

Localization: Find yourself in Duckietown



Students: Amado Antonini, Teddy Ort, Hans Susilo

Staff: Luca Carlone

Objective:

To estimate the location of the robot given a map of Duckietown. The map describes the pose (rotation and position) of a set of landmarks (*AprilTags*), which the robot can detect using the onboard camera.

Method:

- In Duckietown, each traffic sign is associated with a unique QR-like identifier called an *AprilTag*, which is located under each human-readable sign.
- **Camera detections:** since we know the shape of each tag, we can estimate the pose (location and orientation) of the robot relative to that tag using the robot's camera.
- **Pose estimation:** we use the given map, which stores the location of each AprilTag in a global coordinate frame, to turn our relative pose estimate into a global position estimate.
- **Improving the estimate via multiple detection:** if we detect multiple tags, we average the corresponding pose estimates to improve robot's localization. Since the random error in the position estimates are assumed to have zero mean, averaging multiple observations mitigates measurement noise.

Use: knowing the robot's location is fundamental for it to navigate efficiently in the environment (e.g., reach a desired destination)

