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Article

Supplementary Materials: Development of a Microservice-Based Storm Sewer Simulation System with IoT Devices for Early Warning in Urban Areas

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1. Web APP Simulated Demonstration

First, set the inflow rate in the field and click "Submit" to send the flow data to the server. The server will return a confirmation message indicating that the settings have been successfully applied, as shown in Figure S1:

Figure S1. Set up the flow rate.

After the flow rate has been set, the web page automatically redirects to the data upload page. Select the SWMM input file and water level measurement data from your local machine, and upload the data to the server. Once the upload is complete, a message will appear indicating a successful upload, and the simulation will start automatically, as shown in Figure S2:

Citation: Lin, S.-S.; Zhu, K.-Y.; Zhang, X.-H.; Liu, Y.-C.; Wang, C.-Y. Development of a Microservice-Based Storm Sewer Simulation System with IoT Devices for Early Warning in Urban Areas. *Smart Cities* **2023**, *6*, 3411–3426. https://doi.org/10.3390/smartcities6060151

Academic Editor: Pierluigi Siano

Received: 1 October 2023
Revised: 16 November 2023
Accepted: 22 November 2023
Published: 5 December 2023

Figure S2. Upload the input file for SWMM.

After the simulation is complete, the server will return the simulated water levels for each node and the error between the simulated and measured water levels. Users can download a CSV file containing the water level errors and view a water level comparison chart, as shown in Figure S3:

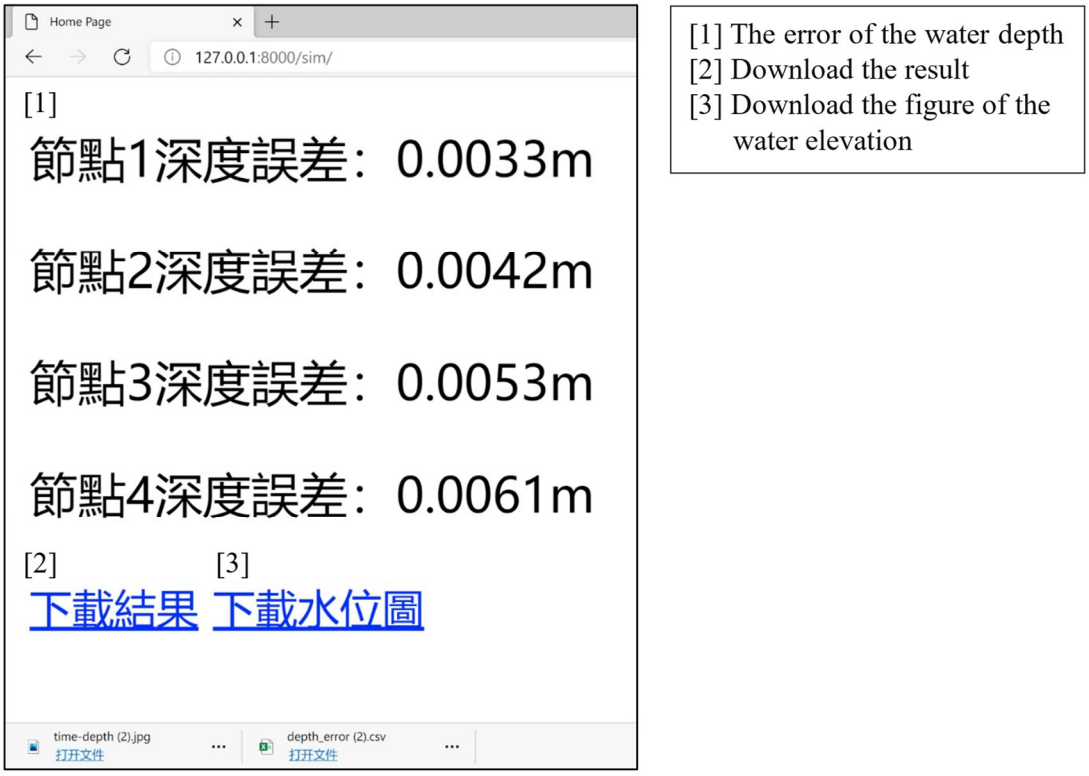


Figure S3. The simulated results.

2. Mobile App: Real-time Simulated Demonstration

The developer first deploys Docker to the cloud and starts the Docker service to ensure real-time response to user requests through the API. Users utilize a pressure-based water level gauge and a Raspberry Pi to upload measurement data to the cloud server in advance.

