COMPUTATIONAL TOOLS AND FILE FORMAT FOR VISUAL INTERACTIVE INDOOR MAPPING

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ABSTRACT

This paper introduces FIVE (Framework for Indoor Visual Environments) and HIJSON (Hierarchical Interactive JSON), respectively a Javascript API for indoor mapping applications, and a novel cartographic document format. Client-side FIVE applications, entirely based on web technologies, rely on HIJSON documents produced server-side using LAR, a novel representation scheme for topology and geometry.

An *interactive indoor mapping* environment is a virtual reconstruction of a physical indoor space, where the user may interact with virtual objects, experienced in the actual position they occupy in the real world. Our approach outlines a specialized and evoluted 3D *user interface* giving a glimpse of a section of the real world, that the user can handle intuitively. Furthermore, the virtual indoor environment API provides a platform where many different applications can rely upon. Accessible via web browsers from any kind of device, several applications may coexist on this platform. IoT monitoring, realtime multi-person tracking, and cross-storey user navigation, are already implemented using an automatic search for all valid walkable routes, and taking into account both architectural obstacles and furniture.

The HIJSON format is used to represent any geometry of the indoor space of complex buildings, capturing their hierarchical structure, a complete representation of their topology, and all the objects (either smart or not) contained inside. Such textual representation allows the FIVE framework to offer a web environment in which the user is presented with 2D or 3D models to navigate. With respect to current cartographic formats, HIJSON suggests four major enhancements: (a) exposes a hierarchical structure; (b) uses local metric coordinate systems; (c) may import external geometric models; (d) accepts semantic extensions. The semantic extensions supported by the FIVE architecture encapsulate the details about communication protocols, rendering style, and exchanged and displayed information, allowing the HIJSON format to be extended with any sort of models of objects, sensors or behaviors.

This paper quickly outlines the generation of geometric data of a complex building, to provide both an explicit semantic and a hierarchical model of indoor spaces. LAR, a general representation for geometric and solid modeling is used for this purpose. The generated LAR structures are exported to HIJSON format, extending GEOJSON for indoor mapping and the Internet-of-Things. A convenient way to extend the representation capabilities of IoT *smart objects* is also mentioned as semantic extensions, that affects both document format and the web framework, and can be easily collected in a public repository.