Division of Environmental Studies

Department of Human and Engineered Environmental Studies

Laboratory	Faculty	Introduction of research activities and laboratory	Key words	Projects or activities summer program students can participate
SASAKI Laboratory	Dr. Ken SASAKI	Our research activities are based on mechatronics and signal processing. Current research topics are human body communication (HBC) and environmental sound recognition (ESR). HBC utilizes human body as part of the electric signal transmission between wearable devices. Data transmission is established only when the devices are in contact with the user. We are interested in development of practical application devices and theoretical transmission model. The second topic ESR is a technique to recognize non-speech sounds such as sounds that we hear in our daily life and sounds of machines and facilities. Since composition of these sounds is different from that of the speech sounds, speech recognition methods do not work so well. Currently, we are focusing on continuous sounds that have random fluctuation in their spectrums, such as sound of running water, and on transient sounds that we hear in our daily life such as sounds of door knock and footsteps.	Electronic circuits, Data transmission, Sound recognition, Signal Processing	There are two projects relating to the two research topics described above. The first project is on human body communication. The aim of this project is to fabricate demonstration devices using human body communication. Activities will include electronics circuit fabrication and micro computer programming. The second project is on environmental sound recognition. The student will choose a particular sound that we hear in our daily life, sample the sound, and analyze the sound. The goal is to find parameters that can be used to differentiate the chosen sound from other environmental sounds.
Simulation of Complex Systems Laboratory	Dr. Yu CHEN	In our lab, fields of research range from social-economic, complex fluid, to biological systems. There are three research directions: (1) Multi-agent cooperative evolutionary games for modeling and simulations of financial markets; (2) Discrete kinetic models for the simulation of complex fluids; (3) Cellular automata and heterogeneous stochastic agent models for the simulation of cancers.	Complex Systems, Agent-based modeling, Financial Markets, Soft-condensed Matters, Cancer	In the program, a small project will be assigned to the visiting student, basically relating to model construction and computer simulations. The specific complex system for study depends on student's interest. It could be a financial market, a solution including colloid, or a growing tumorous tissue. Apart from the research activity, visits of the supercomputer center, scenic sites surrounding Tokyo, etc. are also being scheduled.

Industrial Information Systems Laboratory	Dr. Kazuo HIEKATA	In modern days, distributed human agents and artifacts cooperate in highly networked information society. Our target is to study about reforming and creating structures of industries by utilizing advanced information technologies. Our research topics include deployment of wearable computers in shipbuilding and aircraft manufacturing, developing information management platforms for product maintenance and life-cycle, designing new transportation systems based on simulations, leveling up reliability of man-machine systems based on the analysis of situation awareness of operators. The research topics include applied researches to the industry and diversions of basic research. One of the applied research topics is the development of accuracy measurement system for large size assemblies using laser scanners. Development of information system for on-demand transportation and the experimental operation is the representative research topic of diversions for the society. For carrying out these researches, perspectives from several academic disciplines, such as engineering, information technology, economics, business administration and domain specific knowledge, are necessary to be integrated.	On demand bus system, Social welfare service, Log data analysis	On Demand Bus is a demand responsive transit service where the vehicles will transport users after they reserve their seats, and the vehicle will not move when there is no reservation. From 2010, Tamaki town, Mie prefecture has introduced this service for the purpose of supporting elderly's moving. Students can develop a prototype system for helping elderly's life by collaborating with social welfare council of Tamaki town. We can provide flexibility for the theme of projects for students. One of candidate research topics is to detect unusual behaviors of each elderly person by using the log data of On Demand Bus system in Tamaki town. Social welfare council needs to call each elderly person at a specific interval for watching their health condition. By detecting unusual behavior of each elderly person, social welfare council can call each elderly person efficiently.

Morita Laboratory	Dr. Takeshi MORITA	By pushing a piezoelectric material, electrical energy can be generated; it means you can utilize this phenomenon for sensors or energy harvesters. On the contrary, by applying electrical field to the piezoelectric material, mechanical strain can be obtained with piezoelectric effect, which contributes to be actuators. Without complicated structure such as an electromagnetic coil shape, a conversion between electrical and mechanical energy is possible by using the piezoelectric effect. Based on the high conversion efficiency and the large energy density, piezoelectric effect is utilized for medical acoustic devices, ultrasonic transducer, micro energy harvester and so on. Our group is interested in developing innovative piezoelectric devices; for example, we proposes new driving principle of piezoelectric actuator and sensor control system. At the same time, we believe that breakthrough comes from the fundamental understanding of the piezoelectric effect itself. Therefore, the research field is not limited to the design of the transducer but is expanded to the nonlinear piezoelectric vibration, the dynamic resonant frequency control and the shape-memory piezoelectric actuator, which are related to the domain structure inside the piezoelectric ceramics.	Piezoelectric effect, Functional material, Energy harvesting device, Modeling	A practical experience is quite effective for starting something new. In this project, a piezoelectric plate sandwiched with thin metal electrodes is provided to the students. Flipping this plate, the electrical energy between two electrodes will be confirmed by monitoring the oscilloscope. You can say that this is one of the energy harvesting devices. Then, please modify the mechanical structure and the electrical circuit for the practical device application. Of course we'll support you. You can use 3D printer and machining equipment. What do you want to utilize this piezoelectric plate for? Wind force power generation? Or, do you want to get energy from walking behaver by putting this material under yours shoes? Any idea is welcome, but maybe you don't like to study for boring topics. It's up to your proposal. After making your device, a modeling for the device is conducted to understand the piezoelectric effect.