Telecommunication Development Sector

Study Groups

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Question 5/1:	**Strategies and policies for the deployment of broadband in developing countries**
Question 1/2:	**Creating smart cities and society: Employing information and communication technologies for sustainable social and economic development**
Question 6/2	**ICTs and the environment**
SOURCE:	Japan
TITLE:	Proposal for the sustainable smart society
Action required:	Participants are invited to consider this document.
Keywords:	*IoT sensors*、*Visualization of information and data*、*Smart city and society*、*Renewable and eco-friendly Bio-mass power generation*、 *Clean energy, Big data analysis*

Abstract:

In the countries of declining population like Japan, automatic collection of environmental data by deploying various IoT sensors and its effective use of obtained data are important measures for social life. This contribution introduces the case of Shiojiri city of Nagano prefecture of about 70 thousand population where they have been challenging the sustainable smart society by ICT implementing the environmental information sensor networks for the quality life of local people for about 20 years. The empowerment of the local communities is one of the important Japanese government's goals. This IoT sensor networks extended to every corner of the Shiojiri with partial government subsidy contributes to the vitalization of local industries for development of IoT sensors and related application software. Bio-mas power generation system with smart functions to be completed soon is eco-friendly, carbon neutral and renewable energy plant and becomes the community grid to supply almost all individual households and ICT networks in the city. This plant is aiming for supporting local forestry and lumbering industries and then contributing to carbon sink of greenhouse gas emission.

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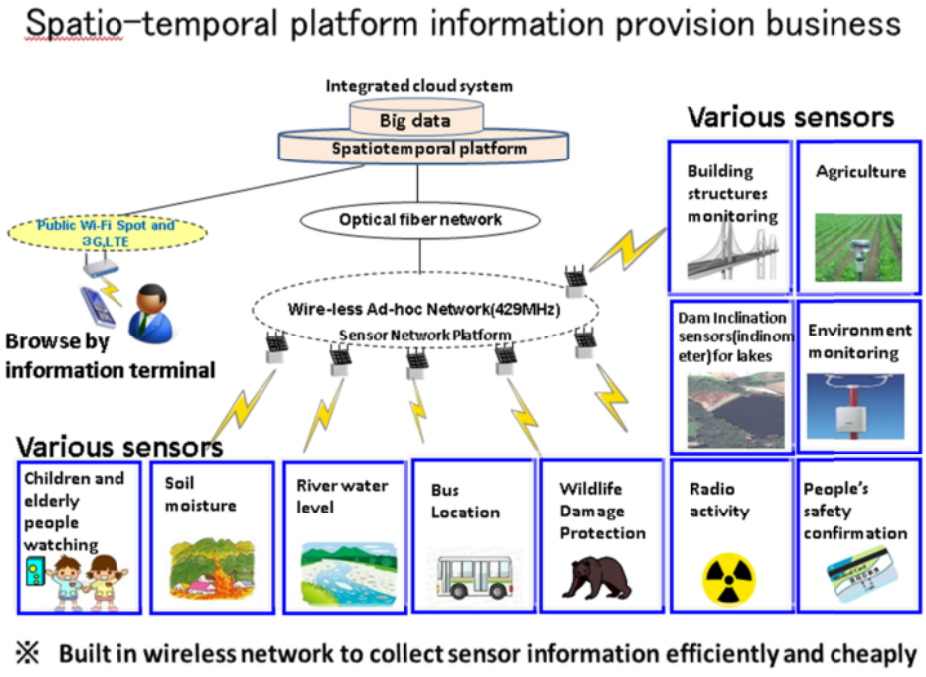
1. Background

