Precise Geo-referencing of « long » indoor photogrammetric acquisitions

Context and goals:
Photogrammetry (3D modelization from images) made spectacular progress during the last decade, mainly on automation. From a « well-designed » multi-stereoscopic acquisition, it is now possible to create, without any human intervention, visually « perfect » 3D digital models of rather complex scenes.
However, when 3D models are used as measurement tools and not as communication supports, their metric precision is still an open question in many cases, such as for indoor modeling where the lack of GPS signal prevents absolute readjustment and makes the technique very sensitive to « band drift » (systematical errors accumulation on poses estimation that may lead to bad reproduction of objects, e.g., a planar object may be reproduced as « slightly cylindrical »).
The goal of this thesis is to develop a photogrammetric acquisition system, hardware and software, that minimizes drift effects in indoor scene modeling. Potential applications are extremely numerous, such as non-exhaustively digital models (new BIM norms), 3D plans creation by the administrators of inspectable networks (e.g., RATP, SNCF, sewers…) complying the European standards.

Approach:
The candidat will rely on the existing methodology of the LOEMI laboratory, in particular:

- hardware: LOEMI's light photogrammetric camera (CamLight); the camera features allow the creation of a light system (less than 1 kg) built around several cameras synchronised and having a high temporal (5 to 10 Hz) and spatial (20 Mega pixels) resolution;
- software: open-source photogrammetric suite MicMac developped at ENSG; this software already allows bundle adjustment (precise orientation) taking into account some physical characteristics of the system (rigid pair as an example); the open C++ code makes it possible to add new observation equations.

At first, the candidat will make acquisitions with « heavy » systems based on off the shelf cameras (reflex camera) and will process the data with the existing software suite on scenes with control ground points. The information extracted from these first tests will determine the hardware system design and software evolutions.

Supervisory staff:

- Thesis director: Marc Pierrot Deseilligny, co-director: Christian Thom, supervisor: Jean-Michael Muller;
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Profile:

- Research Master 2 holder or equivalent;
- Taste and aptitude for programming, C++ knowledge would be a plus;
- Taste for experimentation;
- Basic knowledge of electronics.