In-Network Data Processing for Wireless Sensor Networks

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Introduction

The wireless sensor network formed by many components and devices, including accelerometer sensor, photo (light) sensor, base station, etc.   If someone entered a protecting area without authorization, the sensor nodes will communicate with each other and send the data back to the base station. Then, the base station will control the camera to take some photos. After that, the base station will send an email with the photos to the owner. Thus, the owner can be alerted by the security system if someone entered his/her place.

We have further converted this sensor network into an accurate and sensitive indoor security system. With the excellent cooperate between sensors and our own well designed multi-hop routing algorithm, we provide a better security system than traditional CCTV and IP camera.

Our system includes not only the sensor network but also a rotatable camera. It's able to send a warning message to warn the room owner when there is any unauthorized person enters the room and it also provides a real time video of the camera. An email with a snapshot and logging attached will be sent to owner email box too.
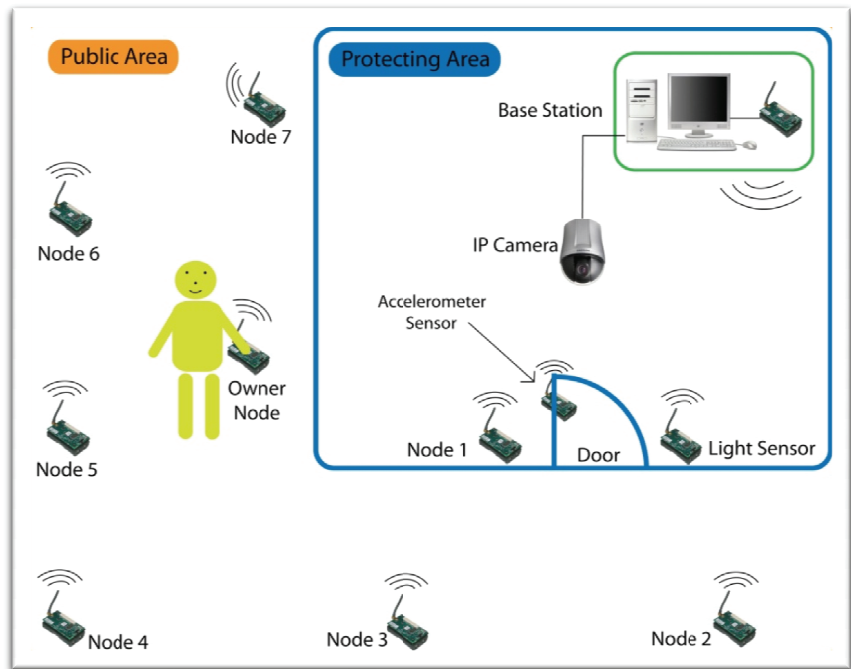
Design

1. **Photo Sensing Algorithm**
   - It is used to determine the brightness of a particular area.
   - The threshold value of algorithm is used to determine whether the door is opened and improper threshold value will lead to high fault positive rate.
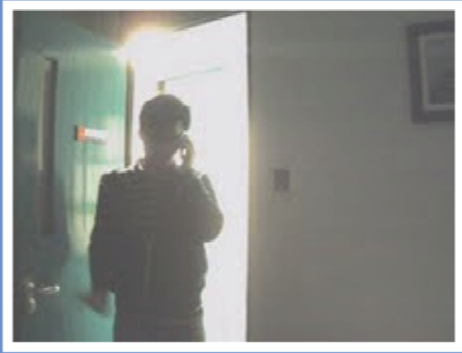
2. **Acceleration Sensing Algorithm**
   - It is used to detect the vibration of door.
   - If an acceleration sensor has a reading, then the door is moving.

