

Documentation for Visualizing the Magnetic Field in Gate RFID Research Project

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1 Objective

In this project, we are going to detect the areas in the gate which the magnetic field strength is not enough to make the RFIDs active. The overall use-case for our system is as follows:

1.1 Goals

First of all, we have to find a way to make the real-world environment consistent with the environment which we have in the application because finally user should be able to map what he/she sees in the application to the real-world. Then we should start to collect the pose and magnetic field strength data; and finally, we should find a way to visualize the magnetic field in a specific range. So, the main task is first divided into three main sub-tasks:

Setting up Scene In this part we are going to set up the size of the gate, the origin of the part of the environment which are going to measure the magnetic field in it.

Collecting Data First of all we have to define the resolution of the data which we are going to achieve. We will make a grid in the area of the interest and we will try to store one value for each element of the grid. The resolution of the grid, determines how precise do we need to collect data. This task will be done by moving the a dipole in the area of interest and collect the data about the dipole pose and magnetic field strength in each point. The dipole is able to measure the magnetic field which is received

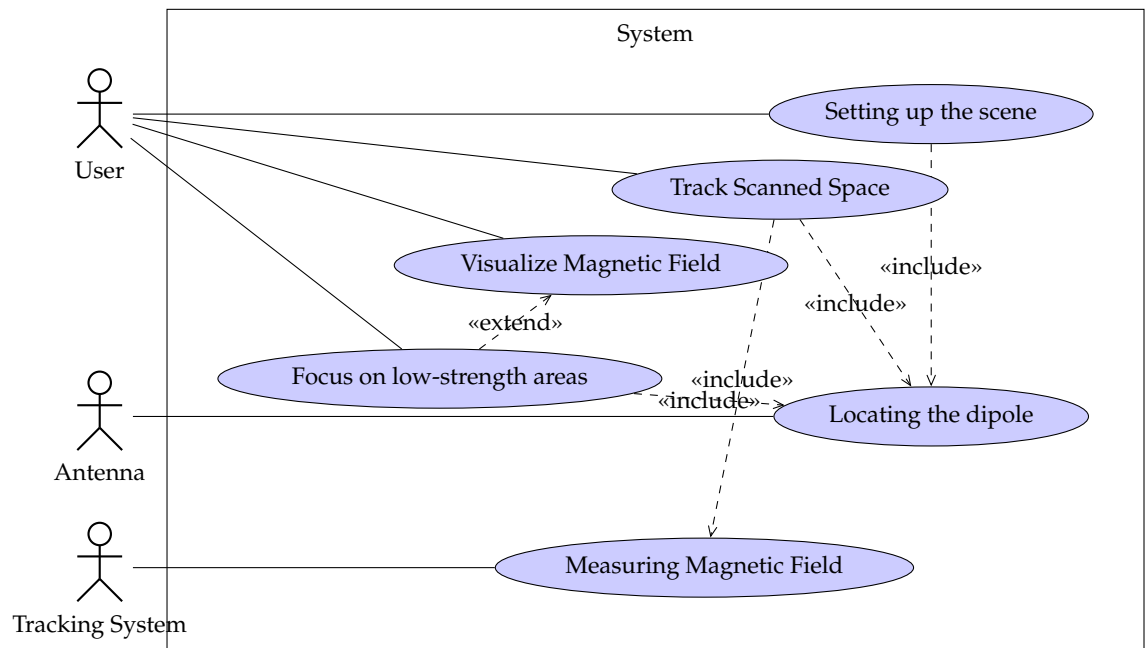


Figure 1: The overall system for collecting and visualizing the magnetic field into the gate.

from the antennas and there is tracking system which can measure where the dipole is.

Visualizing Data Then, the user wants to visualize the data in the grid in a way which the magnetic field in different areas of the gate can be well-presented in classified areas. Areas which their magnetic field strength are in some specific range is displayed and colored based on the user preferences.

2 Steps to Do the project

2.1 Setting Up the Scene

To set up the scene, we have to define the gate dimension and origin, and the area of interest. The area of interest is the area which magnetic field measurements are done there. Additional, to these two main needed specifications, we want to define the antenna position and orientation on the gate to make the visualization environment closer to the real world.