The app interface and operational flow are shown in Figures S4–S7. Users follow the instructions by copying the INP file to the "Document" folder within the app. They then click on "Start Simulation" to initiate the flow rate configuration. Next, they set the

simulation flow rate to match the laboratory canal flow rate. If the configuration is successful, the server will return a success message. After clicking on "Run Simulation," a simulation request is sent to the server. Finally, the app will display a notification of simulation completion, and users can click on "Show Results" to view the output.

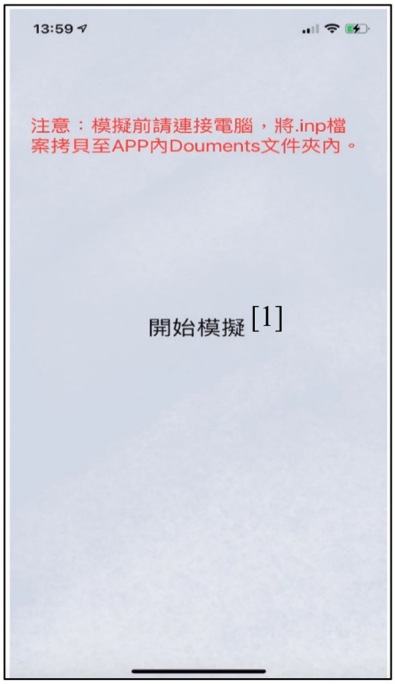


Figure S4. App Homepage.

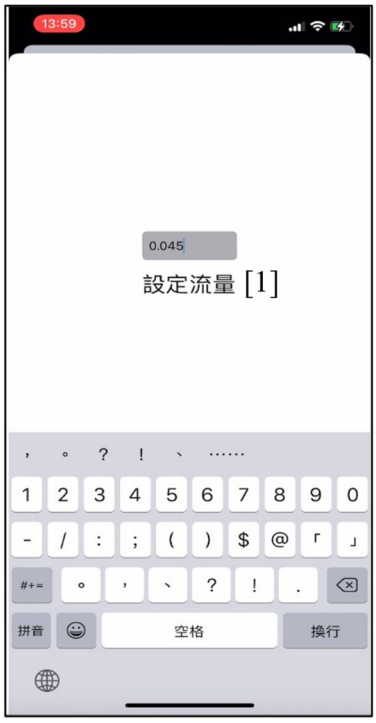
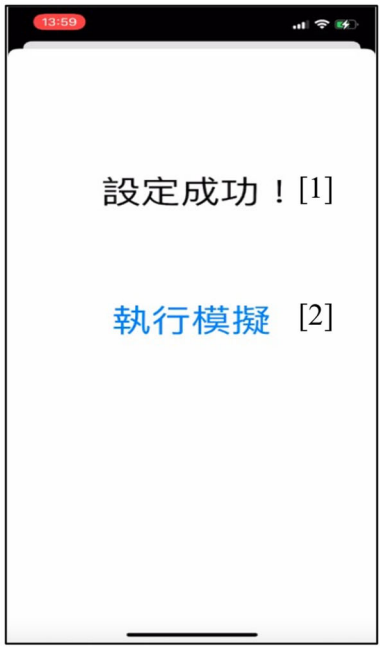
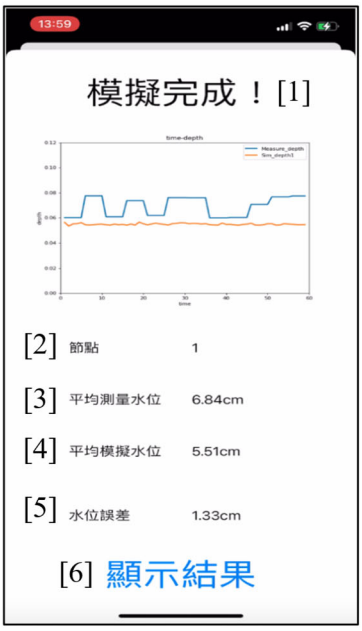


Figure S5. Set the flow rate.



[1] Setup complete successfully !
[2] Execute the simulation

Figure S6. Click the start-to-simulate button.



[1] Simulation completely !
[2] The index of the node
[3] The average measurement water -level
[4] The average simulated water -level
[5] The error of the water-level
[6] Show the result

Figure S7. The simulated results.