3. **Email Format**

   Security System to me   show details Apr 24 (9 days ago)   Reply ▼

2010/04/24 14:27:47	Door Status : **CLOSE**
2010/04/24 14:27:47	Owner is inside the room
2010/04/24 14:27:52	Owner is outside the room
2010/04/24 14:28:02	Door Status : **MOVING**
2010/04/24 14:28:05	Light sensor reading 181
2010/04/24 14:28:05	Door Status : **OPEN**
2010/04/24 14:28:06	Light sensor reading 338
2010/04/24 14:28:07	Light sensor reading 339
2010/04/24 14:28:11	START SENDING WARNING
2010/04/24 14:28:12	Light sensor reading 337
2010/04/24 14:28:13	Light sensor reading 337
2010/04/24 14:30:10	Door Status : **MOVING**
2010/04/24 14:30:11	Door Status : **MOVING**
2010/04/24 14:30:12	Door Status : **CLOSE**
2010/04/24 14:30:13	STOP SENDING WARNING

   video.jpg
   29K View Download

   ↩ Reply ➡ Forward

   Security System to me   show details Apr 24 (9 days ago)   Reply ▼
   Someone has entered your room.
   Please enter the following links to view the live video
   For PC user: http://143.89.191.37/
   For 3G cell phone user: rtsp://143.89.191.37/live.sdp

   - It is used to alert the user via email when unauthorized person entered the protected area.
   - User can used the RTSP protocol to watch the real time video of the protected area.

Testing
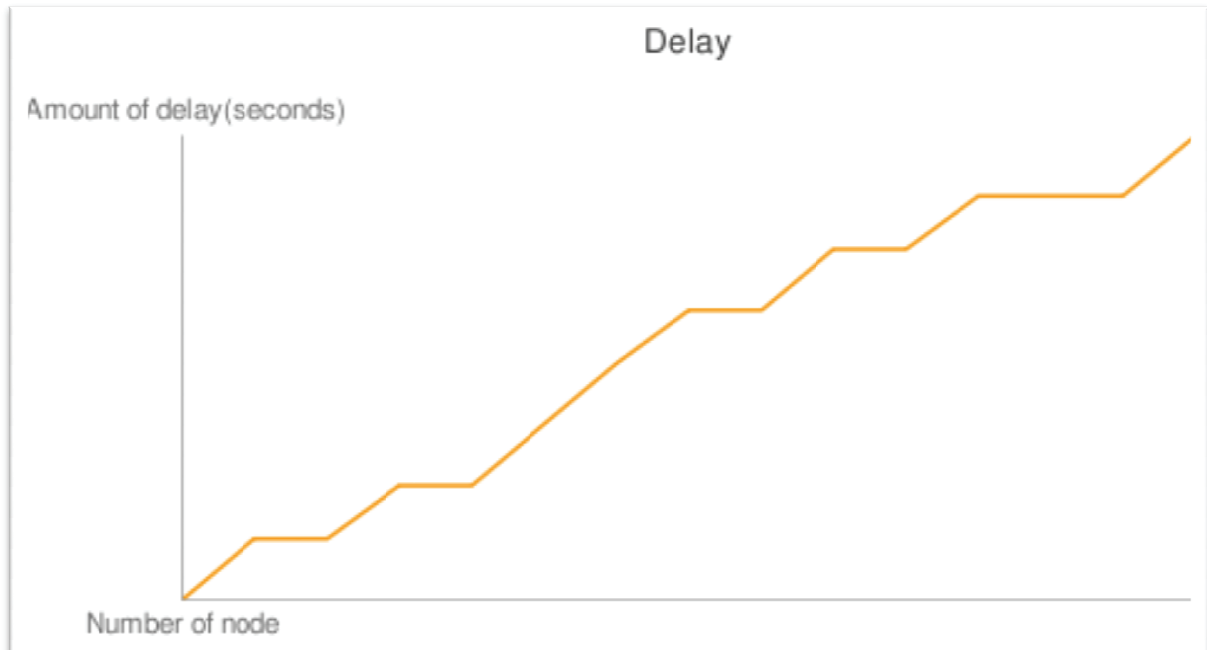
- Number of node increases → Amount of delay increases
- To decrease delay: Increase frequency of sending message → battery life becomes shorter → system's lifetime become shorter
- Optimal delay level for our system: around 6 seconds delay

Accelerometer sensor readings:

```
2011/04/01 17:30:36 Accelerometer sensor readings:X-axis:592 Y-axis:593
2011/04/01 17:30:37 Accelerometer sensor readings:X-axis:419 Y-axis:602
2011/04/01 17:30:38 Accelerometer sensor readings:X-axis:577 Y-axis:453
```

Light sensor readings:

```
2011/04/01 17:30:32      Light sensor reading 143
2011/04/01 17:30:33      Light sensor reading 140
2011/04/01 17:30:33      Light sensor reading 140
```

Here is the statistic of our system on detecting the movement of the door.