Partnerships for Enhanced Engagement in Research (PEER)

"WATER GOVERNANCE OF MINORITY COMMUNITIES IN THE MEKONG DELTA"

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Small-scale automatic irrigation systems using solar energy

***An Giang,* June 30, 2018**

Salt water from the sea and ocean constitutes 97% of the earth's surface, while usable water is only 3% (Shiklomanov & Rodda, 2004). However, 0.3% of usable water can be obtained from surface water, channels, and pools, but the rest of the usable water is mainly from ice, snow and groundwater (Shiklomanov & Rodda, 2004).

According to the World Bank (2016), the agricultural sector in Vietnam consumes about 80% of the usable water, which creates more burden on the nation's natural water resources. In dealing with this issue, priority is placed on seeking alternative strategies and effective enhancement in agricultural water management. Therefore, application of technological solutions can save a significant amount of water in agricultural production and sustainable water management. Sprinkler systems are globally applied in the agriculture sector to distribute water in agricultural production economically. Precision agriculture applies exact amounts of water and fertilizer on time and on location to achieve high productivity (Valente et al. 2011).

To help address the demand for ways of saving water in the agricultural sector, AGU researchers have successfully employed a high-tech automatic sprinkler system. A sensor is installed under the ground and connected to the sprinkler management system. Moisture information is sent directly to the system via artificial intelligence (a mathematical formula) to turn the sprinkler system on or off automatically. This system maintains soil moisture by favoring root insurance to maintain moisture above the minimum essential level but below the point of saturation.

This technical solution in agriculture is globally applicable, in comparison with automatic control systems based on timer reset, with its advantages including the ability to apply sprinkler systems automatically and maintain soil moisture. This can mitigate water use and erosion, maintain fertile soil, and reduce environmental pollution. Moreover, the sprinkler system economically waters and manages the amount of water applied following various stages of tree growth.

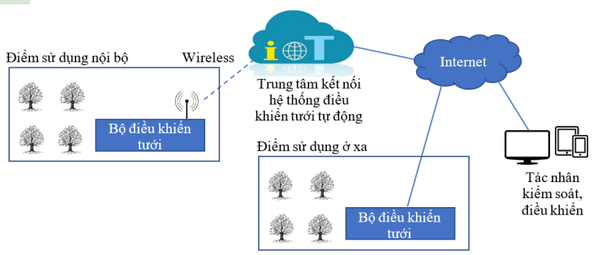

Fig. High-tech sprinkler system

Research team:

- Information Technology Center, An Giang University (Mr. Pham Minh Tan, principal technical researcher);
- Faculty of Agriculture and Natural Resources, An Giang University (Dr. Pham Van Quang, co-principal technical researcher);
- Research Center for Rural Development, An Giang University (Dr. Van Kien Nguyen, a water governance and social research expert, as well as project leader).

Besides saving water, the system can also save energy by operating on solar power.

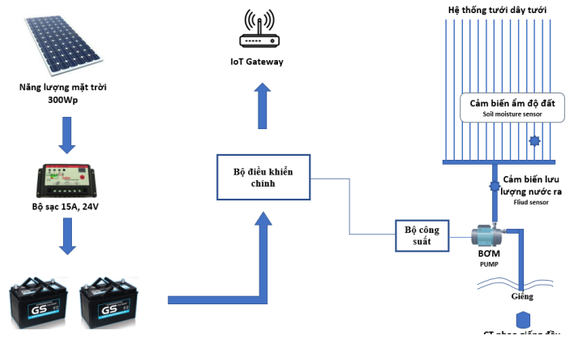

Fig. Model of automatic sprinkler system using solar energy

This project aimed to establish small-scale automatic irrigation systems to supply a citrus *Chuc* tree farm in the Khmer communities (Nui To Commune, Tri Ton District of An Giang Province), the socioeconomic groups most vulnerable to the impacts of climate change in the Mekong Delta.

The effectiveness of this automatic sprinkler system has not been evaluated fully, but an initial trial indicates it is likely to show advantages in terms of saving time and water. For example, in Tri Ton District, local people apply the automatic sprinkler system SPN01 to water 200 *Chuc* trees, which consumes about 40 liters of water per hour with a pumping system capacity 6-10m^3 per hour and high penetration coefficient. This sprinkler system operates on solar energy with a capacity of 300W. Controlled by a system housed at An Giang University, the watering timetable fluctuates and varies between days so that the automatic sprinkler system responds to changes in soil moisture to switch the system on or off as needed. The trial was conducted on April 1-16, 2018, with 15 watering times for a total of 70 minutes (5 minutes per day) and 500 liters of water per day consumed, equivalent to VND 6,500 per day of electricity consumption to replicate the same watering model. In comparison with traditional watering appliances with 200 *Chuc* trees, according to the *Chuc* garden owner's response to a survey, watering cans (with capacity 20cm x 30cm x 25cm) are more commonly used by local people and consume 1,000 liters of water per watering time. Additionally, this traditional watering method takes 3-5 hours to water 200 *Chuc* trees, which is equivalent to VND 150,000 for labour cost to do the same activity. For the above analysis, the automatic sprinkler system mitigates not only 50% amount of water, but also labour time and financial costs.

Beneficiary:

- Mr. Chau Chum, an owner of a *Chuc* tree garden in To Thuan Hamlet, Nui To Commune, Tri Ton District, An Giang Province.
- Sub-Department of Agriculture & Rural Development, Tri Ton District, An Giang province.

Soil moisture sensor → The analysis system → Power controller → Pump → Water spray

Features of the automatic sprinkler system:

- Automatic watering based on data from the installed soil moisture sensor;
- Multiple control methods: on switch, timer, remote control, Internet (smartphone);
- Ability to manage soil moisture parameters, battery voltage, and solar panel battery via Internet;
- Ability to maintain the system after running out of water;
- Ability to maintain the system while sensor is broken;
- Automatic switch-off system based on time.

Details on current trial:

Area	1.400 m^2
Total number of *Chuc* Trees	200
Nozzle type	SPN01
Nozzle capacity	25 l/h
Total capacity	4.8 m^3/h
Pumping system capacity	400 W
Pumping system voltage	24 V
Battery voltage	24 V
Battery capacity	40 Ah
Solar panel capacity	300 Wp





Fig. Field work on the automatic sprinkler system at the *Chuc* tree garden of Mr. Chau Chum, at *To Thuan* Hamlet, *Nui To* Commune, *Tri Ton* District, *An Giang* Province – 04/2018

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