Ecological Disasters

Khalid, Yousuf

My project idea for drones is along the same line of disaster response that we discussed last meeting. We can use drones in situations of natural disaster evacuation and rescue, with drones acting as warning systems and scouts. However, something we didn't consider during the meeting is drone use in ecological disasters as well. Say an oil pipeline bursts in the Gulf of Mexico, releasing millions of gallons of gas and oil. Drones can greatly assist in clean-up efforts and prevention efforts, scouting for oil slicks and potential pipe leaks. These same principals can also be applied to many other ecological disasters that have appeared to only worsen throughout the decade, such as forest fires in California, Australia and Brazil, with drones potentially being used to identify areas of high vulnerability to fires and scouting ahead to find small pockets of forest that may already be on fire. I'm looking forward to our discussion on Saturday, thank you!

Natural Disasters

Madhav Thamaran

During or after any form of natural disaster, there is panic, and people oftentimes flee the city in search of safety. However, this creates more panic as people rush into the highways to speed away from the disaster because this state of fear causes people to not think rationally, sometimes leading to car crashes. This leads to more panic as people are left stuck on the road with no safe path out. This is why it is important to activate a drone guided system for people to follow in cases of emergencies like tornadoes or other natural disasters.

Using drones to assist drivers can be very useful as it saves drivers the time it takes to figure out a way out of the danger zone. Using predetermined algorithms, it is possible for drones to alert drivers the fastest possible route away from the danger. Also, it is possible to intentionally move cars into different paths to divert traffic into different paths to increase speed. If every car was alerted to go to the same path, the speed of the cars would decrease. Drones could also alert emergency services of any stopped cars on the roads. Using image recognition, we can identify if an object is idle on the road at any given moment and alert emergency services of where the object is, whether it is a car or anything else.

Another instance where we can use drones during disasters is getting emergency services to people who are in critical condition. In many instances, ambulances have a hard time arriving where they need to on time because they have to go through traffic. They notoriously take a lot of time to respond to a call; sometimes even up to 30 minutes. In this time, the patient’s condition may have gotten worse. Although they have sirens, it takes time for drivers ahead to recognize the sound and move aside in an orderly manner. This often leads to ambulances having to stop and wait for cars ahead to move out of the way to move forward. This is a big problem because it can cause ambulances to not reach their destination on time and it leaves the patient suffering for longer. One way we could help solve this issue is by using drones to signal drivers to move aside ahead of the ambulance. This would lead to faster response times and more people able to get help during natural disasters.

The usage of drones during an evacuation

By: Jayanth Pandit

Civilian evacuations are almost always extremely chaotic, difficult to organize, and almost impossible to control. Often, the panic of the danger forces people to take on an every-man-for-himself attitude and act incorrectly or irresponsibly. The instructions of police and evacuation officials often get lost in all the traffic and many individuals don’t receive the vital information that could save their lives. A failure to receive or follow safety instructions during an evacuation can lead to people getting lost, trapped, or even killed.

In such circumstances, drones can be very useful, even crucial, to effectively deliver a population of people from danger. There are some specific capacities that I believe drones could serve in to help evacuations go as smoothly as possible. The first of these capacities is guidance. Drones can act as a signal to evacuees to let them know which direction they should go and lead them to safety. Drones can also act as routers and allow for messages sent from a coordinating office to reach evacuees’ phone quickly and efficiently. Drones can also serve in search and rescue capabilities by using face recognition software to seek out lost individuals and bring them to a safe area. Lastly, drones can be used to find safe paths and determine a piece of infrastructure's structural integrity. This could mean determining if a bridge will be able to bear the weight of a group of evacuees. This could also mean finding a safe path through a pile of rubble where something won’t crash onto the evacuees. Such capacities are incredibly important and could be augmented by the use of drones.

Any wide-scale humanitarian effort has required the use of signals and signalmen for communication, information relay, and interconnectivity. Every major military force and public safety force has a signal corps through which information is disseminated among the various workers and then to the people involved. Drones can be incredibly important in this role as they could easily get to places that telephone lines and electric cables cannot reach. If a group of evacuees is trapped inside of a building, a drone could seamlessly fly into the building and deliver messages either by routing information from some central communications center or by directly announcing the information to the stranded people through visual or audible means.

The usage of drones in such high-capacity services has mostly been restricted to military purposes with many emergency and public safety services not fully using drones to their full potential. With this project, we can hopefully expand the capabilities of drones to serve in capacities like guidance, signaling, search and rescue, and path searching. This serves to make evacuations easier for the officials, the evacuees, and the general public and lessen the chaos and strain that evacuations often entail.

