



# Smart Home Sensor Networks Pose Goal-Driven Solutions to Wireless Vacuum Systems

Huan Chen, Bo-Chao Cheng  
Chih-Chuan Cheng and Li-Kuang Tsai

Badruduja Bhuiya (Noman).  
3280089  
Dresden, 29.01.2008

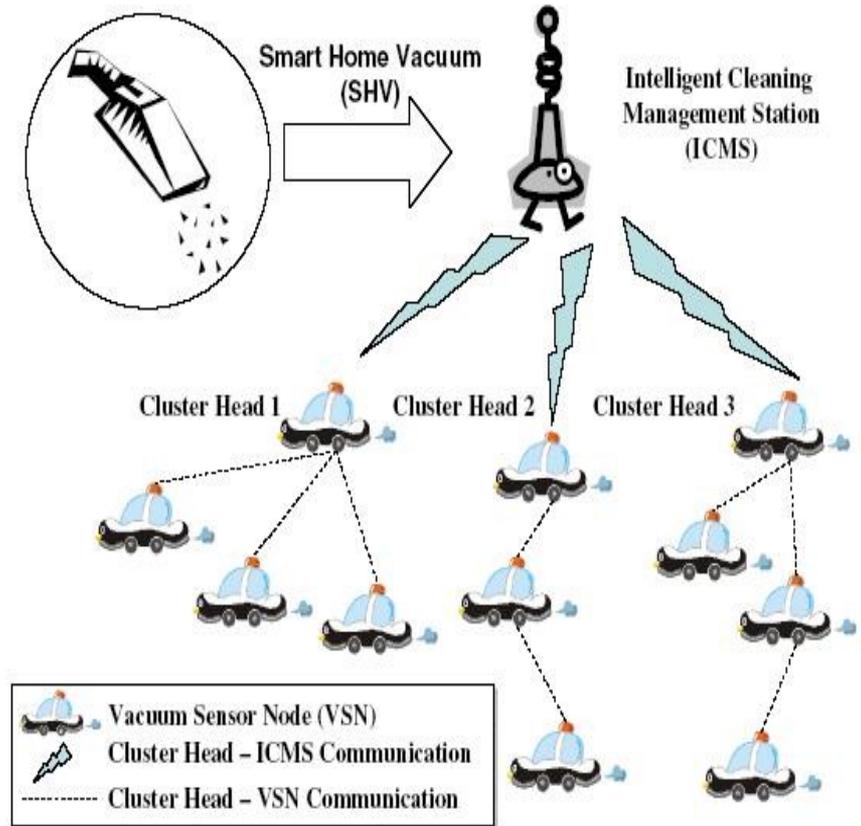
- smart home sensor
- sensor routing
- total cost of mobility and routing
- ICMS task assignment

home sensor nodes are embedded device that sense environments to process collected information, to perform specific task and to cooperate with other sensor or cluster

motivation of this paper:

development wireless sensor routing protocol for mobile nodes that will be energy efficiency for network lifetime

- ICMS collect information from sensor and perform GDTP algorithm and published information to cluster head
- cluster head will communicate with corresponding sensor each periodic of time



[1] Authors: "smart home vacuum system"

## data communication

- sensor always collect information from environment and communicate with cluster head (CH)
- cluster head aggregate data and communicate with intelligent cleaning management (ICMS)

## LEACH cluster head selection algorithm

$i$ - sensor node

$r$ - round of time

$X_i$ - sensor node choose random number is between 0 to 1

$T(i)$ - sensor node select cluster if it is satisfy threshold value

$P$ - percentage of cluster heads for sensor network (5% in LEACH)

$S_N(r)$ - sensor node in round of time

if  $X_i < T(i)$ , then sensor node select cluster head

$$T(i) = \begin{cases} \frac{P}{1 - P \cdot (r \bmod \frac{1}{P})} & \text{if } i \in S_N(r) \\ 0 & \text{otherwise.} \end{cases}$$

## comparison LEACH between GDTP

- LEACH approach sensor select cluster in each round of time
- problem: sensor are moving periodically
- solution: goal driven task planning algorithm
- each periodic time GDTP engine select sets of VSN(s) for cluster head
- GDTP engine maintain node status information and updates periodically

## goal driven task planning algorithm

- intelligent control management system (ICMS) always calculate total cost of each sensor
- after that ICMS forward energy efficiency sensor information to the cluster
- each cluster maintain a least cost estimate from ICMS
- summery: ICMS always checks least cost path between source and destination

E - energy      i - node      r- periodical time

moving,  $E_m(i,r)$

working,  $E_w(i,r)$

communicating,  $E_c(i,r)$

sensing,  $E_s(i,r)$

$Q(r)$ - total energy consumption

$$\begin{aligned} Q(r) &= \sum_{i=1}^N Q(i, r) \\ &= \sum_{i=1}^N \{E_M(i, r) + E_W(i, r) + E_C(i, r) + E_S(i, r)\}. \end{aligned}$$

