HYBRID SLAM MODELLING OF AUTONOMOUS VEHICLE WITH AUGMENTED REALITY DEVICE

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1. Introduction

Nowadays we meet more and more autonomous vehicles. The concept of autonomous issue is closely related to enhancements in sensors and mathematical models. To design fully autonomous vehicle is unfortunately still a hard task. It is due to the fact that many situations during controlling the vehicle can be non-expectable and only undergone experiences and deduction from such knowledge can handle such situations. Human brain with its vast library of experiences accumulated during various situations is a perfect solution solver for such events. For such reasons the vehicles are often constraint to certain areas such as lanes, barriers, certain area, predefined expectable space.

In order to successfully perform during autonomous navigation we have to divide the whole process into two parts. The first one is the way how to obtain as much accurate map of surrounding environment as possible and the second one is how to autonomously control the vehicle according to certain expectations. The concern of this article is mainly the localization of the vehicle in real time and mapping its surroundings. Interesting approach is described in [1] as SLAM (Simultaneous Localization and Mapping) which is becoming an essential element for navigation [2].

The basis for SLAM procedures is an Extended Kalman Filter (EKF) described in [3]. For successful localization deep mapping has to be performed. During mapping many obstacles are found around the vehicle. Such obstacles have to be somehow categorized in order to decide to which superior landmark it belongs to. One of the key information about each obstacle is its position. Anyway there are new interesting SLAM techniques nowadays [4]. We will discuss mainly fastSLAM and L-slam approaches in this paper. FastSLAM was introduced firstly by Montemerlo & Thruns [5] as so called "stochastic SLAM". This algorithm uses division of stare variables into two different groups. The first group is evaluated with the help of particle filtering and for the second group the EKF is used. We can observe noticeable problem simplification [6]. The second approach (L-SLAM) is mainly focused on each distinct obstacle characterization - mainly its orientation to real-time vehicle position [7]. Unfortunately both methods experience a quadric computational complexity [8].

In the presented paper we would like to introduce new approach to perform mapping of the environment based on commercially available Microsoft HoloLens technology. Such a device is the first functional augmented reality gadget offered to a wide audience. Easily obtained example of mapping based on HoloLens is in Fig. 1. The environmental scanning is performed in real time. Such technology is meant for mostly static or slowly moving environments which will be enhanced in the already released version 2 of the equipment. The whole architecture is a hybrid one preserving locations of the landmarks. For certain landmarks EKF is applied. Hence the computational complexity is minimized remaining the information for absolute reliable and accurate locations of them.

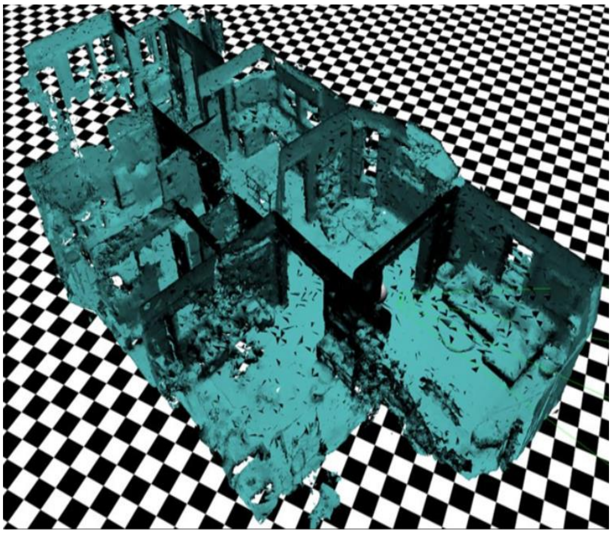

Fig. 1. Map of indoor environment with HoloLens.

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