Application challenge description

Robotics software engineer

First of all, thank you once again for your interest in joining the Crover team. Your profile stood out and looks very promising. To evaluate your capabilities further, we would like to invite you to a small programming challenge. It consists of a single day task, where you are asked to develop a small localisation algorithm, and where you can demonstrate your various skills. Not only are we interested in your technical proficiency, but also your ability to adapt and learn (we don't expect you to know how to do everything from the start), to communicate (we will ask you to write a small report) and to manage your time. It is also a way for you to get a taste of working with us, we hope you will enjoy it!

Task description

The challenge consists in developing an algorithm in order to localise a car equipped with wheel encoders and a GNSS receiver. The wheel encoders provide linear and angular speed information, while the GNSS provides position information. We make the following assumptions:

- The sensors are mounted in the center of the rear axle of the car.
- The car is moving on a 2D plane.
- The position is expressed in the `map` frame. The `map` and `odom` frames are identical in our scenario.
- The measurements are affected by some noise, the estimated covariances of which are provided.

Expected output:

- Estimated position and orientation of the car in the `map` frame.

Input description

The input is provided both as a rosbag and CSV files. You can use the format which you prefer.

Rosbag

The rosbag `data.bag` contains the following topics:

- `/sensors/gnss/odom`: GNSS position measurements of the car in the `map` frame.
- `/sensors/odom`: linear and angular speed measurements of the car with respect to the `odom` frame, in the frame of the car (x axis pointing forward, y axis pointing left)

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- `/sensors/odom/ground_truth`: true position and speed of the car, given for reference.

CSV files

For all CSV files, the time is given as a Unix timestamp (in nanoseconds), position is in metre, and speed in metre/second. The provided files are the following:

- `gnss.csv`: GNSS 2D position measurements of the car in the `map` frame. The estimated standard deviation on the measurements is 0.7 m.
- `odom.csv`: linear and angular speed measurements of the car with respect to the `odom` frame, in the frame of the car (x axis pointing forward, y axis pointing left). The covariances on the measurements are also provided.
- `ground_truth.csv`: true position and speed of the car, given for reference. The orientation is expressed as a quaternion. The speed is given with respect to the `odom` frame, in the frame of the car.

Task submission

You are asked to share your work in a GitHub repository, including both the code you developed and small a `README.md` markdown report file (at the root of the repository) containing the following information:

- Instructions on how to install and run the software.
- Technical description of your work, both on the implemented functionalities and the code.
- Performance analysis of the algorithm: you can include some pictures, graphs, or metrics for example.
- Work description. We want to see what you have done, and how you tackled the task. The goal is also to have a taste of how you reasoned things out, how you organised your time, and how you resolved any issue(s). If there were concepts you didn't know about before and you had to learn on the way, don't hesitate to mention it too, it's also something that interests us.

Please send a link to your GitHub repository to HR@crover.tech once you have completed the challenge.

Thank you, and good luck.

The Crover Team