Carlos - Car Entertainment System

Patrik POLATSEK[*], Martin PETLUŠ[*], Jakub MERCZ[*]
Lukáš SEKERÁK[*], Peter HAMAR[*], Róbert SABOL[†]

Slovak University of Technology in Bratislava
Faculty of Informatics and Information Technologies
Ilkovičova 2, 842 16 Bratislava, Slovakia
team03.1314@gmail.com

Entertainment and information systems become the important part of our lives. One of the most modern and natural human-computer types of interaction is an *augmented reality* (AR), where a real-world environment is supplemented by virtual data, such as visual, textual and audio data.

Our aim is to create a prototype of an interactive system with a user-friendly interface for fellow travellers in a car designed for entertainment and educational purposes. The proposed system called *Carlos* changes a car side window into a *transparent projection screen* to supply the surrounding reality with the virtual information. The system creates an AR on a car window, due to which it can inform travellers about the immediate environment in real-time.

Carlos visualises the information on a side window with a transparent film using a small LED projector. The whole system is controlled using a mobile phone with gestures, voice commands or rotation of the device.

Carlos detects interesting objects such as sightseeing, restaurants and hotels on images captured by a camera mounted on a car. In the detection phase it compares the images using the actual GPS position and the internal database of objects of interest. The detection starts with the selection of potential objects close to the GPS position automatically received from a mobile phone. Subsequently the object detection is performed using the feature extraction and matching methods. After the successful detection the system computes the location of objects using the homography [1]. Due to proper displaying the information, Carlos works with Kinect device to detect the user's head position. Then the location of detected objects is recomputed in order to the precise placing of virtual information for the actual user's gaze at the window. Finally, Carlos projects on a window the basic tourist textual and visual information for detected objects.

Carlos is not only the information system, but also the entertainment system. It uses the object detection also for an educational game based on the answering a question related to the object. Another AR game is a flight game which aim is to keep a plane above the horizon as long as possible. In order to detect the horizon the system detects sky regions with an edge detection algorithm. The flight of a plane is controlled by simple gestures on a screen or rotation of a smartphone.

Most AR car systems create an AR on a front window to display navigation information or increase the safety by detecting objects close to the car. An example of an entertainment system which aim is closer to our system is a project called *Touch the Train Window* by

[*] Master study programme in field: Information Systems
[†] Master study programme in field: Software Engineering
Supervisor: Dr. Vanda Benešová, Institute of Informatics and Software Engineering, Faculty of Informatics and Information Technologies STU in Bratislava

IIT.SRC 2014, Bratislava, April 29, 2014, pp. 1–1.

Salad[1]. The system just allows a user to place virtual objects on a window in a train using GPS position and Kinect device which tracks the user's hand and window.

Our system is implemented in C++ and Java language using OpenCV, OpenGL and Freenect library. It consists of several modules which structure is presented in Figure 1:

- **Control module**: Each module is controlled by this single central module. The module manages other modules and their inputs and outputs, receives images captured by camera and displays virtual information using a projector.
- **Image processing module** implements the object detection algorithm using feature descriptors. The module returns the position and name of detected objects on an image captured by a camera. The module also detects the horizon using the edge detection.
- **Kinect module** processes video and depth information from Kinect device. It detects the face and computes its actual position.
- **Module of text position computing** calculates the correct position for projected virtual information according to the traveller's actual gaze using the position of detected objects and the position of the face.
- **Android module** is implemented in a Java application for a smartphone with OS Android. It contains the interface for controlling all Carlos applications. The module implements 3 types of interaction – gestures, voice and rotation of the device and records the GPS location.
- **Augmented reality module**: The primary aim of AR module is to create the visual information projected using the projector. This module implements 2 types of games. The first one is a quiz game which asks questions about detected objects. In another game a user controls a plane and tries to keep it above the detected horizon.
- **Database module** manages an internal database which contains photographs, GPS positions and essential information about objects.

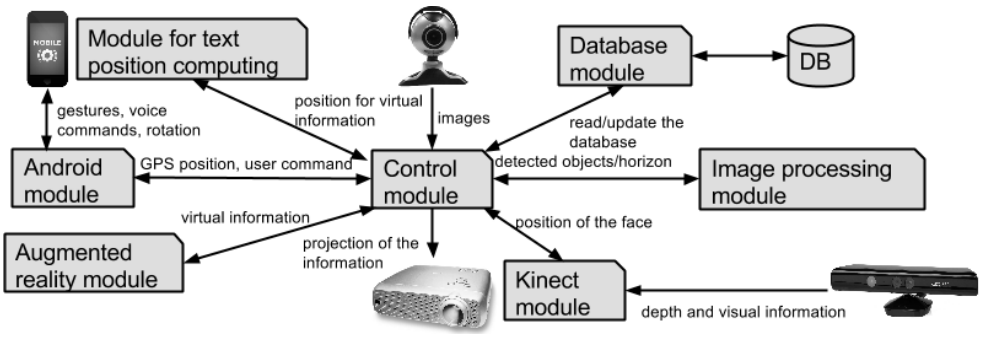

Figure 1. Structure of our system.

Acknowledgement: This project is partially supported by Volkswagen foundation.

References

[1] Sonka, M., Hlavac, V., Boyle, R.: *Image Processing, Analysis, and Machine Vision*. Thomson-Engineering, 2007.

[1] http://csp-salad.com/