- a. Finding the 4 inner corners of the gate to determine the gate dimensions and center. Tip: Why 4 corners? Because calculating the center of the gate is hard to do in real world but putting the dipole's head in the corners of the gate is pretty simple. Then, finding the center of the gate is easy to calculate.
- b. Determining the antenna position and orientation. This step is not necessary but to make the visualization closer to the real world we are trying to include that. To determine the antenna position and orientation, we will put the dipole close to the antenna with almost the same orientation of the antenna and then ask the application to store this position as an antenna position and orientation.
- c. Then we will use the dipole again to determine the area of interest for measurements. First we put the dipole in one corner of the area of interest and then we will put it in the another corner of the area of interest. As it is obvious, here we only determine the bounding box of the area of interest. If we want, we can use some other meshes using the application. But this is not our goal. We just want to fill a 3d cube of data.

Using these steps, the scene will be set up. During the scene setup the user is able to see the results until now. Additionally, during all these set up scene there should be good tutorials to tell the user how to define his/her goals.

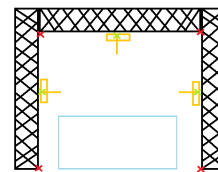


Figure 2: Setting up the gate

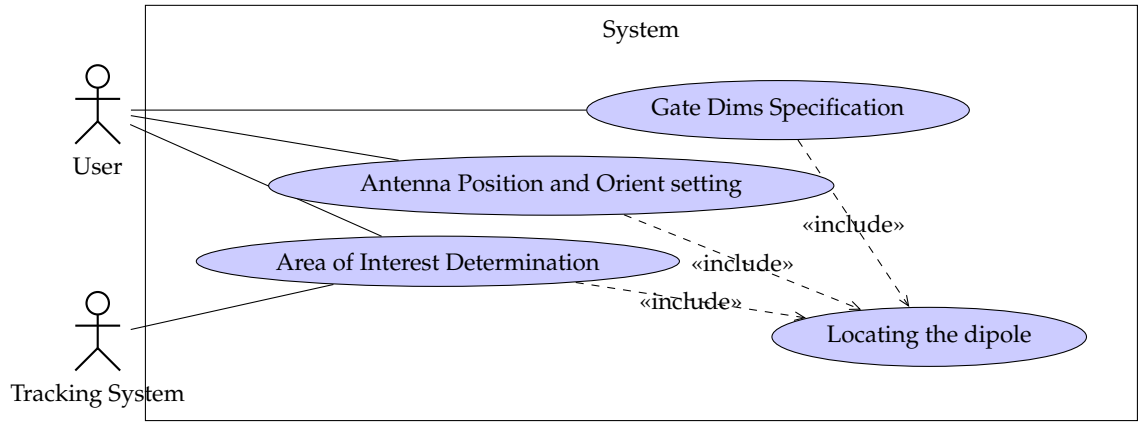


Figure 3: Setting up the scene use case.

2.2 Collecting the data about the magnetic field in the area of interest

As the first step, we should determine the resolution of the box. Possibly, it would be a widget which is opened and user is able to enter the number of segments along length, width and height of the bounding box of the area of interest. Then, everything is setup and we are able to scan the area of interest.

While we are measuring the magnetic field, we should determine the position of the dipole, store the measured values, dipole position and orientation to a data structure. During collecting the data via scanning, the application should show which part of the area is scanned and which part is not scanned. Also, there should be a mechanism to help the user to find the parts which are not scanned and needed to be scanned to finish the measurements.

