Overview of the problem and solution:

Cancer is a disease that destroys lives. Radiation exposure often leads to the development of cancer. As such, radiation is a significant problem in aerospace engineering because astronauts will be exposed to high levels of radiation from the sun when in space. Even on Earth, people may be exposed to harmful levels of radiation through radioactive materials testing or by being outside. Understanding how radiation affects the body and how it can be blocked are both necessary to the subjects of radiation testing and space travel. Additionally we wish to spread more awareness about the connection between radiation and cancer, especially symptoms that may be the result of the onset of cancer, through a user-friendly frontend simulation.

Radiation segment:

Currently, the fastest and most accurate method of simulating bombardment uses a toolkit called Geant4. It is a CERN-managed platform for creating and visualizing physics experiments using the monte carlo method of probability calculation. The first part of the simulation includes writing a '.tg'(text geometry) file. This sets up the physical placement of objects and detectors. The second part includes writing a '.mac' file. This sets up everything else in the simulation including visualization and radiation sources(s). The setup for the radiation bombardment is to use a variety of radiation sources and barriers in several programs to find which types of blockades block certain types of radiation the best. These results, containing dosage and radiation type, will be saved to a '.CSV'.

Cancer segment:

Information about the radiation that leaked through the barrier will be saved to a ROOT file. This file will then be loaded into a probability calculator that predicts how a subject's lifespan would be affected given the diseases that radiation would inflict. Various cancer types and other illnesses like Acute Radiation Syndrome or Cutaneous Radiation Injuries will be contracted, and important information about these illnesses will be presented along with the subject's general health after each loop of the code.

Frontend segment:

In order for the information from the previous two segments to be easily interacted with, we will create a frontend for the project in Unity game engine. This will allow much easier selection of experiment parameters than using the console, and also present the data in a more understandable format. Along with general data organization, there will also be a visual simulation of the experiment in order to further increase clarity.

Progress thus far:

We have put in a lot of work on each segment of the project: Our Geant4 simulation is starting to output useful data, the damage calculator has a working base and is just waiting for proper parameters and tuning, and the frontend's parameter selection and visual interface are mostly finished. Research is coming along well as we have looked into the significance of things like grays and sieverts, which are important for gauging the biological interaction of a subject from radiation.

Expected results:

We expect the results of this project to be that thicker barriers of high-density materials, like lead, will be more effective in blocking the radiation from reaching the human and minimize the loss of life expectancy, while thinner barriers of materials like water will have a negligible impact on the shielding of the radiation and thus cause a lot of radiation damage to the subject.

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