Shiojiri municipality in 2000 started to build the autonomous optical fiber network of 90 km later total 130 km and 75 public facilities in the city are connected by gigabit ether network. The network is interconnected with upper layer service providers. The municipality then established the information and incubation plaza for the purpose of nursing the IT literate population. Low power wireless area network deploying 429MHz frequency spectrum was built with ad-hoc network configuration. 640 distributed wireless repeater stations are powered by solar panels and self-sustained by low cost and efficiently interconnected IoT sensors. Beginning of declining of population and birth rate in Japan is serious social issues among the first in the world and progressing rapidly for recent years. Taking into consideration of 50 years to come age group composition will change adversely from now, which is causing the great social concern. The effect of such social phenomena is remarkable in rural municipalities of this country. Building smart society by ICT in such circumstance is aiming for improvement of life of community dwellers easy to live, which could be expected to contribute to suppress the migration of population from rural to urban or even to promote adverse migration from urban to rural. The IoT sensor network is built by the partial government subsidy and Shiojiri promoted development of ICT related device and application software by the SME and academia (the university, college and technical high school) of the region. Shiojiri has established the incubation plaza where SME and the academia gather for collaboration of ICT development. In recent activities for ICT development Shiojiri Municipality invested for the building network of various IoT sensors in every corner of the region to automatically collect the environmental data and exchange the obtained data among concerned organization for the benefits of the community dwellers. For the purpose of independent power grid in the municipality to respond to the demand of individual households and ICT networks of the region, Shiojiri invested for the biomass power plant to supply low cost, eco-friendly and carbon neutral power to the 67000 population of the region. It will contribute to the regional socio-economic development in the forestry, lumbering, related industries and creation of job opportunity. This investment is expected to improve remarkably the quality of life of dwellers in the region for coming years.

(Shiojiri's Environmental information data collection platform and its IoT sensor network)



a) Children and elderly people watching system

Children going school and back home and elderly people walking outside in the remote community are watched and located for their safety by the sensor network to detect the signal from the active tag with embedded button battery carried by them.

b) Soil moisture sensors

The sensor device detects moisture content of the soil at 20cm depth increments to predict landslides or mudslides and sends out alert when the moisture level exceeds the threshold or send out safety announce when the level go down the threshold.

c) River water level sensors

The sensor device measures the water level of lakes and rivers and sends out alert when the water level exceeds the threshold to let the community people evacuate to the shelter before the floods or the debris flows.

d) Bus Location sensors

The sensors inform users of location of buses on routes through the city every 30 seconds. In the remote areas of Shiojiri city bus is scheduled every one or two hours. So this service is for the convenience of citizens in remote areas.

e) Wildlife Damage Protection Sensors

The sensors are used for protecting the villagers or farmers from the wildlife such as boar and monkeys in the rural and remote areas in the suburbs of Shiojiri city. The sensors detect the wildlife and watch the movement of wildlife or capture them for reducing the damages caused by those animals.

f) Radio activity sensors

Sensor network protects citizens from radioactivity pollution by detecting the level of aerial radioactivity of the city to maintain the environmental safety of people’s life.

g) People’s safety confirmation sensors

Sensors locate the citizens when they evacuate during disaster to the community shelters and to grasp the number of people in each shelter and confirm their safety to their family and relatives, etc.

h) Building structures monitoring sensors

Sensors monitor the aged deterioration of public building structures in particular bridges by detecting abnormality of characteristic vibration of structures which is useful to take measures to suppress further deterioration.

i) Agricultural sensors

Sensors track the long term behavior of diligent farmers and its information together with the analysis of their expert knowhow and environmental data such as temperature, humidity and solar radiation, etc. which may be useful for prediction of huge outbreak of pest insect and storage of the digitized agricultural knowhow and easily pass down high level agricultural knowhow obtained from the analysis to fresh farmers.

j) Dam Inclination sensors (inclinometer) for lakes

Sensors detect the micro inclination of dam of lakes for the long term and the digitized difference may indicate the dangerous change to result in the break of dam.

k) Environment monitoring sensors

The environmental data such as temperature, humidity, wind direction, wind speed, solar radiation, rainfall, obtained from the sensors may be digitized and stored in the cloud for the use of many purposes in combination with other data.