Pre and Post disaster rescue with drones and robots

(Dhiraj Bijenepally)

Pre-Disaster plan

1. Set up multiple pre-planned evacuation routes with drone
   1. One main path of evacuation
   2. Multiple alternate paths of evacuation
2. All of these plans should be pre-planned with exact spots where the drone will be
   1. Areas such as intersections, along highways, and so on
3. Dispatch drones when news of the disaster
   1. Drones must be prepped with bright lights (red and green) and a speaker
4. When dispatched the drone should go to the road that is the main escape route for the area.
   1. When the drones are present here the drone should glow green to indicate the safe path.
5. Other extra drones should block other roads and glow red to indicate that that is the wrong path
6. During this whole process, the Drones should broadcast the direction to the main path
7. Also during this process, there should be survey drones that use image sensing to find crowded areas and use an alternate path to lead those people and break up the crowd.
   1. Each route should have its own survey drone so that the density of people is always monitored
8. In case of an ambulance, the survey drone will notify the detection of the ambulance to the system and the ambulance will be led to the path with the least density
   1. Another idea is to have a drone for the ambulance to follow and the deon will lead it the best way
9. These steps will repeat until the evacuation is complete

Post Disaster plan

1. Release drones into a disaster
   1. The drone should be equipped with loudspeakers and a multitude of heat sensors.
2. The area will be should be divided into the number of drones and each drone should be deployed to that area.
   1. This method is similar to a grid search
3. Each drone is responsible for searching an area thoroughly.
   1. First-round will be with heat-sensing
   2. If heat is detected in the right range then the onboard camera will run image recognition to detect humans.
4. If a human is detected then the information is sent to the station then another drone is sent to the area
   1. While the drone is going to the signaled area its will scan the ground with LiDAR to find the optimal path for land vehicles
5. The second drone scans the area again to make sure that the statement of the first drone is accurate
   1. The drone then sends a signal to the land robot or a car with the navigation
6. Then the car or robot arrived with the personnel required to search and rescue the person found
7. In case no heat signatures are found then the drone will still search the area with image sensing to find any human remnants.

Human Recognition

(Harsha Kota)

I believe that this research project depends on the certain story that needs to be conveyed to the reader. When given the challenge to prepare an emergency communication system using a drone and an unmanned ground vehicle, it is important to understand the disaster that forces the need for an altered communication system. Basically, there are two types of disasters: natural and man-made. While the natural disaster list contains Tornadoes, Storms, Hurricanes, Floods, Wildfires, Earthquakes, and Drought, the most common man-made disasters are mass violence and terrorism. For most, if not all, of the above examples of disasters, it is important to deal with damaged properties and to aid people.

Given a plethora of options, it is easy for any human to get confused in a time of panic. Only an algorithm or a computational device is capable when used properly, to choose the right decision. I am working on Human Recognition. Although it has proven to be incomplete, currently, the final product involves a drone that is can be controlled using a computer. A live feed is shown where the drone is able to identify a Human being. This can be, then, applied to direct other drones or an unmanned ground vehicle to its location. But this can be improved upon. For example, through Dhiraj’s work. Currently, the drone’s flight path requires human control. Using his work, a declared flight path can be set and the need for human control eliminated. Unfortunately, there isn’t a speaker or microphone attached to send or receive any sort of human communication, but this can always be changed. Adjusting to provide such tools has limitless uses. A detailed evacuation protocol, depending on the location of the drone, can be sent. Communication lines can be established to send and receive information. Through another computational code, the drone can automatically, share the nearest shelter, checkpoints, or safe zone depending on its location.

Another common application is dealing with missing or trapped humans. Drones and unmanned ground vehicles can be equipped with thermal sensors. Using a similar code that is used to detect humans, images, or live video feeds enhanced with thermal sensors can provide assistance with tracking missing or trapped humans. Apart from the sensor itself, only the processing electronics are required since the drone is already equipped with a lens and mechanical housing.

The method I am using to track humas is through the Harr Cascade Method. It is similar to the code that Madhav used to stop the drone when a human face is detected. The difference is that I am tracking for the entire body, not just the face. Through research, I came across a working code published on GitHub where a dataset of celebrity faces was used to identify a name to a face. Other works like this present a solid foundation in working towards a practical solution to the problem that we are solving as a group.