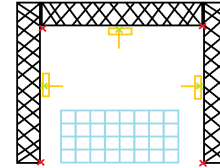


Figure 4: Defining the resolution of the 3d cube of interest

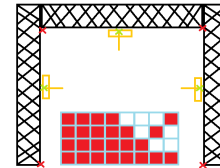


Figure 5: Scanning the cube to collect the data

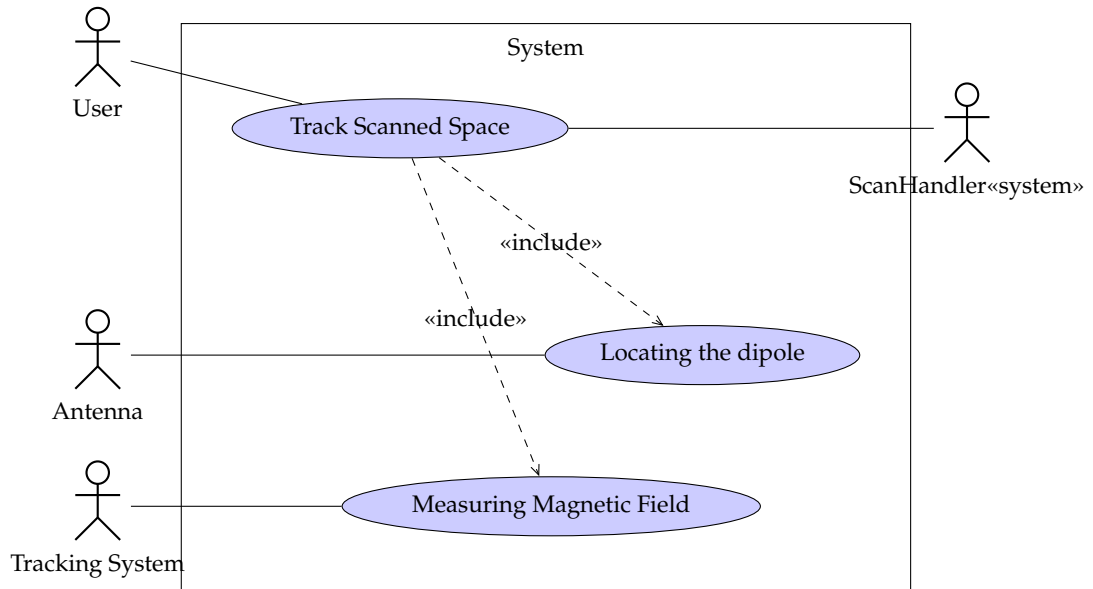


Figure 6: The collecting data use case.

2.3 Visualizing the collected data

The collected data in previous sections should be used to visualize the data in a good way. For now, the user will define some range of magnetic field values as critical range. The critical range is the range of values which is considered as low-strength. It is good if we have also some range as the normal range which the user is able to see the normal range beside the critical range. Additionally, the user is able to define a value-color map to represent different values of the magnetic fields with different colors, to make them easier to understand.

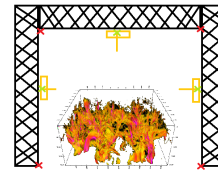


Figure 7: Visualizing the collected data

2.4 Gantt Chart

The schedule for doing the project of IDP can be found in the following Gantt Chart:

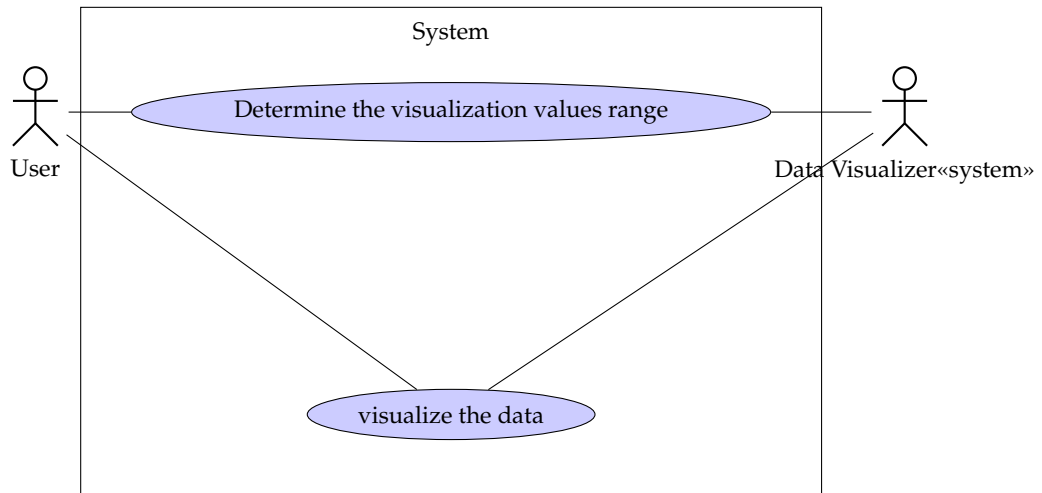


Figure 8: The visualizing data use case.

