Recent Achievements

Research Funding and Donations

- Thermal Monitoring and Management of Data Centers (Intel & NSF, 3 years)
- Body-Area Network Security based on Physiological Values (NSF, 3 years)
- Software Optimizations on Multicore Platforms (hardware donation by Intel).

PhD Graduates

Book Publications

Transaction Papers

Related Courses
- Mobile computing http://impact.asu.edu/cse535fa07.html
- Computer Architecture http://impact.asu.edu/cse420sp07.html
- Embedded Networks

Advisor Dr. Sandeep K. S. Gupta
Post Doctoral Researcher Georgios Varsamopoulos

IMPACT Laboratory
School of Computing and Informatics
Ira A. Fulton School of Engineering
Brickyard Suite 517
699 South Mill Avenue
Tempe, AZ 85281
Phone: (480)965-3806
Email: Sandeep.Gupta@asu.edu
Url: http://impact.asu.edu

Research is funded by

Devices are donated by

Creating adaptive technologies for ever changing world...
Overview of IMPACT

IMPACT is a group of researchers working under the guidance of Dr. Sandeep K. S. Gupta. This research group was born in the Spring of 2001 at the Computer Science & Engineering Department of Arizona State University. The research areas in which we are working are sensor and biosensor networking, wireless and sensor network security, and biomedical computing. Our group is involved in the development of security implementations for Body Area Networks (BANs) for net applications of IMPACT.

Thermal Management of Datacenters

**Goal:** To create a thermal map of the datacenter
- Dynamic management to reduce cooling cost
- Improve equipment reliability
- Find Hot spots in the datacenter

**Challenges:**
- Aggregating data from different sensors
- Proactive (push-based) reporting of temperature
- Determine optimal frequency of reporting
- Design efficient, fast scheduling thermal-aware algorithms

In situ monitoring (SNs)

Mathematical Modeling

Algorithm and Software Architecture

Design and Implementation

Security in Body Area Networks (BANs)

**Goals:**
- To provide a plug-and-play security paradigm for BANs utilizing physiological values (PVs) as basis for key agreement
- Make security implementations more practical

**Challenges:**
- To identify physiological values (PVs) which can be used for this purpose and from which high quality keys can be generated
- To develop light-weight algorithms for processing PVs and generating features from them in order to facilitate key agreement
- To implement a prototype of the technique as a proof-of-concept on an actual body area network

Network organization

Data manipulation process

Ayushman — Practical and Secure Health Monitoring

**Goal:**
- To create a pervasive, remote, health monitoring infrastructure
- Employ off-the-shelf components
  - Wireless Sensors
  - Wearable Medical Devices
  - Handheld Computing Systems

**Challenges:**
- Low Power Light weight operation
- Integrating diverse computing and communication technologies
- Ensure System availability at all times

Kid Socialization Monitoring and Localization

**Goal:**
- To detect interaction between kids
- To track the location of kids

**Challenges:**
- Accuracy: detecting an object within a small range (2-3 ft.) indoor/outdoor
- Scalability (Localization is NP Hard) and life-time
- Wearability: not disturbing kids’ activity
- Heterogeneous information: inter-node measurement can be proximity range or angle information
- Use of relative localization and virtual coordinates

Multicore optimizations for net applications

**Goals:**
- To make use of multicore availability and architecture
- To parallelize and optimize network applications to multicore

**Challenges:**
- Simultaneous applications may compete at various levels:
  - Cache, bus, disk I/O, net, core contention
  - Parallelize existing network application algorithms
  - Create prototypes on new multicore platforms
  - Ensure scalability and high throughput

Kid Socialization Monitoring and Localization

**Goal:**
- To detect interaction between kids
- To track the location of kids

**Challenges:**
- Accuracy: detecting an object within a small range (2-3 ft.) indoor/outdoor
- Scalability (Localization is NP Hard) and life-time
- Wearability: not disturbing kids’ activity
- Heterogeneous information: inter-node measurement can be proximity range or angle information
- Use of relative localization and virtual coordinates

