# Using the last steps – exploring natural interaction for automotive use cases

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**ABSTRACT**
Adjusting the car to the drivers' and passengers' needs is a key value for safety, well-being and customer satisfaction. Configuring the car can be tiresome and complex. Methods of pre-configuring may raise the level of comfort if applied correctly. We introduce several scenarios to use the time of approaching the car for implicit and explicit communication between human and machine by 3D object recognition and gesture interaction. Identifying persons and understanding their situation is critical to set gestures into the right context. First steps towards assembling a prototype to explore the range of natural interactions around the car have been taken to test the feasibility of the approach.

**Keywords**
Gestures, implicit interaction, remote control, visual context sensing, privacy settings, configuration, pre-configuration, optical sensor.

**MOTIVATION**
Paul likes to listen to loud metal music while driving. He has a date tonight he is looking forward to and happily drives to the restaurant where they want to meet. The evening goes well, and Paul offers to drive his date home. They go to his car, and while walking towards it, several things happen: As it is a cold evening and they walk towards the car together, seat heating is switched on for both front seats. Moreover, Paul performs an unobtrusive gesture with his right hand, which is a secret sign for his car to switch to quiet romantic music to avoid the embarrassing moment of screaming load music when starting the car. They both enter the car and Paul is pleased about his intelligent car when he notices that his date is feeling well.

**APPROACH AND METHODOLOGY**
The idea is to use data available even before driver and co-driver are sitting inside the car. Everything the driver or the car itself do before actually entering the vehicle shortens the time needed to start driving. Moreover, if you get the impression your car understands the context of approaching and supports your needs and wishes, the relationship between driver and car will become more natural as the technical and therefore impersonal pressing of buttons or choosing settings in a menu can be omitted. Today, a bidirectional communication between car and key can be established in a range between 15-20 meters around the car. This enables us to activate the sensors several seconds before the car gets unlocked. This additional time is very valuable to apply configurations and settings and prepare the car.

**Figure 1: Differing approaching scenarios.**

**Using sensor data**
On the one hand, adjustment can happen implicitly – like recognizing the amount of people walking towards the car, or how tall they are so the car can be prepared for the expected passengers. Fischer et al. [1] have developed a support system for cars where an omnidirectional vision sensor detects an approaching person as well as height and size characteristics. By additionally building up a model of the surrounding, doors are automatically opened without collisions in narrow parking situations and the seat position is preset to allow for comfortable ingress. We aim to enhance this approach to further improve context sensitivity. On the sensor side, integrating techniques like face detection and additional sensors can be used to enrich available information. On the application side, this knowledge can be used to support more than the ingress process. Different scenarios are possible, like unlocking the trunk when sensing a large carried along object, switching on seat heating depending on number of persons and temperature, using identification data to load specific music playlists, or setting privacy contexts.

### Defining explicit communication gestures

On the other hand, explicit gestures offer potential for preparing the car while approaching. 3D gestures operated on hand or arm level can be used to communicate unobtrusively during the last meters, and allow making adjustments like opening the roof of a convertible without searching for the key. In another scenario, gestures can be used to set the privacy level of the infotainment system, like hiding navigation history or media consumption details when certain persons are accompanying.

## FUTURE STEPS

At the moment we are using the RGB and depth image of a Microsoft Kinect© and the OpenNI framework to create skeleton models for the detection of gestures. In combination with face and finger recognition algorithms based on eigenface detection [2] and background subtraction [3], a broad range of sensor data is available. Future steps include finding the ideal position to attach cameras to allow for distortion-free taking of images. Furthermore, evaluation methods to test the benefit and acceptance of pre-adjustment while approaching need to be developed.

## REFERENCES


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