In 2002, Graduate School of Information Science and Technology was established in Osaka University. Since then, in our Mobile Computing Laboratory, we are studying about algorithms, software and design methodologies concerning with mobile computing, wireless networks, communication protocols, ubiquitous systems, ITS (inter-vehicle communication), advanced sensing systems and so on. We aim at developing new technologies for constructing affluent and high-reliable ubiquitous society.

Staffs and Students

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Research Themes

(1) Ad-hoc Networks
Our research group has designed and developed a network simulator for realistic evaluation of mobile wireless network systems and protocols, called MobiREAL (http://www.mobireal.net). Our MobiREAL simulator enables developers to specify realistic behavior of mobile nodes, and provides a framework to simulate both the behavior of mobile nodes and wireless communication among them interactively. This research was partly supported by Strategic Information and Communications R&D Promotion Programme (SCOPE), Ministry of Internal Affairs and Communications (2004-2007). Currently, MobiREAL is used in about 100 research institutes of 25 countries.

(2) Advanced Wireless Communication Technology for Efficient Rescue Operations
Core Research for Evolutional Science and Technology (CREST) Project, Japan Science and Technology Agency (JST) (2007-2013)
We consider situations where many persons are simultaneously injured in disaster such as earthquakes and train accidents, and propose an advanced electronic triage system for sensing physical condition of those injured persons and collecting their sensed data in ad-hoc wireless communication. The triage system presents dynamic change of injured persons’ location and physical condition on monitors in real time.

(3) ITS & Inter-vehicle Communication
Recently, considerable research work has been focused on applying ad hoc wireless networking technology to moving vehicles on roads. It has been suggested that ad hoc communication can be used to propagate information related to traffic jams and accidents. We focus our research on efficient data exchange for acquiring local traffic information and detecting dangerous vehicles on roads and/or highways cooperatively.
(4) Ad-hoc Localization

We present a range-free ad-hoc localization algorithm called UPL (Urban Pedestrians Localization), for positioning mobile nodes in urban district where location seeds are deployed sparsely. Each mobile node in UPL relies on location information received from its neighboring mobile nodes in order to estimate its area of presence. We also present an off-line algorithm called TRACKIE (TRACe reproduction algorithm with Keypoint Iterative Estimation) to estimate trajectories of mobile nodes using ad-hoc communication.

(5) P2P & Middleware

We propose a protocol to construct a degree-bounded delay sensitive overlay multicast tree called MODE (Minimum-delay Overlay tree construction by DEcentralized operation). We also propose a new middleware, which supports implementation and evaluation of Application Layer Multicast (ALM in short) protocols in real environments. As an example, we have implemented ALMI, NARADA, NICE and OMNI as ALM protocols, and compared their performance on PlanetLab.

(6) Real-Time System Design

Recently, it is required to develop a methodology to design a complex system in a shorter time that performs efficiently and still meets the required specification such as real-time constraints. To cope with such a problem, we are developing a technique using parametric model checking to derive automatically a condition formula for design parameters. We are also studying analysis, performance evaluation, and cost-/power-optimized automatic synthesis of communication structure of System-on-Chip (SoC) and Network-on-Chip (NoC).

(7) Other Studies in Mobile Computing Lab.

Information Gathering from Disaster Victims

When a disaster occurs, it is required to rescue victims quickly and confirm their safety. Mobile phone with wireless LAN and GPS receivers will be developed and spread generally in near future. We are studying MANET based information gathering systems from disaster victims.

Protocol Testing and Performance Evaluation on MANET

Reliability and performance of MANET protocols strongly depend on their protocol parameters. There are several combinations of those parameter values. We are studying testing methodology for finding a set of protocol parameters that strongly affect their reliability and performance.

Network Management

We propose an autonomous distributed network monitoring technique called FLEXA (FLEXible Autonomous network monitor) to detect viruses and DDoS attacks. In our technique, network segments with specified problems can be detected autonomously, and forms the corresponding group. FLEXA achieves scalability, availability and autonomy with APIs provided by our middleware.

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