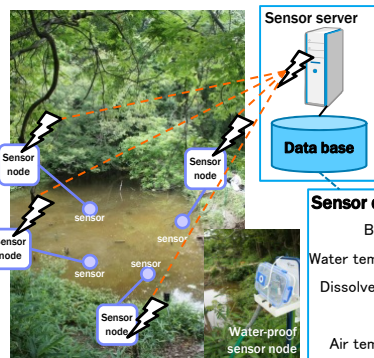


Abstract

We are investigating **environmental monitoring technologies** for various fields with wireless sensor networks. We developed essential technologies for field monitoring, e.g., a **data compression method by exploiting temporal spatial correlation** of environmental sensor data and a **virtual machine that dynamically changes sensor nodes behaviors**. We can achieve effective sensing satisfying individual requirements of each field with these technologies. We demonstrate habitat monitoring of endangered fish with wireless sensor networks in a joint experiment with the Faculty of Agriculture, Kinki University. Our developed technologies enable measurement, accumulation and analysis of detailed and long-term environmental sensor data.

Endangered species habitat monitoring

- Habitat factor analysis
- Conservation of biological diversity

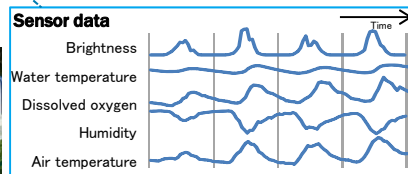


*Cooperative experiment with NTT West

Rhodeus ocellatus kurumeus



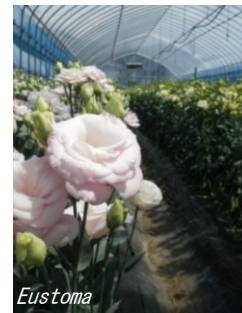
A small fresh water fish
Critically Endangered



- Continuous sensing of dissolved oxygen (DO)
We connected DO sensor to wireless sensor nodes for this experiments
- Analysis of accumulated value and daily range of water temperature and DO
- Stable development of sensing system using on-site update function of our developed virtual machine

Greenhouse monitoring

- Recording temperature and humidity distribution
- Clarification of feasible cultivation environment



Eustoma

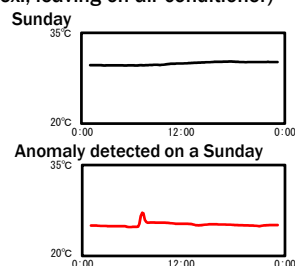


Sensor node
in the greenhouse

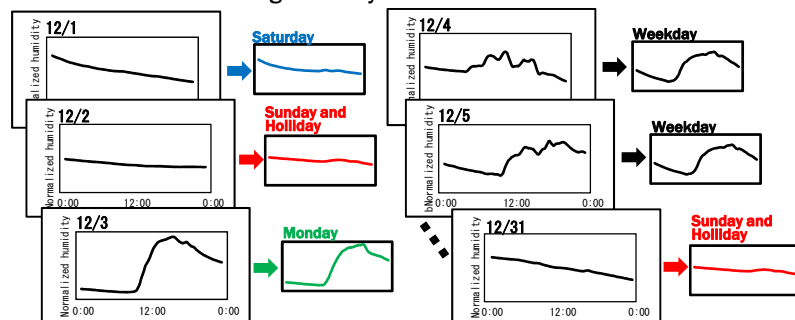
- Verification of difference of insolation with sunshade
- Recommendation of extend cultivation period
- Farmer's motivation increased by recording and visualizing

Environmental data analysis : temperature and humidity in office

Anomaly detection from temperature data
(ex., leaving on air conditioner)



Pattern classification using humidity data



Related work

[1] Y. Kishino, Y. Sakurai, Y. Yanagisawa, T. Suyama, F. Naya, "SVD-based hierarchical data gathering for environmental monitoring," *Adjunct Publication of the 2013 ACM Conference on Ubiquitous Computing (UbiComp 2013)*, pp. 9-12, 2013.

Contact

Yasue Kishino Learning and Intelligent Systems Research Group, Innovative Communication Laboratory
E-mail : kishino.yasue{at}lab.ntt.co.jp (Please replace {at} with @)