**EXIT FINDER – ILAN VAINBLAT & AVIV ASTA**

**A screenshot of a computer screen

Description automatically generated**

**The project evolution:**

Our project went through several iterations of ideas, goals, and restrictions. Initially, we had two ideas for a project. We had a third idea; essentially a small scale github for hardware design but after hearing the requirements we realized It doesn’t fit the lab’s theme. Our two ideas were:

1. Point a camera at a surface, at a certain time, a projectile is shot behind the camera, predict where on the surface the projectile will land. Usage example: Iron Dome like detection system from high altitude.
2. In a room, use an infra-red (thermal) camera mounted to a drone, and navigate towards a person in the room. Usage examples: suicide attack drones, supply drones.

After discussing the matter with Dan, we decided to focus on the second option. We started researching what cameras are available, how their api looks etc. We encountered a problem, the first of many to come: All the cameras we could easily find were too heavy for a small drone. On the first weekly Wednesday meeting we asked Dan about the matter, and he let us know that the lab might not even have a thermal camera, he told us to instead use ToF (Time of Filght) cameras – cameras that use lasers (or other technologies) to measure the distance to points in the frame. This is a big diversion from our initial goal, nonetheless, we proceeded. We started off by researching technologies for SLAM (Simultaneous localization and mapping), adhering to Dan’s advice, we focused on ORB-SLAM and on COLMAP:

The COLMAP installation was a relatively straightforward and after taking several pictures of an object, we managed to get a mapping (see appendix 1). ORB-SLAM wasn’t so easy: we started by trying to download the newest version: ORB-SLAM3, to do this, we created an ubuntu VM in Oracle’s VirtualBox, Ilan already had an ubuntu22 image from a previous project so we used that, after following the instructions on the official GitHub repo (<https://github.com/UZ-SLAMLab/ORB_SLAM3>), it didn’t work. After some digging around, we found out that in VirtualBox, giving a user sudo permissions doesn’t really work, the only reliable way is to modify the /etc/sudoers file. After using this method to give our user sudo permissions, it still didn’t work. Since ORB-SLAM3 is relatively new, we decided to try with ORB-SLAM2, using what we’ve learned, we tried to install it, and again, it didn’t work. After some digging around, we found out that ORB-SLAM2 was meant to be used on Ubuntu18, creating a new VM, it still didn’t work, we found several Github repos with explanations on how to install it, we found several, hour (ish) long YouTube tutorials on how to do it, nothing worked. After many attempts, (and many VMs) we learned that there is a simulator. Using the simulator’s guide, it still, didn’t work, turns out, we had Ubuntu22.06 and not Ubuntu22.04. Creating a new VM with the right Ubuntu version, the download finally succeeded, trying to run it still didn’t work. Yet, after several headaches, we managed to get it working.

Roughly at this time we started to work separately: Ilan on the simulator side, Aviv on the theoretical side. We found several academic papers that deal with scanning using ToF data (see appendix 2), additionally, since we still didn’t know what api amd file formats to expect for the ToF camera, we found a tool called “ImageMagick” that swiftly convers image file formats, we even wrote a script