Title:
As-built 3D Presentation of the Urban Environment around University Campuses

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Introduction:
"Chi-Da commercial district" is located next to Taiwan Normal University campus, Taipei. Due to large number of students, there is great demand for food booths or grocery vendors. From the original student-related activity to the accumulation of shops, this district has developed to be a high density and versatile community. The development has accelerated recently, since urban renewal and new MRT stations have attracted more and more people. The interlacing of residence and commercial activity has blurred the boundary of the original design as a quite community. The interlaced activities, which are intolerable to residents, have cause noise, smell, and the intrusion of privacy.
The district is also famous for night market. In early days, most shops sell daily groceries which are not considered as or running like night market. Now, the grocery stores have been superseded and replaced by coffee shops, cafeteria, south-east Asia restaurants, etc. The new shop types have created a new aspect which was reported on TV by travel channel and food channel intensively. The TV promotion also attracts government bureau to integrate this community as part of a must-see sightseeing location. Consequent government-lead promotions include alley culture event, beef noodle festival, good business certificate, and beauty patent. Since more and more alleys are involved, the shift of a quite community has changed the environment and consequently offended local non-commercial-related residents.
Nowadays, city modeling has reached a new paradigm in which 3D point cloud models have been treated with geometric properties. Technical, policy and institutional barriers are usually faced in integrating data from multiple state-based sources [2]. Same situation can occur to departments of a local government for spatial-referenced multiple land information databases. It's important that data from all platforms need to be exchangeable for the best efficiency [1]. Based on shared data, system integration can be achieved to support decision-making of planning and facilitate the facility management after construction. The concept of cross-sourcing virtual cities [4] should be promoted further to as-built city data, as to reflect the real content of an environment. 2D registration processes should be extended to cover 3D property registration [3], like the integration of topographic map and as-built 3D city models. The concept of rich geometric data should be extended to GIS field by capable of integrating with existing 2D vector drawing for update purposes.
The creations of new scans were based on existing point model for broader registration reference (up to 180m, comparing to the common scan range of 200m) and better result. The new scans facilitate the integration and extension of existing database. Since former effort was taken into account, the reference framework in a larger scale is extended and feasible for future work. This project is measured about a 1 square km (Fig. 1 left).

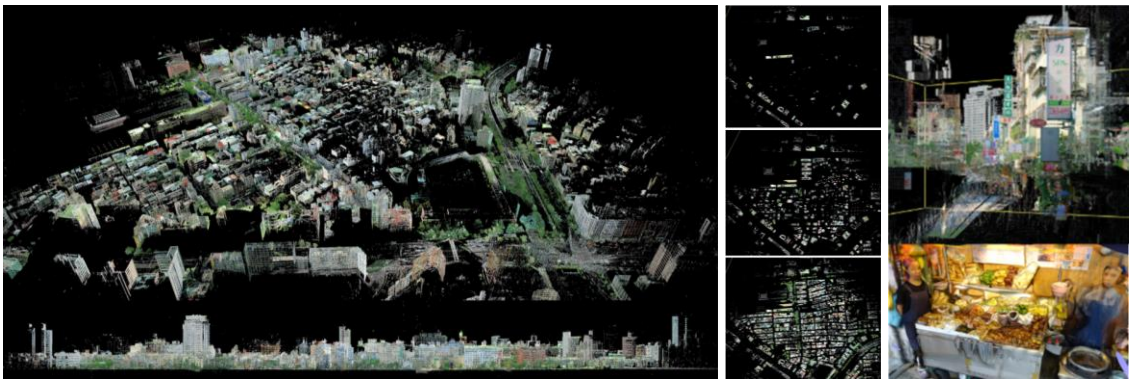

Fig. 1: The 3D point cloud of the district and elevation (left), urban fabrics (middle), and as-built street scene models (right).

Issues

The issues behind 3D urban scan have multi-fold. The data not only help visualize urban space in different levels of abstractions, but also enable the experience of dimensions in different scales. The visualization facilitates qualitatively study with precise description of the mutual relationship of artifacts. The urban fabrics at different altitude are also presented (Fig. 1 middle). The relationship quantitatively specifies the amount of intrusion, illegal occupation of public spaces, or the variation of skyline as follows.

- the archiving and re-interpretation of the "alley commercial activity" within the culture-education district;
- the interface between the campus and the business district;
- the identification of the existing conflicts between residence space and business space;
- the archiving of the changes along streets.

Patterns

The scans have help discovering specific patterns or features that exemplify human-space interaction as follows.

- the deployment of advertisement panels on street-facing façade (Fig. 1, right);
- the installation of illegal roof covers on low-rising apartments;
- the adaptation of old apartment front;
- the reuse of parking lot for new shop types;
- the conflicts between public circulation and commercial activities;
- the existence of interstitial space between street and apartment front.

The overlapping artifacts of different proportions are presented in a specific hierarchy. Sections along the most popular street by intervals are super-imposed together to enhance vertical profile of building components and artifacts (panels, window installations, facility additions). Most of the facility additions are beyond the old apartment design and were installed without order. Crowded with temporary pipes and wires, an alley is a well self-contained world of adventure for food, clothes, and ornaments, not only for college students, but for all ages.

Conclusions:

Although current landscape was created based on architectural design and urban planning drawings, the data belongs to different departments. Now the as-built data cover the construction outcome from public or private, the location-based inter-relationship is also clarified. So the model not only shows the original designs, but also the records of chronological additions or modifications which were legally or illegally made. The communication cross departments can be made accordingly, even to the level of graffiti.

The as-built model presents an objective reference for urban planning related decision making. The model not only is feasible for site analysis, but also used for publicizing the government planning policy for its advantages in illustrating both visual perception and 3D geometric dimensions.

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