was demonstrated where I used Dijkstra's Algorithm and Depth-First Search (DFS) in Enhancement Two to enhance my Python game. These examples reflect my ability to design and assess computing solutions that effectively address specific problems. In this case, I created a cheat mode for my players to get through the game in a unique manner. The DFS and the Dijkstra's Algorithm found an efficient path through to the end and also revealed the quiz answers to make the game an effortless affair. Through this process, I considered the trade-offs involved such as balancing efficiency with complexity and ensured that the solutions that I implemented were appropriate for the situation.

Course Outcome 4 was achieved in my first enhancement and also in my third enhancement, where I integrated modern web development frameworks. This shows that I am able to work with current and modern industry-standard tools such as TypeScript. Doing so highlights that I am constantly learning and ready to keep up with the latest trends in order to deliver value and accomplish industry-specific goals.

Course Outcome 5 was achieved in my third enhancement where I created a MongoDB database and turned it into a FastAPI, then connected it to my application. This approach enhances security by placing the API as a layer between the app and database in MongoDB, reducing the risks of accessing the database directly. MongoDB is flexible and does not strictly enforce a schema, making it ideal for the type of content that I am using. To meet the security mindset requirement, using FastAPI helped me control that only valid requests reach the database, and I could also control how the data is accessed and processed. I also implemented basic authentication mechanisms so that I am the only one that can create, update or delete records, thereby giving me an extra layer of protection and control over the system.

Part Two:

Provide an update to your instructor on your progress with each category of artifacts for the ePortfolio:

- Software design and engineering
- Algorithms and data structures
- Databases

Checkpoint	Software Design and Engineering	Algorithms and Data Structures	Databases
Name of Artifact Used	CS 210 - Programming Langauges	IT140 - Introduction To Scripting Adventure Game	CS 250 - Software Development Lifecycle Travel website
Status of Initial Enhancement	Completed. **Enhancement made:** - Front-end using Next JS 14, Tailwind and TypeScript.	Completed. **Enhancement made:** - Use Dijkstra's Algorithm to create a "cheat code" for players to find a simple way to get to the end of the game. - Depth First Search (DFS) for cheat mode to show answers to quiz questions.	Completed. **Enhancement made:** - Adding a database via FastAPI (Python) to a version of the "website" to dynamically populate it. - FastAPI with Destinations, Countries, Descriptions and Links created in Python, deployed on countriesapi.crabcakes.dev . Database is hosted on MongoDB, turned into FastAPI to then implement into an application.
Submission Status	Submitted by Sunday 21/9/2024	Submitted 25/9/2024	Submitted.
Status of Final Enhancement	-	Changes made: - Took photos of my game being played. Put it in my narrative. - Uploaded to ePortfolio.	Changes made: - Updated narrative and README to include that I used MongoDB, and explained some of its features and reasoning behind my choice.
Uploaded to ePortfolio	Uploaded.	Uploaded.	Uploaded.
Status of Finalized ePortfolio	-	-	Prepared to submit. Just need to add a CNAME to point at my crabcakes.dev

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