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CS5001

Professor Annexstein

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Individual Capstone Assessment

The senior design project that we will be focusing on throughout the semester is primarily based upon bridging the gaps between hardware, the internet of things (IOT), and virtual reality. As a computer scientist, much of the academic content we engage with is built around creating efficient processes to transfer data and commands from one system to another. Over the past four years at the University of Cincinnati, I have realized that one of the biggest areas of growth that society has yet to see is in the ability to visualize this data in a variety of mediums. Currently, most data visualization is done through basic charts, graphs, and images. However, advancements in the processing power of virtual reality systems have created a new medium for spatial data visualization. Our senior design project is aimed at providing users with the understanding that the current data visualization mediums of phone screens and web browsers may soon become obsolete. Furthermore, providing a practical application within virtual reality will hopefully open conversations into how this technological advancement can create meaningful change in the real world.

The computer science curriculum has provided a variety of meaningful courses that will shape the development of this project. CS2028C Data Structures provided the fundamental aspects of how data will be passed from our automotive sensor to an interactive IOT platform. CS4003 Programming Languages provided an understanding of how object-oriented, functional, and other programming paradigms can be utilized to optimize the performance of the entire system. Likewise, CS4065 Computer Networks and Networked Computing outlined how communication protocols will be necessary to pass data across a variety of mediums. Lastly, the engineering design process taught throughout EECE3093C Software Engineering will provide our team with the structure to carry out all tasks associated with project management. This course taught the fundamentals of organizing use cases and user stories to generate meaningful requirements to guide our project deliverables. Moreover, the team building, and organizational tools discussed throughout the class will allow our team to effectively divide the project into manageable tasks.

Although each co-op experience provided me with unique tasks and learning opportunities, I noticed the most professional growth as a virtual reality and software development co-op at ITE. During this experience, I was tasked with designing a program to generate a three-dimensional data visualization of a bill of materials. This task required applications of database theory, data communications, and advanced trigonometry. Moreover, researching and developing programs in virtual reality using the Meta Quest 2 gave me an increased depth of knowledge into how these worlds can work together. Overall, I believe these skills will be applied throughout this project, especially in the development of a virtual reality interface. Moreover, nontechnical skills like interdisciplinary team activities will play a pivotal role in ensuring the successful implementation of our design. Although the members of our project team have a wide range of knowledge and experience, understanding how to effectively communicate requirements throughout the design process will allow us to have the best overall experience.

Although the current overview for our project design will require many different programs and communications, I am motivated to see how our implementation can create an immersive experience across a variety of platforms. Due to my work in virtual reality, a platform primarily designed for gaming, I am excited to see how we can combine IOT into a three-dimensional space. I believe our preliminary solution to this project will include the usage of a Raspberry Pi connected to a vehicles OBD-II port to measure automotive sensors. This data will be passed via MQTT to Losant, an out-of-the-box IOT platform that will act as an advanced database system for our project. From there, we will design multiple web browser applications to act as user interfaces for interacting with the live sensor data. Next, we will create a three-dimensional model of a vehicle that will hold the approximate positions of each sensor. Inside of a virtual reality headset, a user can have a spatial understanding of this model and each sensor will have a steam of interactive live data.

The results of this project will be the deliverable of a holistic hardware and software system that provides an easy-to-use, intuitive solution for car maintenance identification. If our team can create a successful implementation of our design, we hope to accomplish the generation of a state-of-the-art real-time virtual reality program that can allow a user to easily identify how their car is performing, and what attributes are most likely to fail next. I will consider our project completed when a user with sufficient technical knowledge can operate the system without any supplemental instructions and understand how the solution will benefit their day-to-day lifestyle. Overall, I believe my individual contributions will be evaluated by my personal attention to detail and the quality of product that we are able to produce. I look forward to completing the engineering design process and understanding how the linkage of hardware, software, IOT, and virtual reality can solve problems in our day-to-day life.