

SOURCE: KDDI (JAPAN)

TITLE: Report on Experiment of Wireless LAN System in Rural Areas

Abstract:

This paper reports the project titled “Experiment in Rural Areas Using Wireless LAN System”, which was supported as Human Resource Development Programme by APT (Asia-Pacific Telecommunity) and Japanese Government.

The project was carried out collaboratively by KDDI, Waseda University and UNIMAS (Universiti Malaysia Sarawak).

In the recent global attention to the “Digital Opportunity” issue, this project aimed at affirming the operability of a Wireless LAN System including VoIP and Tele-conference system based on IP Technology in Rural Areas.

The other objective of this project was to promote the development of advanced ICT researchers/engineers in the Asia-Pacific region by exchange of such personnel through international collaborative research projects on advanced ICT.

Project Participant List

Organization	UNIMAS	KDDI	GITS, Waseda Univ.
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1. HRD Program of APT

This project was carried out under the HRD Program of APT and supported by Japanese extra budgetary contribution to APT.

The objective of the Program was to promote the development of advanced ICT researchers/engineers in Asia-Pacific region by exchange of such personnel through international collaborative research projects on advanced ICT.

2. Objective of the Project

In the recent global attention to the “Digital Divide” issue, this project aimed at affirming the operability of a Wireless LAN system in rural areas.

Prior to the experiment, a survey to find out suitable Information and Communication Technology platform was carried out, taking into account IP availability, range, cost, simplicity and speed. Through the survey, we decided to use “CFO-SS (Carrier Frequency Offset-Spread Spectrum)” system as a most effective technology for communications in rural areas and thus this project.

The main purpose of this project was to evaluate an experimental system consisting of CFO-SS, VoIP and Tele-conference system based on IP technology.

The experimental system based on IP Network enabled us to handle not only voice but also multimedia on the network. It will provide us various opportunities, such as, education, medicare, public services, economic activities and so on.

3. Purpose of Collaboration

In order to make appropriate recommendations, sharing of intelligence is indispensable.

The case study of the latest Wireless LAN system was informative and helpful for Malaysian researchers/engineers.

On the other hand, the study visits to the rural areas and the experiments of the system were beneficial for Japanese researchers/engineers to understand real conditions in the rural areas. This experience was useful in developing new products and making more practical proposals for the Digital Divide solution in the future.

4. Partner Organization/Institution

The project was carried out by:

- Waseda University, Global Information and Telecommunication Studies (Japan)
- Universiti Malaysia Sarawak (Malaysia)
- KDDI CORPORATION (Japan)

Please refer to “Project Participant List” on page 1.

5. Outline of the Experiment

5-1. Component of the Experimental System

- Wireless LAN System: CFO-SS10A (KDDI R&D Labs.)
- Teleconference System: Quality Meeting (KDDI R&D Labs.)
- IP Telephone System: IP Phone PH-2000P (OSI Plus)

5-2. Procedure

The experiment consists of six stages. On each stage, the experiment was carried out with different range.

Stage	Range (m)	Site	Position
Stage I	536	UNIMAS Campus	Former FMHS* Building
			Kenari College (students' dormitory)
Stage II	1,260	UNIMAS Campus	Construction Office
			Kenyalang College (Students' dormitory)
Stage III	2,100	UNIMAS	Kenyalang College (Students' dormitory)
			Celcom Tower
Stage IV	5,250	Kuching City	Kuching North City Hall (Cat Museum)
			UNIMAS FMHS* Building
Stage B-I	169	Bario	SMK (Secondary School) Bario
			SK (Primary School) Bario
Stage B-II	668	Bario	Lodge
			Clinic

*FMHS : Faculty of Medical Health Science

5-3. Check Items

In order to evaluate the performance of the experimental system, the following items were checked.

- Packet Loss (PING sent-out continuously: 100 times)
- Round-Trip Time (PING sent-out continuously: 100 times)
- Throughput (Network observation tool)
- Operations of Teleconference System and IP Telephone

6. Findings from the Experiment

6-1. Results

From the experiment, the following results were obtained in all stages.

- No Packet Loss
- Small Round-Trip Time (Avg. 1 ms)
- Sufficient Throughput for IP communication
- Normal operation of Teleconference System
- Normal operation of IP Telephone System (Not tested at Stage B-I and B-II.)

From those results above, it is concluded that the operability of the experimental system is good enough for the use in rural areas.

6-2. Prospects

In addition, the following can be expected from the results.

- Communications in the rural area, in the entire community and between neighboring communities, will be developed with introduction of this system.
- Its Long-range feature contributes to reducing the cost and work load of network construction and operation.
- From the results of practical use of the teleconference system, the experimental

system is expected to contribute to development of education and medical services.

7. Constraints

In the process of the experiment, the following constraints had come up as well.

7-1. Power Supply

It was realized again that power supply for the system is critical. There were some constraints regarding power supply, especially in the experiment in Bario. We used a portable diesel generator and a stabilizer at the place where power supply was unavailable.

Constraints of power supply attributed to the way of power generation. At the sites, where the experiment was carried out, diesel generator was popular and its running cost became costly because the fuel was expensive. It's because logistics in this area depended on chartered air transportation. So it was necessary to save fuel and it caused restrictions on available time and place of power supply.

One ideal solution for this problem could be use of renewable energy. Some VSAT facilities installed at the site actually were obtaining power from the solar power system. The solar system suitable for the power consumption of CFO-SS system is highly expected.

Consideration to the power back up system is also important. Combined use with the other power system (for example, wind power) makes power supply more reliable.

In addition to this, use of renewable energy will consequently contribute to environmental conservation.

7-2. Installation Place

In the case of installing long-range Wireless LAN system, clear line of sight is required. Especially it is critical where the antennas are placed. It is sometimes not easy to find suitable sites, where line of sight is available between two points. In such cases, high tower for installing the antenna is necessary. Setting up of relay stations can be an alternative solution for this problem.

8. Proposal

Finishing this project, the following project is expected as further challenge.

Title: "e^m RAN (empower Rural Area Network) project"

- Experiment using comprehensive Wireless LAN system including power supply
- Long-term experiment for the proposed system (checking durability, operation, etc)
- More practical pilot test in rural areas constructing IP wireless network among multiple sites
- Test of a new Application exploiting IP telephone and Teleconference (Medical or Educational applications)

9. Conclusion

From the results obtained through the experiment, CFO-SS 10A, long-range Wireless LAN system, was proved to be operational in rural area. It contributes to improve information network accessibility in a community and between neighboring communities. Further challenges, however, come up to us. The “em-RAN Project” is proposed as next challenge.

Another big achievement of this project was human resource development. The participants carried out this project collaboratively. Through the process of implementation, human resource development had been activated and it gave participants a better understanding of useful Wireless LAN technology and of the conditions in rural area.

Finally, it is the most important thing that we should continuously think of what is really needed by local people and incorporate that into the following project with involvement of the local people.

10. Acknowledgement

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