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A REVIEW OF STREET ADDRESSING SYSTEMS WITHIN THE REALIZATION OF CONCEPTION OF SMART CITY

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Abstract
This report includes consideration of types and features of Street Addressing systems to be used for realization of conception of Smart City.

Аннотация
Данный отчёт содержит рассмотрение типов и свойств систем Городской Адресации в рамках реализации концепции Умного Города.

Introduction
The main role of Information Communication Technologies (ICT) in realization of conception of Smart City (SC) is introduction of data and service layers for automation and simplification of management of the city infrastructure. One challenge in this process is integration of different data and services and unification of methods of management of different sectors of the city's economy. Street Addressing (SA) has many applications and is a crucial component in initiatives to develop Smart Cities [1]. Thus SA could serve as a connection link between different SA data and services.

Classic SA System
Before considering the SA system for SC, classic SA should be studied. The main purposes of classic SA are as the following: (1) enable people to get around the city more easily; (2) facilitating the delivery of emergency health, fire, and police services; (3) locate urban facilities; (4) improve planning and managing municipal services; (5) assist with urban planning and programming of investments; (6) improve local tax collection; (7) enable utility concessionaires to manage their networks more effectively [2]. These purposes can be simplified into the following one: determination of the location.

Original classic SA system targeted streets, buildings and apartments. But modern city infrastructure is becoming dense and dense because not only of increasing of height and density of buildings, but also because of rising of number of new installations, such as regulatory devices for gas, water, electricity supply services, ATM, POS terminals, communication devices and so on. Maintenance of these installations and devices, development of relating integrated SC services require integrated approach. Installations and devices can be referred uniformly by Street Addreses that makes SA system a base that helps the integration.

Location Based Services (LBS)
There are several definition of LBS. LBSs are information services accessible with mobile devices through the mobile network and utilizing the ability to make use of the location of the mobile device (Virrantaus et al. 2001). A similar definition for LBS is given by the international OpenGeospatial Consortium (OGC, 2005). Another definition reads as: LBS is a wireless-IP service that uses geographic information to serve a mobile user. Any application service that exploits the position of a mobile terminal [3]. Location is a fundamentally ambiguous term. It refers not only to the continuously changing position of a person, but also their relation to the places, things and other people that interweave through space, time and scale [4].

Types of SA System

There are different SA systems applied in cities of the world. The main types of the SA include [2]:

1. Sequential. Objects are addressed by sequence of integral numbers. Letters are used to keep sequence of numbers in cases where necessary number already assigned;
2. Metric. Objects are addressed according their distance in meters from a reference point;
3. Decametric. The same as Metric one, but objects are numbered by 10th metric distancies.

Sequential system is well known one. Metric system was proposed to address cities that are under intensively development. Decametric system in comparison with metric one has shorter addressing numbers, but bigger resolution, that makes it not suitable for dense areas.

Service "what3words"

what3words Limited announced service "what3words" as a new addressing system. The declared key advantage of the service is the simplest way to talk about location by using unique 3 word address that will never change [5]. Although the solution realizes an idea that aimed to simplify memorizing of addresses by people, it has many drawbacks that cannot adopt it as a SA system:

5. There is no relations between neighbor addresses;
6. Addressing of thoroughfares and areas is not simple;
7. The solution needs an application that translates 3-words address into the location. People cannot guess location or direction without the application;
8. The solution is closed source one that introduces risks of providing long sustainability of the service and the services that depends on it.

Long-term sustainability can be considered as a major indicator of quality and health of software systems. Many organizations have requirements for long-term sustainable software systems and associated digital assets. Open Source Software (OSS) has been identified as a strategy for implementing long-term sustainable software systems [6]. For any OSS project, the sustainability of its communities is fundamental to its long-term success [7],[8]. Thus there is doubt in long-term sustainability of "what3words" service.

In fact, "what3words" seems to come in for almost universal criticism by U.S. and U.K. open-map developers [9]. It seems that all problems are relating to misusing of engineering terms and misplacing the solution on the market. From an engineering view "what3words" is a LBS, but not a SA system. Positioning it as a LBS could allow to put everything in its place, get rid of criticism, and develop of "what3words" within mainstream of LBS in Smart City development.

Max Tegmark in his open letter, signed by many prominent researchers and developers, shows that a small change in technology is available at the level of the business, which is interested in the speedy implementation of the solution without an in-depth laboratory analysis of the consequences. At the same time, a change in technology can have a tremendous impact on both human life and the environment [10]. It seems that "what3words" was introduced and implemented without proper research. Avoiding proper peer-review before implementation leaded to criticism, negative feedback, and loses of market position.

Identification of Geographical Objects

Development of data layer for Smart City services supposes to implement unique identifier (ID) for the registered objects. Street Address could be selected as the ID in case if a

location properly identifies the object. Taking into account global character of a Street Address, this ID can be considered as a global ID (GUID). This feature of Street Address allows it to be accepted as primary/foreign key at database design stage. Due to open and universal nature of the SA system and distributed architecture of SC data layer, Street Address is very convenient to be used as reference. Open nature of SA system is an indicator of long-term sustainability and quality of SC services [6],[7],[8].

Conclusion

Development of SA system for realization of conception of Smart City should take into account the following:

1. SA system should be both human friendly and suitable for use in computer systems;
2. Humans should have ability to use SA system regardless of computers;
3. Development of technologies leads to change city urban fabric more and more intensively;
4. Metric SA system is considered to be base for development of SA for Smart Cities because it is suitable for intensively development cities;
5. Street Addresses can be used as references in inter-system interaction, that increase qualities of the SC services;
6. SA system should be open in order to provide long-term sustainability and quality of SC services;
7. Commercial sectors should not implement the solutions without proper research.

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