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. It serves as an visual aid in helping any people 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

The conventional control of the robots still have room for improvements. Traditionally, people need to be trained to operate certain robots properly by using its control pad before actually doing the task. Meanwhile, the commander of the task usually is not the person who directly manipulate the robots and his/her command can be delayed. Moreover, there exists a possibility that the personal in charge of the manipulation misunderstand the commands and leads to fatal error.

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 when delivering commands and avoid misunderstanding of the commands. 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 for the robot. After receiving the information, the robot will automatically follow the designated path and reach it destination.

Therefore, this visualized terrain will provide us with more efficiency and accuracy for the rescue mission.

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