2. Platform for analysis of unique data collected from various IoT sensors

The unique data collected may be analyzed in combination with other data in consideration of time and location for new valuable information which will be of importance for development of regional economy.

3. Case studies

a) The data such as temperature, humidity, and solar radiation may be used for predicting the pandemic of pest insect and reduce the amount of agricultural chemicals. The reduced spray of pesticide will avoid the unnecessary use of chemicals to the minimum of one fifth (1/5) which accordingly resulted in the cost reduction and relief of environmental destruction.

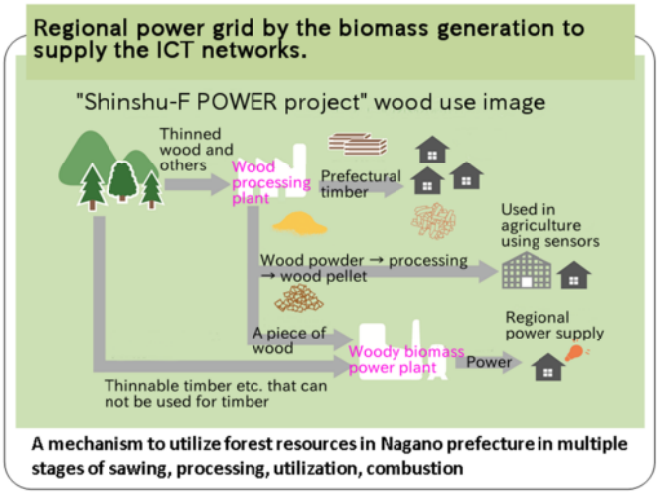
b) The conventional method of alerting the mudslides or landslides was to predict them from the rainfalls and raining duration based on the expert knowledge. After achieving the digitization of level of soil moisture detected by the IoT sensors, the alert may be sent out automatically to risk manager of Shiojiri municipality when threshold level of soil moisture exceeded according to the digital value in the IoT sensor network. On/Off of alert signals in the safety network may be automatic and accurate based on the digitized alert level.

c) In the past it was difficult to predict the serious frost damage to the crop, however after the implementation of the IoT sensor network, the frost warning may be issued according to the level of temperature and the moisture of the sites to protect the crops from the frost damage.

4. Regional power grid by the biomass generation to supply the ICT networks.

Since the great east Japan earthquake in 2011, the shift to natural and renewable energy progressed mainly by the solar power, however Shiojiri promoted the building of biomass power plant as its goal taking into consideration the regional characteristics and job opportunity for the citizens. The regional power grid enables the self-power generation and supply to meet the regional demand for the ICT network and individual households and to maintain the sustainable society.

The biomass power plant contributed to establish the regional industry chain from the forestry and lumbering, and production of wood chips to sustain the environment surrounded by forestry and mountain ranges. For the two years to come, the power plant will become to supply 20 thousands of regional households for 24 hours. ICT will be applied to the power grid to adapt to the coming age of power liberalization and power transmission and distribution separation. This is to aim for the efficient electricity sales to maintain the stable price of power in the competitive market in the region.



Regional effects obtained by the implementation of this project

- ○ Fostering forests and restoring the sustainable cycle of timber use ⇒ "Forestry regeneration" "Forest regeneration"
- ○ Activate the region
  - ・Activate forestry
  - ・Activate related businesses
  - ・Create new employment
  - ・Regional circulation of resources and economy
  - ・Creation of environmental model, creation of regional brand
  - ・Fusion of facility tours and regional tourism
- ○ Construction of a model coexisting with the forest Lifestyle outgoing

5. Conclusion

Shiojiri municipality has been promoting the ICT infrastructure including power grid supporting ICT infrastructure. In the operation of infrastructure ICT seamless services will be blocked if there is something wrong in some part of infrastructure. The accumulated sensor data will be useful for the analysis of local environment change of the present or years back. Biomass plant of Shiojiri independent power grid contributes to the resilient ICT infrastructure and reduction of greenhouse gas emission meeting SDGs.

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