SMARTSAT
COOPERATIVE RESEARCH CENTRE

Satellite Telecommunications IoT-enabled Automatic Ground Water Collection and Aggregation Pilot (SIG Water)

Improving remote-area groundwater management

Mission Goal: Demonstrate the use of an Internet-of-Things and nano-satellite telecommunications to improve groundwater bore monitoring and management.

The Challenge

Like other state & territory authorities, the South Australian Department for Environment and Water (DEW) is responsible for the operation and management of an extensive network of groundwater monitoring bores. Currently, only 6% of DEWs 3500 bores are instrumented and bore observation information is generally collected infrequently by field-visits, often only a few times a year. There is a need to increase the frequency and spatial distribution of monitoring and provide automated data collection to service the growing data needs for effective groundwater resource management, whilst remaining within realistic budgets for monitoring related costs overall.

This project is developing a pilot system to demonstrate the use of an *Internet-of-Things* (IoT) and low cost *nano-satellite* telecommunications (nano-satcom's) as an end-to-end means to transmit and aggregate, in near real time, automatically collected information from groundwater bores. These bores, often located in remote and harsh environments, will be fitted with sensors to measure water levels and other water parameters with a focus on groundwater resource monitoring.

The Solution

The project will test the technical feasibility, reliability and cost-effectiveness of deploying an end-to-end IoT nano-satcom's solution in typical operational environments. This includes evaluating, procuring, integrating and deploying both sensors and telemetry

transmission devices in experimental sites in the field and operating these for a period of around a year. During this time, various aspects of the system will be evaluated, ranging from the equipment deployed and its robustness to the evaluation of the resulting data outputs. The aim is to assess the feasibility and cost of operating such devices autonomously for extensive periods of time. In addition, the project will develop a prototype capability to enable the end-to-end transmission of data from in-situ devices via satellite to end users via the internet.

The SIG Water approach will be compared to current groundwater monitoring scenarios where information is either collected manually and sparsely in time or via costly telemetry systems. The system will be evaluated in conjunction with DEW as a representative end user and will provide results covering 60 to 80 sites across South Australia, including the South East region of the

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state, the Great Artesian Basin and the Eyre Peninsula. Although the focus of the project is on the system as a means for data collection, the data results themselves will also provide insight into how the information can be used in the groundwater management context.

The project also involves a specification of requirements for an 'ideal' monitoring system. This is being achieved through stakeholder consultation both with DEW and with a number of other jurisdictional water regulators and interested parties such as groundwater consultants, water utilities and national groundwater data curators such as the Bureau of Meteorology. A consultation process is under way that includes developing a better understanding of current practices for groundwater monitoring nationally, the gaps and unmet needs of these and how space-based communications solutions like SIGWater can be used to fill those gaps.

FrontierSI is leading the project and an advisory group with designated representatives from the end user organisation (i.e. DEW) will be deeply embedded in the project at all stages and in day-to-day developments, taking an important role in constantly validating and guiding the project to ensure the developments are fit for purpose. In addition, the project will take advice and guidance from the SmartSat Water End-User Advisory Board.

Impact

In Australia, groundwater is an important natural resource, accounting for around one-third of water use nationally and almost two-thirds in south-western Australia. Much of Australia's groundwater use is consumed by agriculture but it is also a significant component of the mining and energy sectors, as well as being a source for drinking water for many communities and sustains dependent ecosystems. Balancing outcomes through government groundwater management frameworks is complex and is often hindered by incomplete and untimely delivery of data. Groundwater resources are many and varied and abstractions can occur many thousands of kilometres and hundreds of years from where inputs originate. Groundwater systems are complex and spread over wide areas, presenting considerable challenge in their monitoring and understanding. Australia has the opportunity to establish itself as a world leader in technology development and application for improved groundwater monitoring systems. The outcomes

of this project can have an impact on groundwater management in Australia, and also have broad global applications and present international opportunities. Satellite and Internet-of-Things (IoT) approaches, capable of providing increased volume and variety of monitoring data, more frequently with greater spatial density, less time-lag for collection and at a lower-cost than equivalent current approaches, can be central to this.

IoT and Satcom's communications solutions like SIGWater are expected enable:

- Improved data coverage and temporal frequency to allow a greater understanding of groundwater systems, more detailed impact assessments and resource management responses and their monitoring;
- Optimisation of the underlying groundwater observation asset base at significant cost savings;
- Significant reductions in staff field time, through automated data collection;
- Increased availability of information needed to assess water use allocations and resource constraints through the integration of information from multiple systems;
- Greater confidence in the scientific evidence required for effective groundwater policy setting and resource management decisions.

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