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Project Requirements (Draft)

Requirements

- 1) **R1** User will be able to generate a 3D model file upon telling the software to scan the pothole(s) it is currently viewing. This file is based on the PLY format, which is a data format used by the Stanford University graphics group. The .ply format is a simple format that stores data in a text format.
- 2) **R2** The software will be able to translate the generated .ply file into an array. This array will be used to establish a hyperplane that references the road's slope.
- 3) **R3** The software will use the reference hyperplane to calculate the volume (and mass if density was provided) within one standard deviation of the actual volume (or mass) required.
- 4) **R4** The software will store all of its calculations in a local SQLite database. This allows the software to keep track of all calculations made and store them for future use.

Constraints

- 1) The software will work with any Intel Real-sense D400 (verify with release notes) series depth mapping cameras. This allows for a wide range of compatibility with different types of cameras. Cameras with a higher resolution will produce more accurate calculations.
- 2) The software will be able to run on a Raspberry Pi 4 8GB tier hardware or better. This allows for the software to be run on a variety of different hardware types.
- 3) The software will produce a volume/mass calculation within 5 seconds of the user's initial command.
- 4) Calculations produced should all be at minimum within one standard deviation of the actual value.

Qualities

- 1) The program should require very little user input to accomplish its goals; the user input should be less than 5 button presses to receive a calculation from the moment the program opens
- 2) The GUI of the program should be appealing to users, and the GUI's theme will have alternate color schemes to allow users a bit of customization.
- 3) The program should output very little information to the user, unless the user specifically requests the information, in which case the program will output every step of its calculation process.
- 4) Software will remain Open Source under the GPL license to allow any other developers to add features or fix potential unseen flaws in the software.
- 5) Software will be entirely developed in python, for maintainability and portability.

Test Plans (draft)

Acceptance Tests

- 1) After the scan command is issued, the data directory should be checked for the presence of a .ply file. This file should then be brought into a 3D viewing software to verify that it matches the camera's vision at the time of the scan.
- 2) The translated array and corresponding reference hyperplane should be graphed in 3D using matplotlib. This graph should be exported so that the slope of the reference hyperplane can be calculated and compared to the slope of the original road.
- 3) Using the known volume and mass required for the control pothole, the calculated volume/mass can be compared, and it can be determined if the calculations are within the one standard deviation required. Further testing can occur when measuring potholes in the wild, as their volume can be calculated using traditional methods and then compared to the volume calculated by the software.
- 4) Once the calculations are complete, a SQLite database should be created or have rows inserted. This can be verified by first looking for the SQLite database, and then opening it up and manually checking that the values are correct