Supporting enhanced disaster management with interactive 3D and Mixed Reality Maps

by KEVIN PATRICK HELZEL

This master thesis examines the potential of cartographic 3D and Mixed Reality approaches facilitating crisis communication of disaster information and planning of disaster response during the process of disaster management. It involves developing an own visualization approach for the use in disaster response planning based on a mixed methods approach combining quantitative and qualitative research methods. As a primary audience for this work, the staff of crisis committees and control rooms can be identified who oversee disaster response activities as the head of operation.
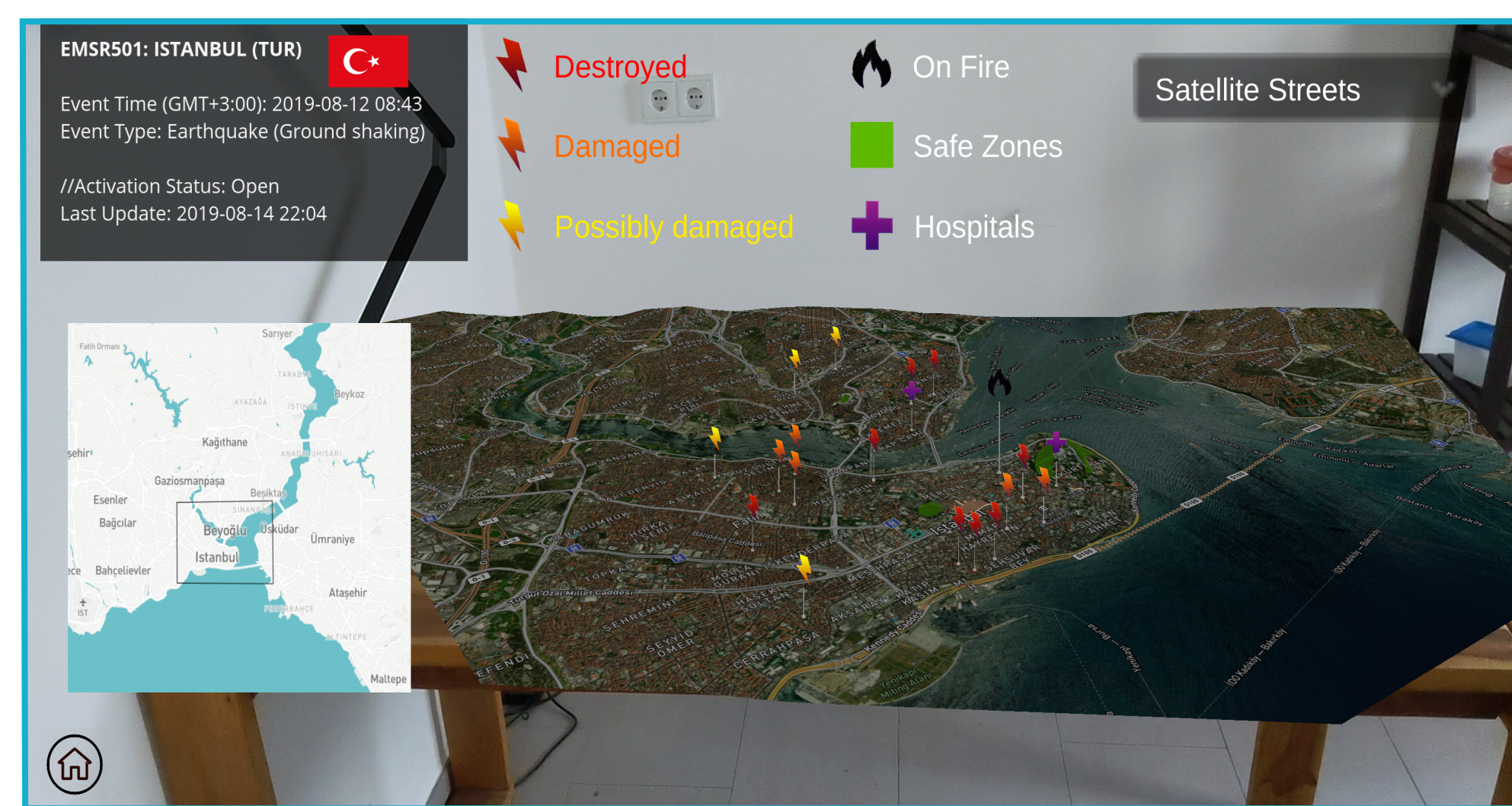

Fig. 1: Tabletop-MR-Scene of a fictional earthquake event in Istanbul, Turkey

DISASTER MANAGEMENT

Disaster management comprises the organization, planning and application of actions aimed at the preparation for, response to or recovery from disasters. The complex, multi-actor process revolves around four interdependent, primary steps: preparedness, response, recovery and mitigation [1].

