

UNCC_WORK Project - Statement of Work (SOW)

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1 Objective

The objective of the project is to develop an interface using the Internet of Things between devices such as cameras, embedded devices, wristband, and augmented reality equipment to detect unsafe work conditions for highway construction workers. A virtual testing site should be developed as well in order to safely verify that the project works correctly and could be used in those environments.

2 Scope

The scope of this project is for the team to develop interfacing between the embedded devices, cameras, wristband, mobile application, and augmented reality glasses. Modeling a schematic of the IoT devices will be conducted with the purpose of developing the backend infrastructure to test communication among each device. A simulation software may be modeled as well in hopes to conduct safe testing on the project without the necessity of physical testing on-site.

3 Background

An NVIDIA XAVIER NX will be used to perform the real time processing required to deliver the final product. In order to properly interface the GPU with the multiple cameras needed, a way for the devices to communicate must be developed. Deep learning algorithms will be pushed to the XAVIER NX board and by interfacing with the camera will analyze potential safety hazards based upon trajectory, speed, etc. of incoming vehicles. This information will be communicated to the augmented reality system that is operated by a mobile application and displayed through a text, or a verbal alert to a roadway worker. Additional information and data will be gathered through a wristband worn on a worker to further analyze the safety hazards.

4 Performance Specifications

Performance specifications can be found in UNCC_WORK_Performance_Specifications_RevA referenced in section 9 (Hupka, Tennant, Pecoraro, Clampett, Zaleski 2020).

5 Technical Approach

The scope of the project is changing so approaches will be subject to change as the group progresses. The team lead should assess the group to learn their strengths and weaknesses. Partitioning any work done individually will be provided based on this information. Overall, the team will seek to complete delivery of backend communication of the devices, wristband integration, mobile application development, and a basic visualization software as stated in section 7. Approaches to these tasks will be developed as the team progresses.

6 Project Management

This project will include five team members, two of which are computer engineering majors, two are electrical engineering majors, and one member is a double major in both electrical and computer. Duncan Tennant and William Clampett are electrical engineers, Damian Hupka and Zachary Zaleski are computer engineers, and Nathan Pecoraro is the double major. Zachary Zaleski will serve as the project lead. Dr. Hamed Tabkhi is a supporter and mentor for the project along with Dr. Nan Bousaba.

The group will work together to complete a schematic of the wristband and mobile app for the conceptual design review. Afterward, when the group is given access to the lab, the group will begin to work more independently.

Along with the supporter, all graduate students working in the TeCSAR lab will be available for any help needed. All software will be available in the TeCSAR lab for testing and development. Simulation software will also be available to demonstrate functionality for the final product of the project.

7 Deliverables

Deliverable:	Description:	Date:
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Conceptual Design Review	A basic schematic will be designed and reviewed.	10/14/2020
Preliminary Design Review	More information will be decided as the date approaches.	11/25/2020
Publish IEEE Paper	Construct an abstract and completed IEEE adherent research paper	Abstract by 12/07/2020, completed paper by approximately January 2021
Backend Communication Infrastructure	Enable each device to wirelessly communicate.	Initial EXPO 12/17/20 Prototype developed by end of March 2021
Mobile app development	Develop a mobile application to interface with the augmented reality goggles	Initial EXPO 12/17/20 Prototype developed by end of March 2021
Wristband Integration	Further analysis of potential hazards apart from data gathered from the camera.	Initial EXPO 12/17/20 Prototype developed by end of March 2021
Basic Visualization Software	Develop basic virtual reality software to demonstrate functionality of the system safely.	Initial EXPO 12/17/20 Prototype developed by end of March 2021

8 Budget

A \$6,000 fund was given for this project by Dr. Tabkhi from the NSF fund. Approximately \$1,500-\$2,000 of that will be expected to be spent over the course of the project.

9 References

1. Hupka, Damian, Nathan Pecoraro, Zachary Zaleski, William Clampett, and Duncan Tennant. "[UNCC WORK Performance Specification RevA](#)," September 29, 2020.