Mathematical Modeling

Algorithm and Software Architecture

Design and Implementation

Security in Body Area Networks (BANs)

**Goals:**
- To provide a plug-and-play security paradigm for BANs utilizing physiological values (PVs) as basis for key agreement
- Make security implementations more practical

**Challenges:**
- To identify physiological values (PVs) which can be used for this purpose and from which high quality keys can be generated
- To develop light-weight algorithms for processing PVs and generating features from them in order to facilitate key agreement
- To implement a prototype of the technique as a proof-of-concept on an actual body area network

Network organization

Data manipulation process

Ayushman — Practical and Secure Health Monitoring

**Goal:**
- To create a pervasive, remote, health monitoring infrastructure
- Employ off-the-shelf components
  - Wireless Sensors
  - Wearable Medical Devices
  - Handheld Computing Systems

**Challenges:**
- Low Power Light weight operation
- Integrating diverse computing and communication technologies
- Ensure System availability at all times

Kid Socialization Monitoring and Localization

**Goal:**
- To detect interaction between kids
- To track the location of kids

**Challenges:**
- Accuracy: detecting an object within a small range (2-3 ft.) indoor/outdoor
- Scalability (Localization is NP Hard) and life-time
- Wearability: not disturbing kids’ activity
- Heterogeneous information: inter-node measurement can be proximity range or angle information
- Use of relative localization and virtual coordinates

Multicore optimizations for net applications

**Goals:**
- To make use of multicore availability and architecture
- To parallelize and optimize network applications to multicore

**Challenges:**
- Simultaneous applications may compete at various levels:
  - Cache, bus, disk I/O, net, core contention
  - Parallelize existing network application algorithms
  - Create prototypes on new multicore platforms
  - Ensure scalability and high throughput

Kid Socialization Monitoring and Localization

**Goal:**
- To detect interaction between kids
- To track the location of kids

**Challenges:**
- Accuracy: detecting an object within a small range (2-3 ft.) indoor/outdoor
- Scalability (Localization is NP Hard) and life-time
- Wearability: not disturbing kids’ activity
- Heterogeneous information: inter-node measurement can be proximity range or angle information
- Use of relative localization and virtual coordinates

Mathematical Modeling

Algorithm and Software Architecture

Design and Implementation

Security in Body Area Networks (BANs)

**Goals:**
- To provide a plug-and-play security paradigm for BANs utilizing physiological values (PVs) as basis for key agreement
- Make security implementations more practical

**Challenges:**
- To identify physiological values (PVs) which can be used for this purpose and from which high quality keys can be generated
- To develop light-weight algorithms for processing PVs and generating features from them in order to facilitate key agreement
- To implement a prototype of the technique as a proof-of-concept on an actual body area network

Network organization

Data manipulation process

Ayushman — Practical and Secure Health Monitoring

**Goal:**
- To create a pervasive, remote, health monitoring infrastructure
- Employ off-the-shelf components
  - Wireless Sensors
  - Wearable Medical Devices
  - Handheld Computing Systems

**Challenges:**
- Low Power Light weight operation
- Integrating diverse computing and communication technologies
- Ensure System availability at all times

Kid Socialization Monitoring and Localization

**Goal:**
- To detect interaction between kids
- To track the location of kids

**Challenges:**
- Accuracy: detecting an object within a small range (2-3 ft.) indoor/outdoor
- Scalability (Localization is NP Hard) and life-time
- Wearability: not disturbing kids’ activity
- Heterogeneous information: inter-node measurement can be proximity range or angle information
- Use of relative localization and virtual coordinates

Multicore optimizations for net applications

**Goals:**
- To make use of multicore availability and architecture
- To parallelize and optimize network applications to multicore

**Challenges:**
- Simultaneous applications may compete at various levels:
  - Cache, bus, disk I/O, net, core contention
  - Parallelize existing network application algorithms
  - Create prototypes on new multicore platforms
  - Ensure scalability and high throughput