Automated Driving Using External Perception

Individual Lab Report - ILR06

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Team E - Outersense

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Contents

1 Individual Progress

1.1 Hardware Setup

1.1.1 Track Preparation

The process of setting up the track involved addressing the issue of creases that had formed due to the track being folded up during the entire summer. To ensure optimal performance and accuracy in vehicle detection and tracking using the Intel RealSense, the following steps and measures were meticulously taken:

1. **Track Cleaning**:

   In order to alleviate the creases and enhance track flatness, a comprehensive cleaning procedure was carried out. This served a dual purpose - not only did it remove dust and debris, but it also contributed to minimizing track deformation during the cleaning process.

2. **Heating the Track**:

   To further ameliorate the condition of the track, targeted heating was employed. This heating was focused on areas with noticeable creases, and it was done with the intent of achieving a uniform and flush track surface. Unlike previous instances where hardwood flooring was employed, it was deemed unnecessary this time.

These meticulous steps ensured that the track was in an optimal state, providing a suitable foundation for the subsequent hardware setup and vehicle tracking operations.

1.1.2 Infrastructure setup

The setup of the infrastructure demanded a meticulous and delicate approach as seen in Figure 1, requiring careful handling and precise positioning of the components. Notably, the Intel RealSense devices had to be remounted onto the infrastructure with the utmost precision, ensuring their correct placement.

In addition to the repositioning of the RealSense devices, a crucial aspect of the setup involved a comprehensive examination and maintenance of the structural integrity of the entire system. This entailed a systematic tightening of all bolts and mounting points to eliminate any potential structural faults or deficiencies.

