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DEPLOYMENT OF AUTONOMOUS NAVIGATION FEATURE ON AN UNMANNED GROUND VEHICLE (UGV)

ABSTRACT

This project presents a study about the deployment of autonomous navigation feature on an unmanned ground vehicle (UGV). Specifically, the study focuses on the use of a robotic operating system (ROS) to manage and control the motion characteristics. To realize autonomous navigation, an advanced light detection and ranging (LIDAR) sensor is integrated into the UGV. The core hardware Raspberry Pi and Arduino are used for sensing and actuating mechanisms. The aforementioned core hardware enables the UGV to sense and decide the tasks with better accuracies, e.g., avoid objects and obstacles while performing prescribed navigation tasks. In order to verify the effectiveness of the proposed solution, several assessments are designed and put to the test. The outcome of this project is will be beneficial in the manufacturing industry for example in material handling section in assembly plant and managing inventory of goods in warehouse such as Amazon, Lazada companies, .

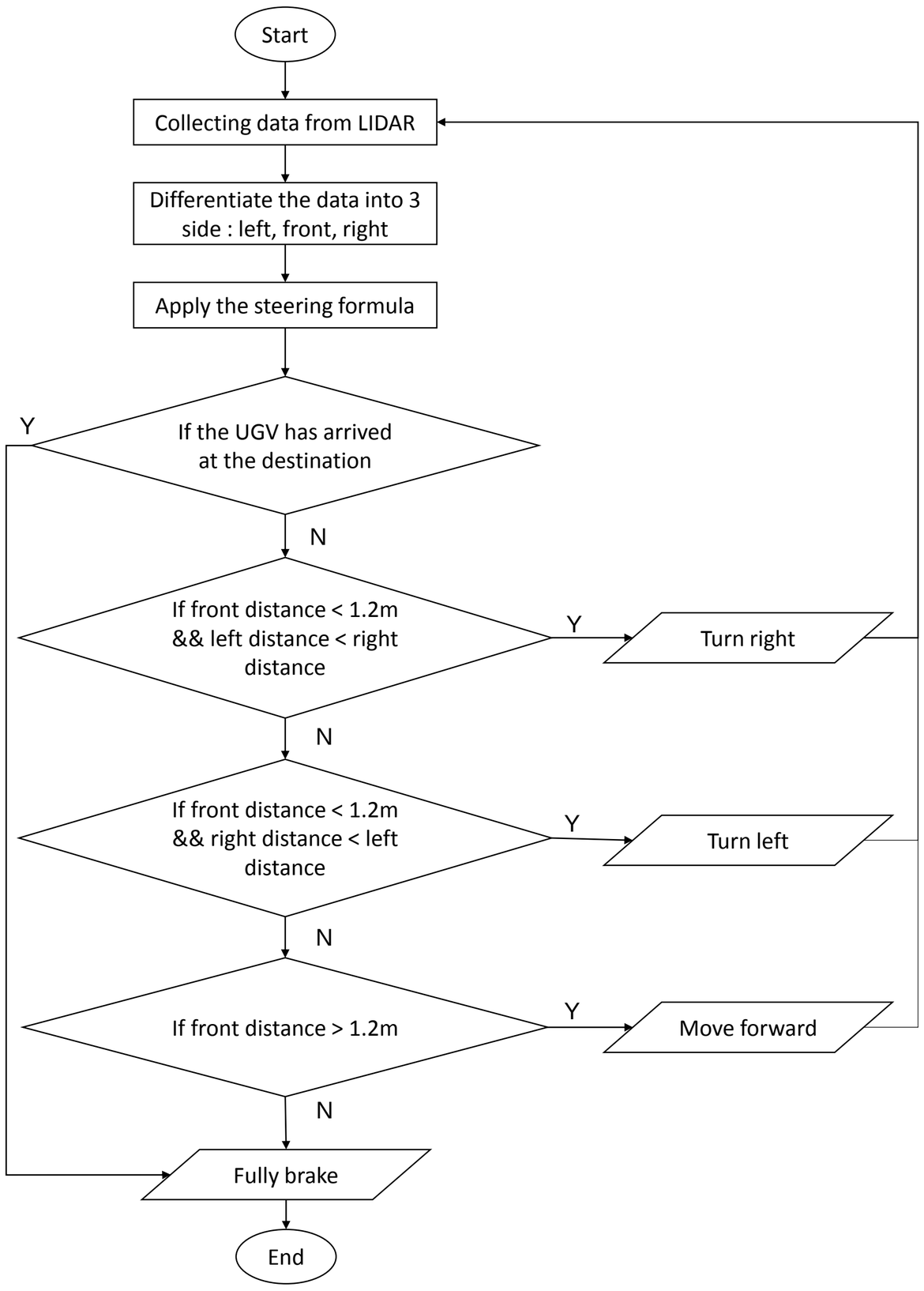
INTRODUCTION

The advent of fourth revolution industry (IR4.0) catalyzes the growth of digital technology which has solved many industrial problems in production, manufacturing and logistics. In this project, we explore and conduct a study on logistic of finished parts in much detailed context pertaining to hardware and software components in order to effectively transport a finished part from one point to another. This is done through the deployment of robot operating system (ROS) framework on the logistic management system.

