Contest Abstract: Agile Indoor Positioning with Smart Glasses

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ABSTRACT

The proposed system exploits the emerging smart glass technology to perform agile positioning for indoor environments, which is infrastructure-free and does not rely on an existing map. The system takes the unique advantages of smart glasses and fuses the first-person Point of View (POV) images with the sensory data to achieve accurate localisation.

1. INTRODUCTION

Most current practical indoor positioning solutions are *smartphone-based* and rely on the onboard sensors such as the IMU and WiFi/Bluetooth, to infer the user locations. Some of the existing work [1] considers cameras, but is not ideal for localisation since smartphones are normally put inside a user's pocket/bag while walking, making it impractical to capture images. Smart glasses on the other hand, have significant advantages in this context: they are equipped with the equivalent package of sensors, and the fact that they are rigidly mounted on the face of a person (shown in Fig. 1) makes it possible to acquire highly informative visual clues during normal walking.

We propose an agile indoor positioning system on smart glasses by combining visual sensing with other modalities. The proposed system does not require the map of the indoor environment, but maintains its own representation of the workspace. The system accumulates the relative trajectories of the users, together with the sensory data observed along the way, to incrementally assemble a graph. When a user moves across the space, he or she is localised with respect to the graph, and could be later projected to a global reference frame. Therefore, the proposed system evolves over time, and becomes more accurate as more users participate.

2. SYSTEM DESIGN

The proposed system has the following main components:
Sensing: The sensing module retrieves and processes the raw data from the on-board sensors of the smart glasses.

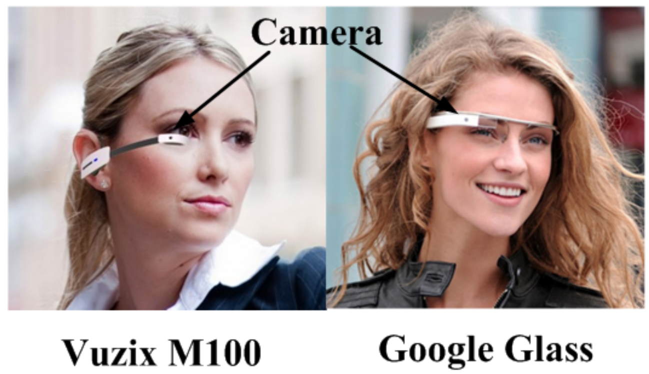

Figure 1: Cameras are configured to good positions to capture images with wearable smart glasses.

The proposed system considers multiple types of sensory data: motion data generated from the IMU, images captured by the camera, and electromagnetic signatures such as WiFi/Bluetooth signal strengths.
Localisation: As a user moves in the environment, the localisation module compares the live sensor streams (provided by the above sensing module) with the current graph, and determines the relative position of the user within the graph. It essentially finds the optimal subgraph that can best explain the movement of the user, and infer her positions in the workspace.
Graph Maintenance: The proposed system saves the the new user trajectories, which are then used to build and update the graph that describes the workspace. Our system exploits the sensor observations to figure out the relative position between the newly saved trajectories with the existing graph, and merges them to form an improved representation of the indoor environment.

3. DEPLOYMENT REQUIREMENTS

Smart glasses will be worn be contesters and no deployment is necessary, though (WiFi) communication with a notebook computer is required to demonstrate *optional* cloud component of the proposed system.

4. REFERENCES

[1] Y. Zheng, G. Shen, L. Li, C. Zhao, M. Li, and F. Zhao. Travi-navi: Self-deployable indoor navigation system. In *Proc. MobiCom*, 2014.