

CLAIMS

1. An autonomous parking system for a vehicle comprising:
 - a detection subsystem having
 - an image capture module for capturing images to provide a camera stream, and
 - a processor module, the processor module receives the camera stream and processes the camera stream, the processor module is configured to process image frames, wherein the processor module is configured to process a current image frame and a previous image frame of the camera stream:
 - to identify a parking slot,
 - to check the parking slot to determine if it is occupied using motion analysis, and
 - if unoccupied, to validate an unoccupied parking slot to determine if the unoccupied parking slot is suitable for the vehicle.
2. The system of claim 1 wherein the image capture module comprises:
 - a first camera unit mounted on a first side of the vehicle, wherein the first camera unit is configured to capture images along the first side of the vehicle; and
 - a second camera unit mounted on a second side of the vehicle, wherein the second camera unit is configured to capture images along the second side of the vehicle.
3. The system of claim 2 wherein the detection subsystem comprises a homography matrix generated from camera unit calibration for image to world position mapping.

4. The system of claim 1 wherein the processor module is configured to determine a parking slot size and a parking slot orientation of the parking slot.
5. The system of claim 4 wherein the processor module is configured to validate the parking slot based on a vehicle size and the parking slot size.
6. The system of claim 1 includes a controller subsystem, wherein the controller subsystem comprises:
 - a vehicle information module, the vehicle information module is configured to receive vehicle information from the vehicle;
 - a path planner module, the path planner module is configured to receive vehicle information from the vehicle information module and unoccupied parking slot information from the detection subsystem and based on the vehicle information and the unoccupied parking slot information, the path planner module plans a route to maneuver the vehicle into the unoccupied parking slot; and
 - a controller module, the controller module is configured to receive the vehicle information from the vehicle information module and route information from the path planner module and generates control signals to the vehicle to control the vehicle for parking into the unoccupied parking slot.
7. A method for autonomously parking a vehicle comprising:
 - performing motion analysis of a current image frame and a previous image frame from an image capture module, wherein the motion analysis determines a parking slot;
 - checking the parking slot to determine if the parking slot is occupied; and

validating the parking slot if the parking slot is unoccupied based on a vehicle size and a parking slot size.

8. The method of claim 7 wherein performing the motion analysis includes performing homography guided motion segmentation (HGMS), wherein the HGMS comprises performing camera calibration to generate homography information comprising a homography matrix for image to world mapping and a perspectivity ratio (PR) map.

9. The method of claim 7 wherein the motion analysis comprises:

performing apparent motion analysis on the previous and current image frames to generate apparent motion;

computing ground motion estimation to segment the apparent motion into ground and obstacles;

performing an occupancy check to determine if there are any obstacles present;

checking if any obstacles are present and if no obstacles are present, the parking slot is unoccupied; and

detecting parking slot markings if the parking slot is unoccupied to determine parking slot information.

10. The method of claim 9 wherein detecting the parking slot markings comprises:

analyzing the current image frame to identify vertical (V) and horizontal (H) lines;

determining V-H line combinations; and

identifying valid corner points from the V-H line combinations.