CLAIMS

1. A method for calibrating an autonomous charging device (ACD), the ACD comprising a camera, an end effector for supporting and moving a vehicle charging connector, a motion control unit, and a computer vision unit for socket-pose estimation, the computer vision comprising at least a baseline neural network, the motion control unit being configured to control the motion of the effector for plugging the connector into a vehicle socket using a pose estimation from the computer vision unit using an image of the socket recorded by the camera,

   characterized in that the method comprises:

   a) Obtaining a baseline inaccuracy between at least one target pose of the end effector and at least one actual pose of the end effector, wherein
      - the target pose is a pose where the motion control unit controls the end effector to move towards, and wherein the actual pose is the end pose where the end effector is effectively moved towards, and
      - the target pose is determined using an output of the baseline neural network;
   b) Adjusting the motion control unit by setting a baseline compensation function to compensate for the obtained baseline inaccuracy;
   c) Receiving an updated neural network for the computer vision unit;
   d) Determining a variation in a pose-estimation inaccuracy between the baseline neural network and the updated neural network; and
   e) Calibrating the motion control unit by updating the baseline compensation function based on the determined variation in pose-estimation inaccuracy.

2. The method according to claim 1, wherein setting a baseline compensation function includes assigning at least one offset to the motion control unit to compensate for the obtained inaccuracy, wherein said offset includes a rotation offset, a translation offset or a combination thereof.

3. The method according to claim 1, wherein the baseline inaccuracy includes at least one of an inaccuracy of the baseline neural network, a pose-estimation inaccuracy, an inaccuracy due to an ACD hardware component, an inaccuracy due to an ACD software component, and an inaccuracy in the motion control unit.

4. The method according to anyone of the preceding claims, wherein the baseline inaccuracy is obtained by measuring a rotational and/or translational compliance motion incurred by the charging connector due to a self-aligning component of the

charging connector and/or a guiding surface of the socket when connecting into the socket, wherein the compliance motion includes at least one of a deflection and deformation of a compliant component.

5. The method according to anyone of the preceding claims, wherein the baseline compensation function includes at least one of a corrective qualitative and quantitative instruction that allows the ACD to achieve a successful plug-in of the connector into the vehicle socket.

6. The method according to anyone of the preceding claims, wherein the variation in the pose-estimation inaccuracy is determined by measuring the difference in the inaccuracy of the pose-estimation output of the baseline neural network and the updated neural network against a benchmark dataset comprising a plurality of images based on which an ACD has plugged in or would likely plug in successfully.

7. The method according to claim 6, wherein images in the benchmark dataset contain means to determine a ground-truth measurement of the socket pose with respect to the camera.

8. The method according to claim 6, wherein the benchmark dataset comprises a plurality of images annotated with at least one ground truth label.

9. The method according to anyone of the preceding claims, wherein the variation in the pose-estimation inaccuracy is determined by subtracting an output of the updated neural network from an output of the baseline neural network.

10. The method according to anyone of the preceding claims, wherein the variation in the pose-estimation inaccuracy is a mean of the difference of an output of the baseline neural network and an output of the retrained neural network over a benchmark dataset of images.

11. The method according to anyone of the preceding claims, wherein the variation in the pose-estimation inaccuracy is determined by comparing an absolute socket-pose estimation error function of the updated neural network with respect to the ground truth with the absolute socket-pose estimation error function of the baseline neural network with respect to the ground truth, wherein the socket-pose estimation error function is determined by comparing the output of the respective neural network with the ground-truth measurement.

12. The method according to claim 11, wherein the means to determine the ground-truth comprise at least one fiducial marker placed at a known position with respect to the socket.

13. The method according to anyone of the preceding claims, wherein the baseline compensation function is updated by adding a six degrees of freedom constant offset to the output of the computer vision module, wherein the offset is determined by subtracting the six degrees of freedom output of the computer vision module when running a benchmark dataset with the updated neural network from the six degrees of freedom output of the computer vision module when running a benchmark dataset with the baseline neural network.

14. The method according to anyone of the preceding claims, wherein the baseline compensation function is updated from a remote device via a communication device, and wherein the remote device compares the variation in the pose-estimation inaccuracy with an optimal variation range from a database of historical determinations, and adjusts the threshold based on said optimal variation.

15. An autonomous charging device comprising:

- an end effector for supporting and moving a vehicle charging connector;
- a camera;
- a motion control unit;
- a computer vision unit for pose estimation, comprising a baseline neural network; and
- wherein the motion control unit is configured to control the motion of the end effector for plugging the connector into a vehicle socket using a pose estimation from the computer vision unit using an image of the socket recorded by the camera; wherein the motion control unit comprises a baseline compensation function compensating for an inaccuracy between an actual pose and a target pose; and
- a control device

characterized in that the control device is configured to carry out a method in accordance with anyone of claims 1-14.

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