Disaster Drone - CSE Team

CSE Senior Design

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Executive Summary

The goal of this project is to develop a cutting-edge system that utilizes drone, photogrammetry, and virtual reality (VR) technology to allow State Farm agents to remotely assess and process insurance claims for disaster scenarios. The autonomous drone will have object detection capabilities and will be deployed to the disaster area to capture images, which will be uploaded to the cloud for photogrammetry processing. We are working in collaboration with a team of EE senior design students who are developing and deploying the drone. After the photogrammetry process, the resulting 3D model will be rendered in a VR environment, enabling the user to walk around and pinpoint specific locations of damage. This data will then be sent to a website where the agent can add text descriptions to each location. Lastly, the information will be compiled into a comprehensive document for filing an insurance claim. By streamlining the claim process, the technology will enable State Farm agents to quickly and efficiently assist their clients in times of need.

Background

Photogrammetry is the process of extracting 3D data from images. We are using **Reality Capture** for this process. It takes in images and turns them into a 3D model.

Unreal Engine is the game engine we are using to develop the VR Environment. We built our project off of the VR Template project created by Epic Games.

Google Cloud Platform is our choice of cloud technology for deploying our GPU compute engine (VM) that does the image and VR processing, housing cloud functions to schedule VM start and shutdown, and object storage.

MongoDB is a NoSQL database that uses JSON-like formatted objects to store information. This is how the case information is stored for each insurance case on the website.

React is JavaScript's most popular frontend framework. It allows for reusable components and is what we built for the disaster drone website.

The **automation** has been developed with a combination of bash scripting, python scripting, and cloud technologies.

Conceptual Design

0. Drone

The drone takes images of the disaster scenario from all angles and sends them to the Google Cloud Bucket.

1. Google Cloud

The Photogrammetry (PG) process takes place on a virtual machine and the output is a 3D model of the disaster area and a list of the camera names and their locations. Then, the 3D model and the camera locations are imported into the VR Environment.

2. React App

Once the PG process is complete, the website displays the new case. Here, the agent can download the updated VR environment.

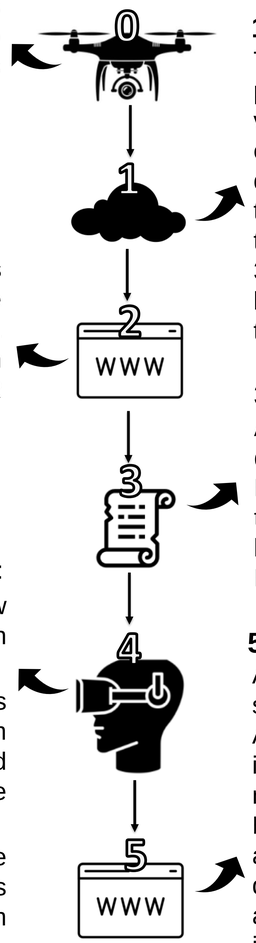
3. Unreal Script

After the agent has downloaded the VR Environment, they can run the Unreal Script which launches the VR Environment.

4. VR Environment

VR Environment Features:

- Move around and view the disaster scenario in VR.
- Place cones in areas where an insurance claim needs to be made and display the original image for approval by the agent.
- When the agent exits the game, the image names associated with each claim are sent to the cloud.



5. React App

After the image names are sent to the cloud, the React App then displays the images from the claims marked in the VR Environment. Here, the agent can add text describing the damage and any necessary info for an insurance claim next to each image. Lastly, the images and the text associated with it can be downloaded as a PDF to be used in the insurance case.

Gathering Data

As the CSE team, we built our own drone to gather a dataset for testing our system. Since the EE team we are collaborating with wasn't ready to fly their drone, we took matters into our own hands. We focused on a small house built in 2017 as a senior design project for CAPPA students. You can see the 3D model of this house produced by our system in the results tab on the left.

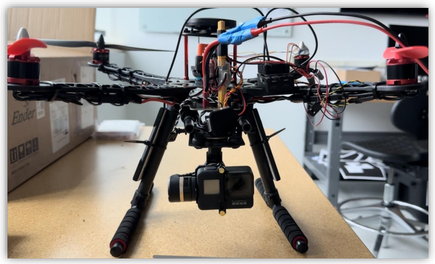
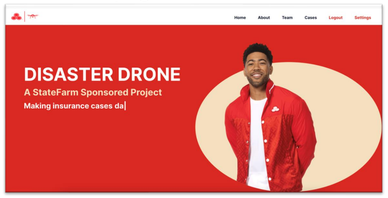


Figure 1. CSE Drone

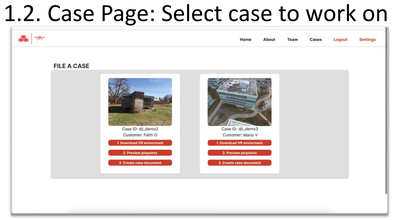
Results

React App

1.1. Homepage



1.2. Case Page: Select case to work on



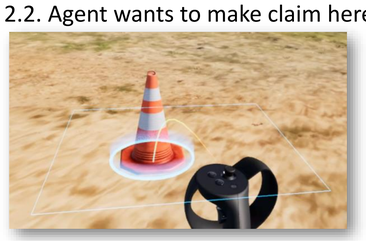
1.3. Gallery Page: Preview claims from VR.

1.4. Document Page: Download PDF

VR Environment

2.1. View 3D model in VR.

2.2. Agent wants to make claim here.



2.3. Cone is placed and closest drone image displayed

2.4. Exit VR Env. and Send data to React App

Conclusions

Currently, our design has matched all our client's original requirements. We are working to make the system work seamlessly as well as improve the aesthetics and capabilities of certain portions. First, we'd like to acknowledge State Farm for sponsoring our project. We'd like to give a special thank you to Amy and Dawsen from State Farm for taking time out of their work schedules to meet with us each week. We would also like to acknowledge Dr. McMurrough for providing us with the continuous support and resources needed to meet all our requirements. Additionally, we'd like to acknowledge Dr. Conly for providing us with the resources needed to develop our VR Environment. Lastly, we acknowledge Professor Wagley for providing insight into the capabilities of Unreal Engine while in the conceptual design phase.

References

1. Booth, H. (2017, March 30). CAPPA senior design project aims to reduce residential footprint. UTA. Retrieved April 13, 2023, from https://www.uta.edu/news/news-releases/2017/03/30/cappa-tiny-houses