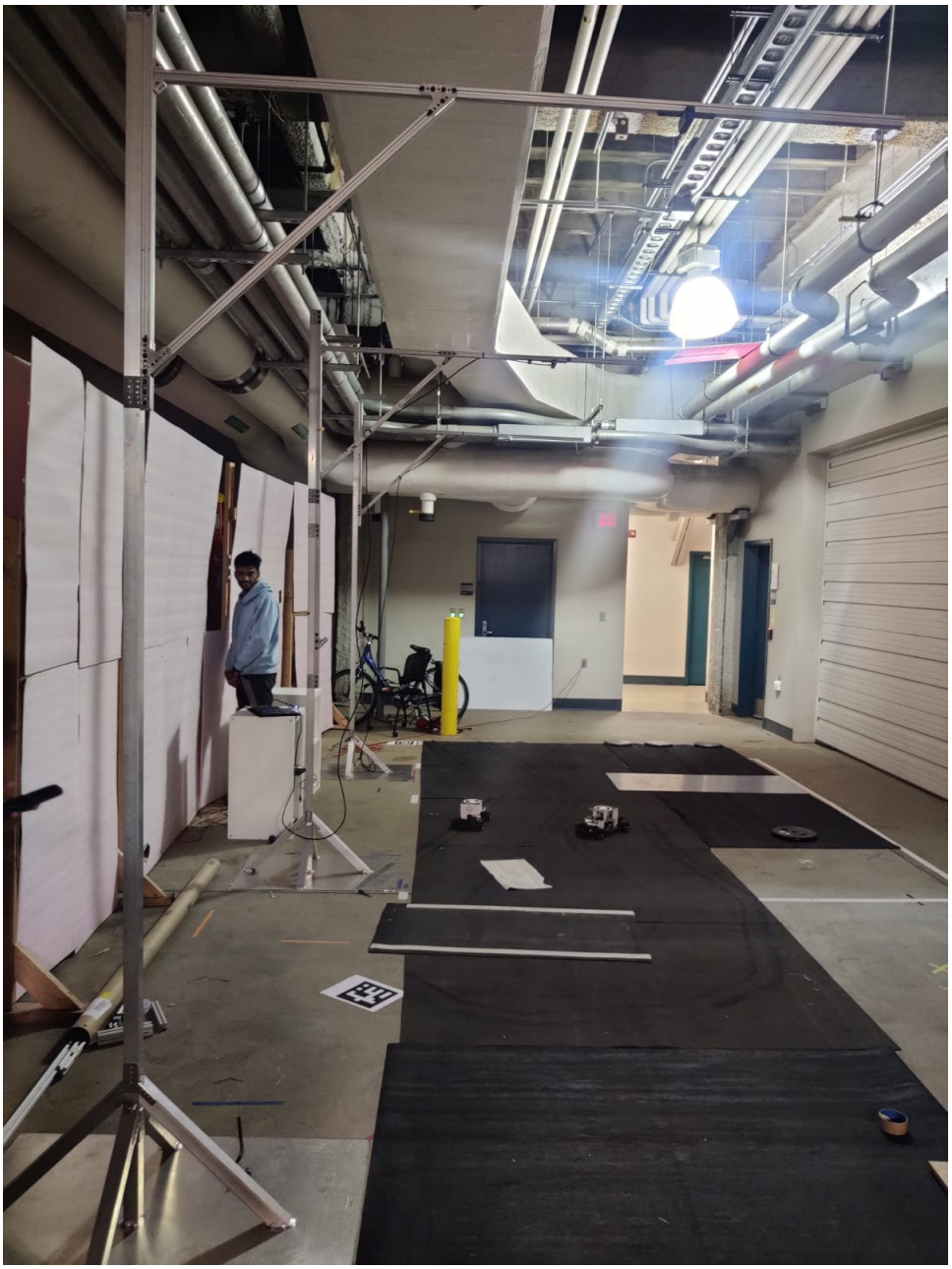

Figure 1: Infrastructure setup

1.2 Software setup

Last semester, we ran into an unexpected issue when a critical edge device suddenly failed. To get things back on track, we had to rebuild the system from scratch. This involved finding the right versions of OpenCV and its dependencies, and then thoroughly testing everything to make sure it would work well in the long run.

The rebuilding process took a while and was a bit challenging because some of the steps were not straightforward, even though we had good documentation.

2 Challenges Faced

2.1 Hardware Setup

2.1.1 Track Preparation Challenges

Setting up the track proved to be a task fraught with challenges, primarily revolving around addressing creases that had developed during the summer's storage. These challenges posed potential hurdles to achieving the desired level of precision and accuracy in vehicle detection and tracking through Intel RealSense technology. The following specific challenges were encountered:

1. **Track Cleaning and heating of track**:

   The extensive cleaning process turned out to be more intricate than initially anticipated. While the primary goal was to remove dust and debris, equal attention had to be given to minimizing track deformation during cleaning. Targeted heating of crease-prone areas presented another challenge. Achieving a uniform and flush track surface, especially in areas with noticeable creases, required precision and care.

2.1.2 Infrastructure Setup Challenges

The infrastructure setup was no less demanding, necessitating a meticulous and delicate approach:

1. **Device Remounting**:

   The remounting of Intel RealSense devices onto the infrastructure proved to be a challenge in precision. Ensuring their correct placement without causing any damage or misalignment added complexity to the setup process.

2. **Structural Integrity Maintenance**:

   Beyond device placement, maintaining the structural integrity of the entire system presented another set of challenges. This involved a systematic tightening of bolts and mounting points, a task that required attention to detail to eliminate potential structural faults or deficiencies.

2.2 Software Setup Challenges

In the realm of software setup, several unforeseen challenges emerged. One significant setback occurred in the previous semester due to the sudden failure of a critical edge device. This unexpected challenge necessitated a comprehensive system reconstruction effort. Despite having comprehensive documentation, following convoluted steps presented challenges, adding time and effort to the rebuild process.

These challenges, although demanding, served as valuable learning experiences and underscored the importance of meticulous attention to detail in the pursuit of project objectives.

3 Teamwork

As for teamwork, each of us are flexible and even though we have our own verticals, our team structure allows us to collaborate with each other to complete high-priority tasks faster.

- **Ronit Hire**:

  Ronit primarily oversees the setup and operation of the perception stack, implementing necessary modifications as required. I collaborated closely with him to ensure that the system, which had experienced issues during the summer, was fully operational from a software perspective.

- **Dhanesh Pamnani**:

  Dhanesh's main focus has been on recalibrating the cameras and configuring the hardware components. I assisted him to assist in the hardware setup, working together to ensure its successful implementation.

- **Shreyas Jha**:

  Shreyas takes the lead in configuring the RC cars and managing low-level hardware aspects, including streaming data to edge devices. As I worked last semester with edge devices, I collaborated closely with Shreyas in this domain.

- **Atharv Pulapaka**:

  Atharv's primary responsibility centers around ensuring the functionality of the control package and making necessary adjustments. I actively engaged with Atharv to discuss our approach to motion planning for the current semester.

4 Future work

4.1 Personal

On a personal front, my upcoming tasks will focus on the following areas:

1. Gazebo Environment Creation: I will take the lead in developing a Gazebo environment to simulate path planning algorithms and establish a comprehensive test bed for their evaluation.

4.2 Team

As for the future work of the team, we wish to achieve the following goals.

1. System Scaling: We aim to expand the system to accommodate multiple cars, effectively scaling our project for larger applications.

2. Motion Planning Implementation: In preparation for the upcoming review, we intend to implement some form of motion planning within the system to enhance its autonomy and decision-making capabilities.