In the first-year project, we provided a road marking detection method, a localization method with camera, a GPS bias correction method using Lidar, and particle filter for integration, and road region detection and localization. A template-matching-based road marking detection method is proposed. Different kinds and different orientation road marking templates are generated and sum of square difference (SSD) is used to find objects with similar appearance. The orientation of road markings are determined based on the SSD value with different orientations. Localization based on detected road markings with a bird-eye view map is performed. Three kinds of method which calculate ego-vehicle position is used. Map matching performs correlation between the map and the whole road surface markings (RSM) image which can capture the relation between each road markings. Object matching calculate the ego-vehicle position individually, which can be further used to adjust the parameters of inverse perspective mapping (IPM) image. Localization with known road marking pattern relies on certain predefined points on road markings and is used as the input to the solve-PnP algorithm. The advantage is that it gives the 3D orientation and position of ego-vehicle.

**System Overview**

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**Localization and Mapping**

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