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Stargate-based Acoustic Sensor Platform

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Stargate-based Acoustic Sensor Platform

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Introduction: Sensor network to monitor acoustic events

Typical acoustic monitoring applications

- **Battle field targets monitoring**
detection, classification, localization, tracking, of tanks and bullets
- **Bio-complexity monitoring**
recognition and localization of animals, species diversity estimation, macro-scale monitoring of group behavior
- **Machinery condition monitoring**
real-time non-intrusive monitoring of running machines
- **Structure healthy monitoring**
detection of mechanical/material failure

Fundamentals of acoustic sensor network

- **Acoustic data acquisition**
Microphone turns acoustic air pressure variations into electrical signals
Audio codec samples and quantizes electrical signals into time series
- **Data/information processing**
CPU(FPU) and memory implement numerical computation
- **Communication/networking**
communication/network stack facilitates information exchange between different nodes for collaboration

Problem Description: High-quality data acquisition of acoustic events

Challenges of high-quality acoustic data acquisition

High-quality acoustic data acquisition is the first step of high-quality acoustic monitoring

Acoustic events such as bird calls in the forest have relatively low signal to noise ratio

Existing iPAQ-based platform has microphones with low sensitivity and high internal noise

Proposed Solution: Stargate micro-server + VXPocket 440 sound card + M53 microphone

Architecture of acoustic sensor platform

- **Intel Stargate micro-server with wireless communication interface**
Stargate provide decent processing and communication capabilities
- **Digigram VXPocket 440 PCMCIA sound card**
VXPocket 440 provide high resolution multi-channel A/D converter
- **M53 microphones**
M53 microphones have high sensitivity and low noise

Stargate features

- 32-bit 400 MHz Intel PXA-255 Xscale RISC processor
- SA1111 StrongARM companion chip for multiple I/O
- 32 MB of Intel StrataFlash
- 63 MB of SDRAM
- 1 type II PC Slot
- 1 Type II Compact Flash Slot
- Linux kernel 2.4.19
- 802.11 and Bluetooth wireless tools
- Form factor – 3.5" X 2.5"



VXPocket 440 features

- 2 stereo balanced MIC/line input
- 48 - 8 KHz adjustable (in 100 Hz steps) sampling rate
- 24 bits A/D converter resolution
- Type II PC bus interface
- XLR connector for microphones
- ALSA (Advanced Linux Sound Architecture) device driver and API library



M32 Microphone features

- 2 stereo balanced MIC/line input
- 48 - 8 KHz adjustable (in 100 Hz steps) sampling rate
- 24 bits A/D converter resolution
- Type II PC bus interface
- XLR connector for microphones
- ALSA (Advanced Linux Sound Architecture) device driver and API library