SITUATIONAL AWARENESS

Situational Awareness is by definition "all knowledge that is accessible and can be integrated into a coherent picture, when required, to assess and cope with a situation" [2]. Disaster mapping products have a critical influence on the success of disaster relief operations because they majorly affect the situational awareness of the emergency management staff and first responders [3].

MIXED REALITY

Mixed Reality technologies as a standalone concept create immersive environments and visualizations which are characterized by physical and digital objects co-existing in space and interacting with each other in real time [4]. This means that any technology which moves in between the boundaries of a completely synthetic, digitally created world and the real physical world can be considered Mixed Reality [5].

RESEARCH DESIGN

Based on the literature review and a user requirement's survey, a self-made cartographic application was set up by fulfilling current needs and demands of the domain's community. Eventually, the created mapping application was evaluated by real actors from the field. The outline of the case study included:

1. Description of the present situation in the domain
2. Analysis and use-case selection process
3. Production of a self-made cartographic application
4. User Evaluation of the developed approach

OWN VISUALIZATION APPROACH
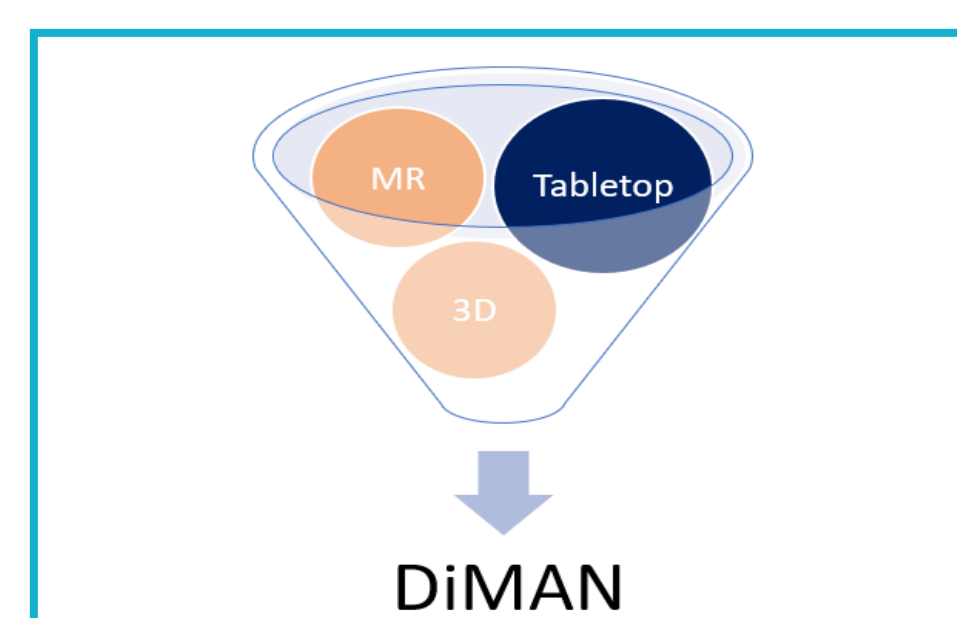
DiMAN (Disaster Management Application) is based on a tabletop approach that visualizes the map on top of a table or other

Fig. 2: Indoor 3D map of a hotel

rectangular flat surface (e.g. carpet, floor) using the device's camera (Fig. 1). The map is being generated via Mixed Reality technologies as a hologram that is anchored to the surface. A 3D indoor map was integrated which can be opened through a button-click (Fig. 2). Other features of the prototype contain:

- Changing of base map/satellite layer
- Different map sizes and zoom-feature
- Integration of pictures and videos
- Setting layers active or inactive
- Real-time data integration

Fig. 3: Tabletop-MR-Scene of a real wildfire event in Castelo Branco, Portugal

CONCLUSION

The disaster model was able to show the potential of cartographic 3D and MR applications which was confirmed by the interviewed experts from the field. The benefits of reality technologies for disaster management was not only indicated in the survey but also re-affirmed by the experts. Due to independent factors like a lack of political engagement and investments into the disaster infrastructure, it cannot be predicted when the new technologies will finally be put into practice, regardless of their benefits.

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