Odor Tracking with an Electronic Nose

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Bi-Weekly Report for: 02/05/03 - 02/17/03

Table of Contents

Progress Made During Last Two Weeks

After the proposal we realized that we needed to be accomplishing more in the time we had. We needed to wrap up most of our research so that we could begin implementation of our project. After our meeting with Dr. Gutierrez-Osuna, we split up the topics that we had to cover before the next meeting. Simon was assigned to research and find a dispersion algorithm for the dispersion module of our project. Greg was assigned to research LabVIEW, mainly focusing on what languages could interact with LabVIEW and how we would do that. Ninh was assigned to research tracking algorithms and provide some suggestions for the group to decide on. Jason was assigned to studying the dilution system that was provided, mainly focusing on how it worked and what kind of inputs and outputs we would be dealing with on that machine.

We then met with Dr. Gutierrez-Osuna and showed him what we found. We discussed our findings along with options of how to use those findings in our project. After that meeting we still had a few questions to be answered before implementation, so we assigned further tasks for each person on the same topics. Simon found many algorithms for odor dispersion, but they were very complicated so he was to continue searching for a more practical algorithm. Greg found out what languages could interact with LabVIEW so he was to run some test programs to ensure that the different languages were compatible with LabVIEW. Ninh found some algorithms for odor tracking and presented them to us. We came up with some ideas for how our robot would track the odor, so Ninh was to search for more algorithms as well as equations that could be used to implement our ideas. Jason found out how the dilution system worked and how the sensors worked. He also found out what the inputs and outputs would be. He was then to study the LabVIEW portion of the dilution system and determine exactly where the inputs and outputs were so that we could interact with the system when ready.

Individual Achievements

- Simon researched the dispersion model. He found that the EPA uses many dispersion models. However, they are all written in Fortran, and their time steps are too great (>1 hr) to be useful to the project. He also found a model on the internet that calculated some numbers that would be able to be plugged into Gauss' dispersion model. However, this seemed too complicated. Dr. Gutierrez-Osuna helped him find some papers dealing with the subject, and Simon will be researching these in the weeks to come.
- Greg researched the LabVIEW program to determine which languages could interface with it, and how this could be accomplished. He determined that C/C++ could easily interface with LabVIEW. He also found example programs on how to interface with LabVIEW, and he is going to be implementing those in the coming weeks.
- Ninh researched to come up with an algorithm that we could develop after he went through many existing tracking algorithms. In order to come to the plume sources, a robot will follow a spiral path and will sample three odor hits at three different layers in a random direction in a "t" time. If the sampling hits succeed, the robot will compare the three odor hits with different concentration [C1], [C2]

and [C3]. If the three odor hits keep increasing ([C1]<[C2]<[C3]), the robot will move a predefined distance in the direction of odor concentration increasing. After that distance, the robot stops and gets another sample hits [C4]. If [C3] < [C4], the robot moves in opposite direction a distance "d1". It samples another odor hit [C5] and compare [C4] and [C5]. If [C5]<[C4], it moves in the opposite direction a distance "d2" = 2*d1" and compare [c4] and [C6]. If [C6]<[C4], it means the robot get a fail path. I will make a new spiral movement and repeat the same casting. If [C6]>[C4], it samples another hit [C7] and compare [C7] to [C6]. If [C4]<[C6]<[C7], the robot is in the right moving direction and will move another predefined distance. The robot will repeat the same process until it hits the odor source.

- Jason studied the dilution system. He found out that there are three diluters, each attached to a single odor solution: ammonia, isopropyl alcohol, and acetone. These dilutors provide the appropriate concentration based on input through the LabVIEW program. A pump pulls the odor from the dilutors through a sensor array chamber. These sensors provide a resistance and the odors cause a change in the resistance based on the odor and concentration. This resistance is in a voltage divider circuit and the resulting voltage is sent to the LabVIEW program as an output for the sensor response.

Plans for Next Two Weeks

In the next two weeks we are planning on doing the following:

- Find/decide on a dispersion model to use
- Begin coding the dispersion model
- Create a C/C++ program that can interface with LabVIEW
- Start calibration of dilution system
- Decide/work-out/design odor tracking algorithm (prototype)
- Start coding E-nose model
- Start coding tracking algorithm

Problems Encountered

This week, we ran into a few problems. The most difficult dilemma was that almost all EPA dispersion modeling software is written in Fortran, and none of the members of our groups know Fortran. Also, these models have time steps that are too great to be useful to us (> 1 hr).

Another problem we faced was deciding on the sensor response formula to use for our E-nose simulator. The major issue was deciding if we should use a single odor source model or a multiple odor source model. This decision may affect the way we implement the project.

Assistance from TA/Instructor

These past two weeks, we received help from Dr. Gutierrez-Osuna and Agustin on the following issues:

- Dr. Gutierrez-Osuna helped us find papers on odor dispersion models.
- Agustin helped to explain the intricacies of the dilution system.