# PHYS CS 15C Research Proposal
# Remotely Operated Vehicle with Visualized Terrain

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## 1 Introduction

Often times there exist terrain on which people cannot tread on. Imagine the complex structure of the debris after an earthquake or hurricane, where an external force of a human stepping on it might cause additional collapse of the structure, putting victims under it in further danger. However, we would like to conduct massive search for survivors under the debris. General search could be done by some high-end device far away, and close up confirmation for each potential signal of life could be carried out by smaller sized vehicles such as drones and ground robots. While drones have high mobility around, the ground robot can go under small holes closer to the survivors. By carrying necessary communication tools and sensors, we could get specific conditions of the survivors, which would be immensely helpful in forming the rescue plan accordingly.

However, even when a signal of life has been detected, there are still obstacles. Removing the top layers of debris might do damage to the lower layer. Depending on the actual situation of the victim and the structure above the victim, a mature rescue plan might take hours in finalizing. Time is an important factor in this process. To earn more time and make sure the victim can stay with us, a ground robot that have access to the victim could then provide necessary care such as food, water, conversation, and hope to stabilize the conditions of the victim.

In this project, we propose to control the robot with a visualized terrain that serves like a sandbox in military planning. This visualized terrain inspired by project Electrick [?] will provide visual aid to help anyone just arriving grasp the overall picture and the current progress of the rescue plan.

Viewer should be able to identify all the potential, confirmed, and successfully saved signals of life as well as the location of the robots and their past and queued trajectories and missions.

# 2 Significance

Traditionally, to manipulate a robot, people need to be trained how to master its control pad before actually proficient enough to conduct the task. Meanwhile, the commander of the task is not usually the person who directly manipulate the robots and his/her command can be delayed when delivering to a certain personal. Moreover, there exists a possibility that the person in charge of the robot-manipulation misunderstands the commands and leads to a fatal failure.

Controlling a robot with a visualized terrain will not merely keep all the personals in the commanding room aware of the most recent update of the situation, but it will also save the time for delivering commands and avoid misunderstanding. To control the robot, the commander just need to use his/her finger or baton to draw a path on the visualized terrain. Then, the touch sensing module from the terrain will send the information of the path to the robot. After receiving the information, the robot will automatically follow the designated path and reach its destination.

Therefore, this visualized terrain will provide us with more efficiency and accuracy for the rescue mission. In addition, the person who operates the robot does not need to know the technical details to manipulate the robot.

# 3 Objective

1. Construct the conductive control pad that serves as the visualized terrain model;

2. Read in path planned by touch control on the terrain model;

3. Build the self-balancing robot with wireless receiver module;

4. Move the robot according the path planned on the terrain model.

# 4 Methodology

# 5 Proposed Project Timeline

| Research Timeline | |
|---|---|
| Week | Description |
| 1 | Order necessary parts |
| 2 | Assemble the conductive layer control pad, supply constant AC current through one pair of electrodes, and measure the voltage difference at different vertices |
| 3-4 | Supply current through all adjacent pairs of electrodes, and readout the voltage differences at all other vertices |
| 5-6 | Visualize the 2-D voltage current density when touching the control pad with tomography imaging |
| 7 | Output coordinate of touch on the control pad; assemble the self-balancing robot |
| 8-9 | Assemble the self-balancing robot and the bluetooth module |
| 10 | Move the robot with control robot |

# 6 Conclusion

The rescue process is often complicated for survivors in debris left by a natural disaster such as earthquake and hurricane. In order to save time and stabilize the survivors, we propose this remotely operated ground robot with visualized terrain that can serve as visual aid in planning the process and communicating the rescue end directly with the survivor end.