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Concept for a Wireless Sensor Network to support GIS based water and land resource management in the Aksu-Tarim Basin, Xinjiang, China

Reiner Doluschitz and Til Feike

Farmers in the oases along the Aksu-Tarim River suffer from severe seasonal water shortage caused by high fluctuations of river run-off. The uncertainty of water availability makes the planning of crop production and related investments extremely difficult. As a consequence farm management is often sub-optimal, manifesting in low input efficiencies, and the value generated in the agricultural sector being way below its potential. The "Tarim Basin Water Resource Bureau" (TBWRB) was founded in the 1990s. Its major task is to implement a basin wide water resources management plan, which involves fair allocation of water resources among the farmers in the different administrative units along the river. Among others, the lack of reliable and timely information on water quantities and qualities within the major water bodies of the basin hinders the implementation of an effective water management plan. Therefore we introduce the concept of a wireless sensor network (WSN) that provides reliable instantaneous information on the status of all important water resources within the basin. In the first step a GIS including all vital geospatial data, like river courses, channel and reservoir network and capacities, soil and land use map, is built. In the second step a WSN that monitors all important parameters at essential positions throughout the basin needs to be established. Measured parameters comprise meteorological data, river run-off, water levels of reservoirs, groundwater levels, and salinity levels of water resources. All data is centrally collected and processed by the TBWRB. Apart from generating a prompt and complete picture of currently available water resources, the TBWRB can use the system to record actual water allocation, and develop an early warning system for upcoming droughts or floods. Finally an integrated water and land management scheme can be established that allocates resources maximizing the benefits at basin level. Financed by public funding, the data collected by the WSN should be accessible to the public. Considering the environmental, economic and social cost of inefficient, intransparent and unfair allocation of water resources, the investments into a WSN are reasonable. However, it requires strong efforts from highest governmental agencies to enable the TBWRB to compile all the required data (e.g. meteorological, soil, river run-off), which is customarily collected and controlled by the respective administrative unit.