Individual Lab Report

Shiyu Dong
Team B – Auto Pirates
Teammates – Tushar Chugh, Bikramjot Hanzra, Tae-Hyung Kim, William Seto
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1 Individual Progress

In this week, I worked with Tushar to create a PCB that will be possibly used on-board as an extra obstacle alarm. Besides, to prepare for the first field test, I configured the webcam to record videos using ROS so that we will be able to record the Radar data, IMU data and videos that indicates the location of the obstacles simultaneously.

1.1 Schematic

The design of the on-board PCB includes schematic, PCB layout and Bill of Materials (BOM). The idea of creating a PCB that used for obstacle indication is that we will use laptops on board to send commands to on-board computer and show the data and it's high possibility that our program failed and we may lost data from the on-board computer. So it's better to use an independent PCB module to receive data from on-board computer and indicates the obstacles.

To make the PCB more stable, we used the following design:

1. Capacitors between V_{cc} and GND to make the circuit more robust to voltage changes.
2. Ferrite bead between V_{in} and V_{cc} to suppress the high frequency noises.
3. Using transistor to supply enough current for the buzzer.
4. Using NMOS transistor as the reverse voltage protection for the circuit.

1.2 PCB Layout

We have made two version of PCB layouts, as shown in figure 1.

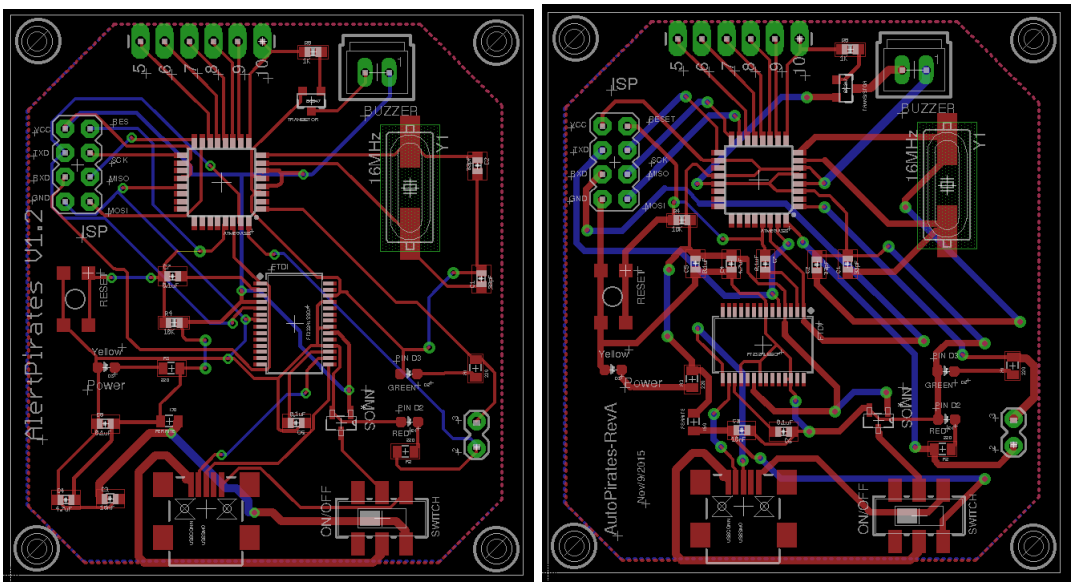

Figure 1: PCB Layout

The left PCB layout is the former version and we made some modification according to the feedback from Professor Luis and Ander as the right one shows.

The major changes that I made for the PCB layout is shown as follows:

1. Move the bypass capacitor near the ATMEGA and the FTDI.
2. Move capacitor C1 and C2 near the FTDI.
3. Move a via from under the ATMEGA to outside
4. Increase the trace width as much as possible to make the PCB more robust.
5. Changed text on top silkscreen from V1.2 to RevA.

1.3 Camera Configuration

Our plan for the first field test is to record Radar data on the river to do more filtering work and be familiar with sending commands to on-board computer using command line as well as GUI. For the perception part, we need to be familiar with log and play back data. We will try to record videos and sensor data simultaneously and check Radar performance for detecting obstacles and future work of filtering.

We are using Logitech HD Webcam C270 now to record video during the field test. As we already

Figure 2: Logitech HD Webcam C270

did the ROS assignment to use GSCAM to display and send videos from a webcam. It will be easy to record the video and use it in the field test.

But there is still something important I want to mention:

1. The field of view of this camera is 60 degree. We will test the performance of it on the first field test. If the FOV is too small to record all the obstacles, we will consider buying another one.
2. If I record the normal frames of the video from GSCAM, the data recorded will be about 100 Mb per minute, which will be too big for a whole day's test. So we would like to use compressed image with the size specified as 320×240, which will be about 1 Mb data recorded per minute.

3. We also tested the performance of the webcam with USB extension cable and the performance is still good according to the test.

2 Challenges

The main challenge is in the design of the PCB. We took feedback from Professor and Ander and it caused big changes to the PCB layout. The experience we got was that it's really important to design the distribution of components on the PCB before doing the routing, or we will take longer time to make modifications. The position of the capacitors will also matter, because it effects the noise on the board.

3 Teamwork

- Tushar worked on the occupancy grid map and he was able to put part of the river map into the occupancy grid map format. He also worked with me on the PCB.
- Bikram worked on filtering the radar data logged in NREC and he also updated the repository of our code.
- TaeHyung worked on the stage simulator for path planning and worked with Tushar to put the occupancy grid map of the river into stage.
- William worked to visualize the radar data and he also led the plan of the field test.

4 Future Plan

The data we recorded on NREC is kind of what we don't want, because the boat is above the ground and the field of view of the Radar is limited so it won't be able to see an object that is too close. And there are also too many obstacles on the shore which caused bad performance of the Radar detection. So we would like to get the data on field test as soon as possible to see what's the difference.

For me, I would first test some filter algorithm for the data we get on the field test. I should first try average filtering for the data recorded when the boat is static to filter some random noise. And then I would try Kalman filter for the data recorded when the boat is moving in a certain speed. In this way, it's easier to get the model to implement the Kalman filter.