PAPER ID: C08

Use artificial intelligence and IoT technologies to build smart irrigation system.

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Taoyuan Irrigation Association (TIA) is responsible for managing irrigation water resource in Taoyuan area, Taiwan. The major water source of Taoyuan canal is from Shi-Men reservoir. Taoyuan canal transports the water to 12 branch cannels and their subsidiary ponds. All the farmland in this area is watered through these ponds. A so-called traditional irrigation policy is to supply a fixed quantity of flow for irrigation during a whole crop season. Staffs of TIA calculate required daily quantity of flow based on the factors of field size, type of crop and the period of crop growth cycle. In a crop growth cycle, water is supplied 7days x 24hours from reservoir to canals, ponds and end up to farmland.
However, the traditional irrigation policy is inefficient. The water may be over supplied in raining days and may be under supplied in hot summer. To improve the efficiency of water management, we build a system to predict the quantity of flow variation in next 3 hours of Taoyuan Canal. Base on the prediction, staffs of TIA fine tune gate of ponds to reserve extra water in advance.
All the staffs of TIA review prediction results and gate tuning suggestions from web site and mobile application.

In this project, we employ artificial intelligence model, linear planning model and IoT technologies to provide high-quality decision-making support system mentioned previously. First, we apply NNR (neural network regression) to build a prediction model. We collect over ten thousand of precipitation and water level historical data pairs as training vectors. In each vector pairs, output vector is composed by water level data and an input vector is composed by precipitation data. CC (correlation coefficient) and MAE (mean absolute error) are chosen to be the performance indices of the trained model.
The average correlation coefficient of the trained model between the predication results and on-line monitoring data from sensors is over 92%. The average mean absolute error is less than 3 centimeters.
Second, we use linear-planning model to rank the ponds which need to irrigate. The factors of the model include current volume of pond, the economic factor of pond, the length of canal between pond and main canal and the irrigation area of the pond.
The data of current volume of pond are gotten from AnaSystem's IoT system, the Senslink and SensMini A4. The SensMini A4 is an innovative compact front-end remote data acquisition device, which provides complete functions that a front-end IoT device needs. Those functions include solar charging, data logging, IP68 protection, auto data addendum, LPWAN communication (4G, LoRaWAN and NB-IoT) and universal industrial I/O.
The Senslink provides hundreds of open API for users to develop their own user interface and applications. The Senslink kernel collects, dispatch and store massive data from IoT front-end device very efficiently. In this project, our system provides gate operation suggestions for each pond every 10 minutes base on the infrastructure of Senslink.

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