3 Known Problems Definition

In this part, we have to define some simple and planned formation of the antennas and the gate and the expected results. This definition will help us to ensure that whether our system is working fine or not.

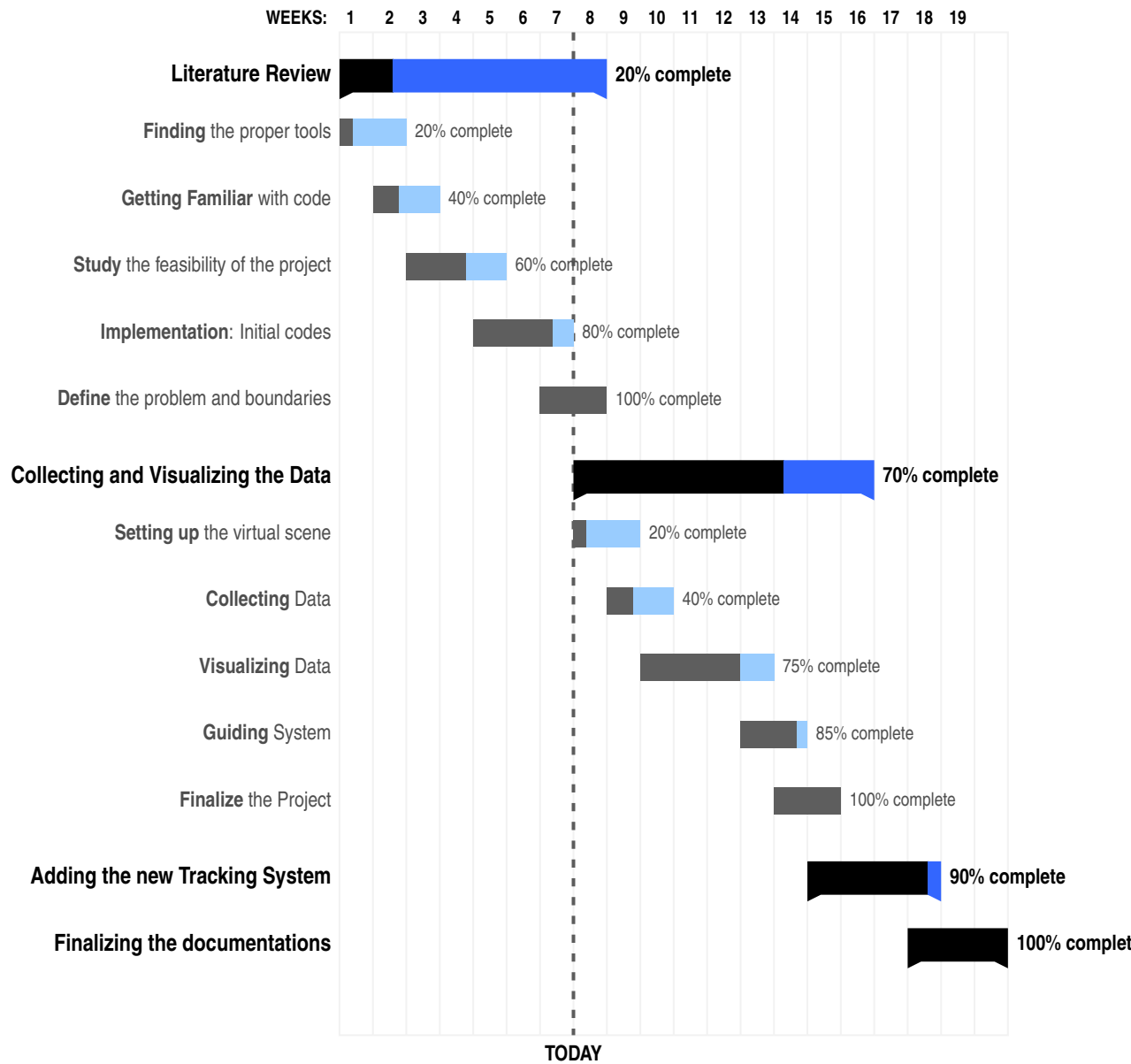


Figure 9: Gantt chart for the project