

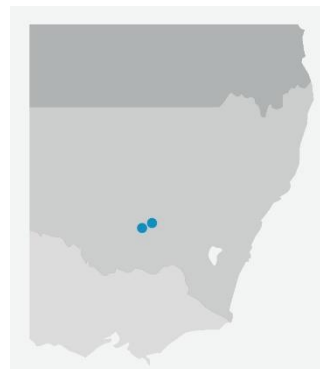


Automated irrigation systems: Integrated smart sensing & automation for cotton

1. What is the project about?

This project is developing and trialling low cost, integrated sensing and automation platforms that remove the requirement for manual irrigation checking and control. The irrigation platforms are being developed in partnership with growers and agriculture technology providers to make sure they are practical, reliable, and effective. The project is also building the capacity of research and commercial partners to offer 'fit for purpose' automated irrigation platforms.

Research and development activities are being conducted at the Irrigation Research and Extension Committee (IREC) demonstration farm at Whitton, and on a commercial farm at Darling Point. The early results have been positive, and the owners of the 'Ringwood' commercial operation have expanded cotton irrigation automation across their multiple farms with approximately 800ha of irrigation layout converted across to automation technology systems for the 2020/2021 irrigation season.



2. Why automate irrigation systems?

Currently most irrigators manually check the status of fields and crops and manually control irrigations. The process of checking status and controlling irrigation is both time consuming and inaccurate.

Early research results have confirmed that optimal sensing and forecasting systems linked to automated irrigation systems will enable irrigators to maximise productivity of their water whilst also reducing labour costs.



3. How will the research benefit irrigators?

The two key learning sites provide an opportunity for irrigators to assess, understand and use integrated, smart sensing irrigation technologies and automation platforms.

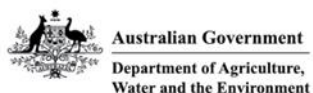
Commercial industry partners are now offering systems developed in the project across the Australian cotton growing areas and have established networks to provide service support.



4. Key results to date

Research activities have been able to demonstrate that the linkage of smart sensing and automation through a cloud-based platform can be achieved within an irrigation farming system across a range of sensing and hardware platforms and protocols for IoT based approaches.

Soil moisture tension has been identified as a key measurement which can be used for autonomous irrigation due to its 'absolute' measurement nature which allows it to be used across multiple soil types without site specific calibration issues. This



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is a particularly important consideration when using such data for autonomous irrigation as ‘calibration’ and ‘drift’ in sensor data across an irrigation season are major issues when using soil moisture data for autonomous irrigation hardware control. The project is developing a range of algorithms using machine learning which can be applied within irrigation seasons and across seasons to future predict soil moisture tension for triggering irrigation events.

The use of water level data for triggering gate drops between irrigation bays has been refined using both pressure transducer and ultrasonic water height sensors. The IRRISENS cloud-based app can now control watering events automatically using this data. This is particularly important on “difficult” soil types where infiltration is an issue. The IRRISENS automation can be used to control irrigation events to reach a water depth within bay and ‘hold’ that water at that level to promote infiltration without overtopping the hill or bed, allowing difficult soil types to be more effectively irrigated. The cloud based IRRISENS platform can now be run in a supervised or unsupervised fashion allowing full automation from the channel delivery outlet.

During the 2020-21 irrigation season, a fully automated smart sensing and automation trial on 17 ha of cotton was undertaken at the IREC farm in Whitton, NSW. The three bankless fields were operated throughout the irrigation season by the IRRISENS system developed in the project and smart in-field sensing and forecasting was used to trigger irrigation events and then water height sensors used to control within irrigation gate drops to subsequent bays. Smart sensing and automation trials were also conducted at Keytah in northern NSW on large >30ha bankless fields with multiple inlets/outlets per bay.

For more information visit the [Smarter Irrigation for Profit](https://smarterirrigation.com.au) website or click on the following links:

- *Smart Sensing and Automation of Irrigation*, Keytah Moree. Available at: <https://www.youtube.com/watch?v=DeZbigYdPWk>.
- *New Tech Integrated Smart Sensing and Automation for Cotton*. Available at: <https://smarterirrigation.com.au/southern-nsw-cotton-research-update/>
- *Levels of automation available to irrigators with bankless channel irrigation*. Available at: <https://smarterirrigation.com.au/grant-oswald-from-padman-stops-talks-about-the-levels-of-automation-available-to-irrigators/>
- *Economic Case Study, Integrated smart sensing and automation for cotton bankless channel irrigation*. Available at: <https://smarterirrigation.com.au/economic-case-study-integrated-smart-sensing-and-automation-for-cotton-bankless-channel-irrigation/>
- Filev Maia, R et al (2020). IRRISENS: An IoT Platform Based on Microservices Applied in Commercial-Scale Crops Working in a Multi-Cloud Environment. Available at: <https://www.mdpi.com/1424-8220/20/24/7163>
- Ballester et al (2021). Effects of three frequencies of irrigation and nitrogen rates on lint yield, nitrogen use efficiency and fibre quality of cotton under furrow irrigation. Available at: <https://www.sciencedirect.com/science/article/pii/S0378377421000482>

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