OBJECTIVE

1. **To apply the light detection and ranging (LIDAR) sensor on the UGV in avoiding the obstacles.**
2. **To develop an algorithm in robot operating system (ROS) environment for the UGV in python and C++ languages.**

METHODOLOGY



Programming ecosystem of the UGV

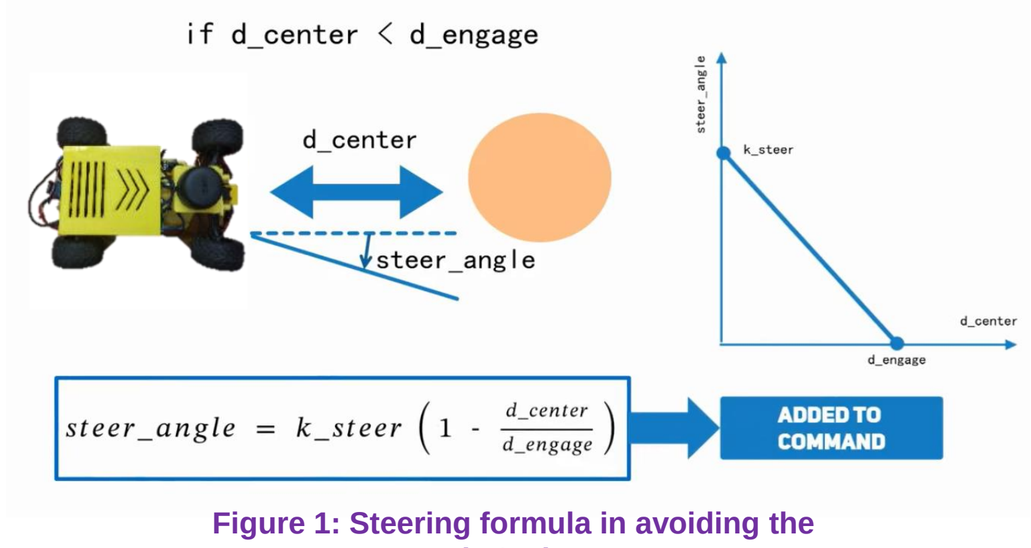


Figure 1: Steering formula in avoiding the obstacles

RESULTS AND DISCUSSION

1. Design optimization and development

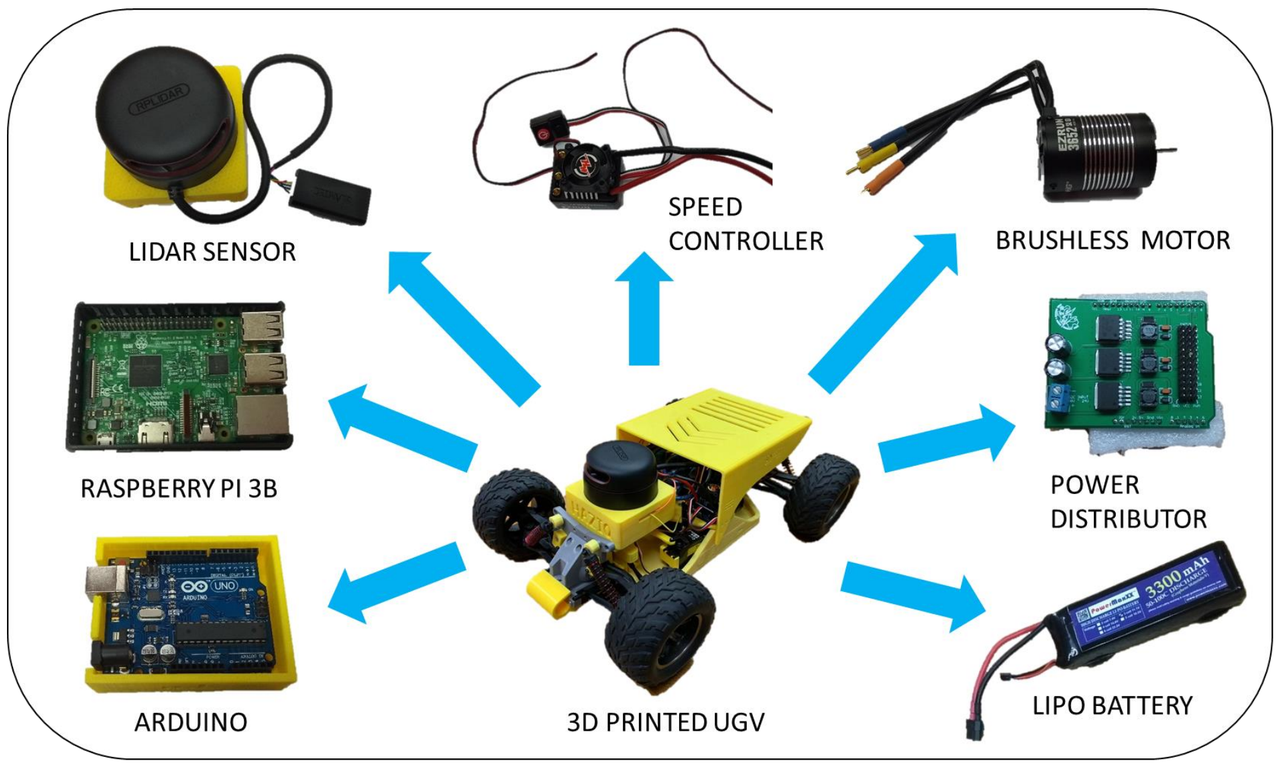


Figure 2: UGV main devices

2. Experimental result

Figure 3: UGV fully brake when the distance is less than 0.4m

Figure 4: UGV successfully avoid the obstacles

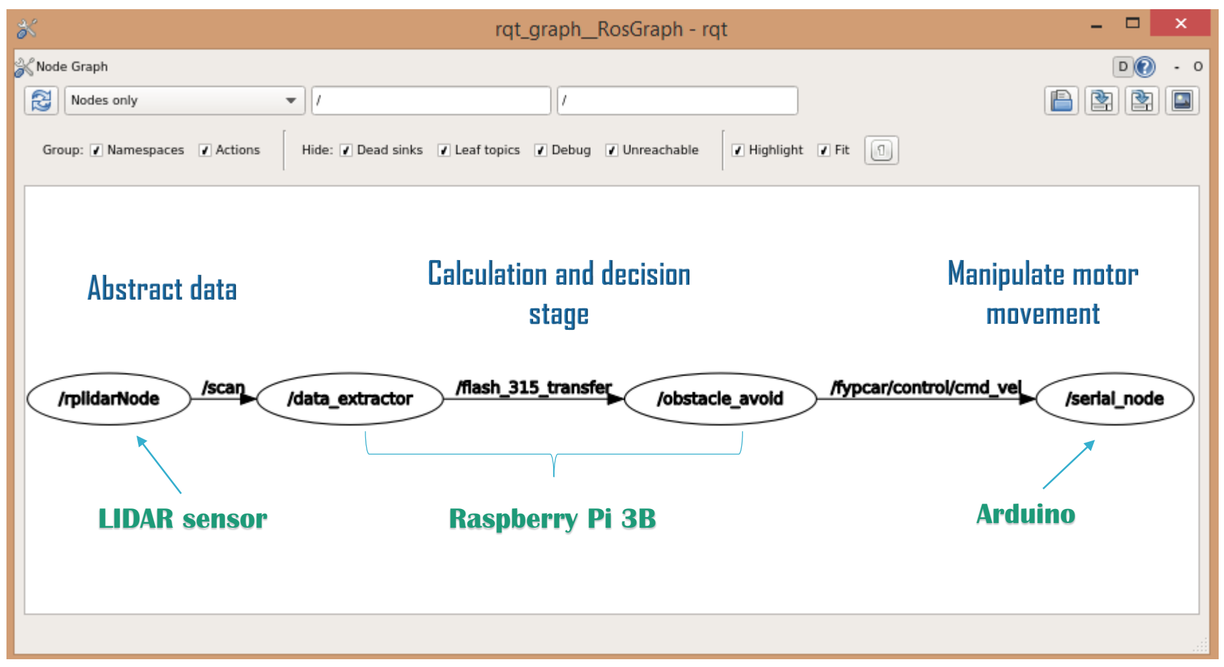


Figure 5: Programming structure in ROS environment

CONCLUSIONS

In conclusion, this project has successfully developed the logistic management system that employs UGV as the main test bed and utilize a LIDAR sensor to optimize autonomous navigation task.

In this project, a number of programming languages, and software were deployed to ensure the UGV behave according the prescribed goals.

The results illustrate that the low speed movement provide greater accuracy but it is a trade off between accuracy and processing time.

It is also found that, ROS environment response smoothly with acceptable latency (time delay) and give rise to better control of the UGV.