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Generic Mobile Data Acquisition System for Geosciences Applications

Admire Kandawasvika, Wolfgang Reinhardt, Stephan Mäs, Fei Wang
AGIS Lab – Arbeitsgemeinschaft GIS
University of the Bundeswehr
Werner-Heisenberg-Weg 39
D-85577 Neubiberg, Germany
e-mail:{admire.kandawasvika, wolfgang.reinhardt, stephan.maes, fei.wang}
@unibw-muenchen.de

ABSTRACT

Advances in mobile information and computing technology are enabling the realisation of different applications in the geosciences. Taking advantage of this, the research work being addressed here covers the conceptual issues and prototype development of a sophisticated, open standards-based mobile data acquisition system for use by geoscientists in the field [1,2,3]. As pointed out in [1], mobile acquisition of geodata usually requires experienced users with knowledge about existing data and the underlying data models. For effective and efficient data acquisition, the system should facilitate all knowledge levels of users in performing their mobile acquisition tasks without getting involved with such details. Also, the existing systems expect the users to examine and synchronize the data in the office, before going to the field. If any unforeseen errors occur in the field, to the prior downloaded data, there is no other possibility for the user to access the original data from geoservers. Furthermore, the user can not verify or check the newly acquired data against the data model (i.e. if all the pre-set conditions and quality constraints are met). All the field work has to be validated back in the office. This common approach makes the acquisition procedures costly and time-consuming, and also data maintenance becomes more expensive.

For our system concept, taking the discussed problems into consideration, the following aspects have been proposed:

- Establishment of an online access to relevant, distributed geodatabases in the field
- Definition of an open, standards-based platform
- Design an architecture for the mobile data acquisition system
- Development of a generic acquisition frame for the system
- Integration of quality assurance into the main workflows

The mobile user should have optimal, location-based access to distributed geospatial databases residing on the servers. As mentioned in [2], using mobile Internet, wireless communication (WLAN, Bluetooth, or other radio technologies), in combination with geospatial services, can optimise workflows in geodata acquisition and management campaigns, and also can enable the user to access the geodatabases in real-time. In order to avoid proprietary, vendor-dependent developments, our system is based on standards like OGC Web Feature Services[4] (i.e., for data access and transactions), the geographic markup language (GML)[5] (i.e., for modeling and transportation of data), etc. For the purposes of adaptability, our system employs a generic approach of data acquisition. This ensures that the system can be adapted to different applications in the geosciences. In addition, data collection should always be in harmony with or compliant to the underlying data model. Our system mobile clients get the knowledge of the data structure from the schema information and communicates this information with the user in simple ways, e.g. by means of a form for allowing the user to enter attributes of a feature, etc. Also, main workflows have been devised to support various kinds of quality checks directly in the field. Regarding data acquisition, geosensors like GPS receivers and total stations [6] can be plugged into the mobile client which is running on mobile devices like tablet PCs.

As proof of concept, a prototype of the system has been developed. A landslide monitoring application has been used as a geoscientific case study for the research. First tests have been carried out in a test area near Balingen in Germany [7]. The area has very unstable surface and slopes in which rock masses, soil and other loss material may fall at anytime from the mountain, and may be hazardous to people and the nearby infrastructure (e.g. roads). Geodetic measurements reveal continuous movement of the surface. Monitoring of such an area requires up-to-date situational awareness. For example, if any new ditches, gaps or slopes occur, the geoscientist should be able to collect this information and update the databases. In short, mobile data acquisition is vital for this application.

The first field tests were successful. A field server and two mobile clients communicating within a local WLAN network have been used. Considering that the test area is wooded (i.e. high density of tall trees), two bridge access points could cover the whole area (250m by 150m). For data acquisition, only a total station was

employed. To utilize GPS, special professional receivers may be used to overcome the problem of signal blockage by tree leaves and branches.

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