



# Environmental Monitoring Based On Wireless Sensors and Actors Networks

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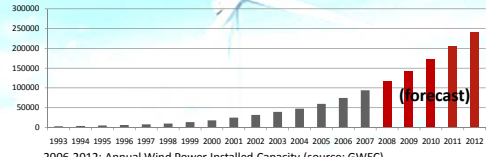



## Outline

- Background
- Motivation
- Objectives
- WSN
- WSAAN
- Solution
- Discussion

## Background

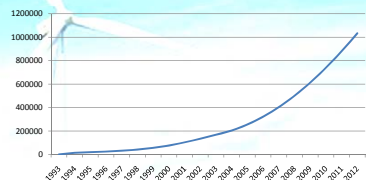
- Energy production
  - Exhaustible resources
  - Greenhouse gases
- Environmentally friendly renewable energies
- Wind power is the fastest growing



2006-2012: Annual Wind Power Installed Capacity (source: GWEC)

## The Problem

- Wind power turbines environmental impact
  - Noise
  - Aesthetics
  - Wildlife
    - Sea life
    - Birds
    - Bats



Annual Bat Fatalities 4,6 Bats/MW (source: AWEA)


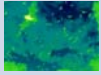

## Why Bats?

- Bat's characteristics
  - Long lived
  - Low reproductive rate
  - Mortality rate
- Species preservation
- Ecosystems' equilibrium
  - Pest control
    - Night flying insects main predator
  - Irreplaceable pollination agent

} Endangered

## Monitoring Methods

- Active vs. passive monitoring
- Acoustic vs. non-acoustic methods

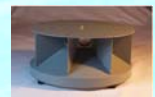
	Acoustic	Non-Acoustic
Active	Bat detectors  <small>Source: <a href="http://www.titley.com.au">http://www.titley.com.au</a></small>	Visualobservation Infrared Cameras Thermal Imagers Radars  <small>Source: <a href="http://www.bu.edu/cecb/BATS">http://www.bu.edu/cecb/BATS</a></small>
Passive	Data Loggers  <small>Source: <a href="http://www.titley.com.au">http://www.titley.com.au</a></small>	Data Loggers

## Monitoring Sites



## Repelling Methods

- Repellents
- Naphthalene
- BWEC



- Extermination



- Bat Boxes

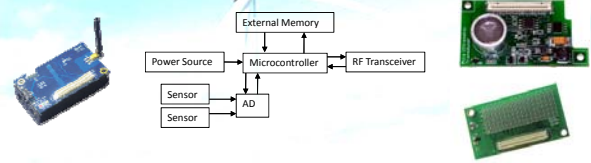


## Objectives

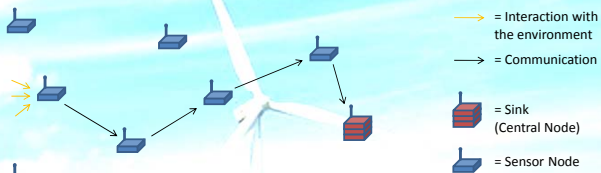
- Monitoring tool
- Deterrent mechanism
- Features
  - Remote monitoring
  - Central storage
  - Remote management

## Sensors

- Low cost
- Low power
- Autonomous
- Battery Limited
- Wireless
- Computation power
- Low memory
- TinyOS/Nesc



## Wireless Sensor Network



## Actors

- Higher capacity
- Actuators
- Fewer number