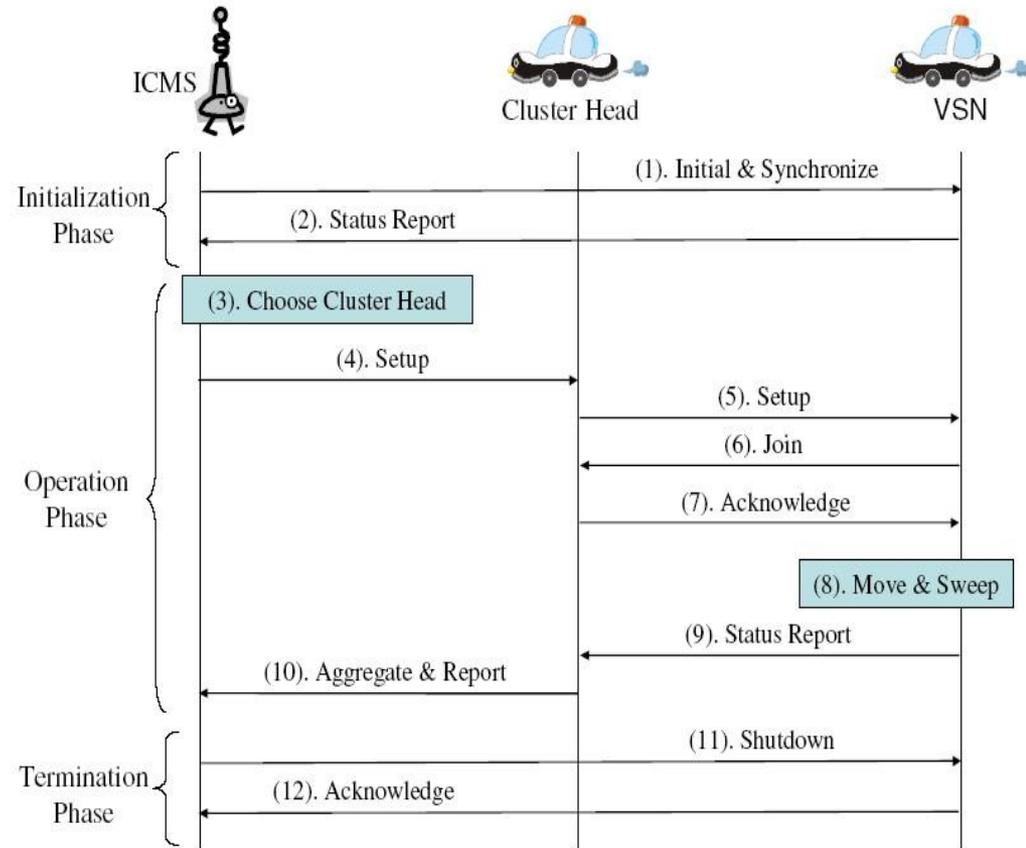
## initialize phase

### step 1

ICMS sends board-cast message to initialize and synchronize VSN.

### step 2

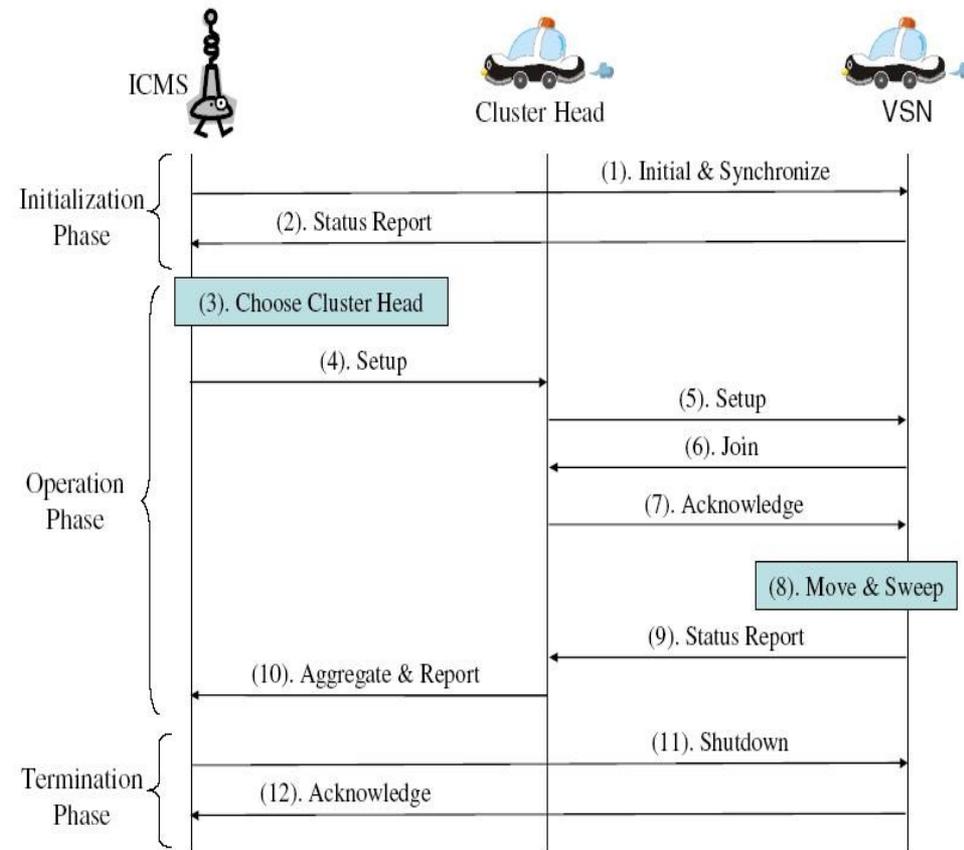
VSN reply heart beat message to ICMS



[1] Authors: "Information Flow of Smart Home Vacuum System"

## operational phase

- step 3: ICMS choose cluster head and corresponding VSN
- step 4: ICMS sends out set-up message including CH and VSN
- step 5: cluster head board casts the “set-up” message to VSN.
- step 6: VSN ACK it



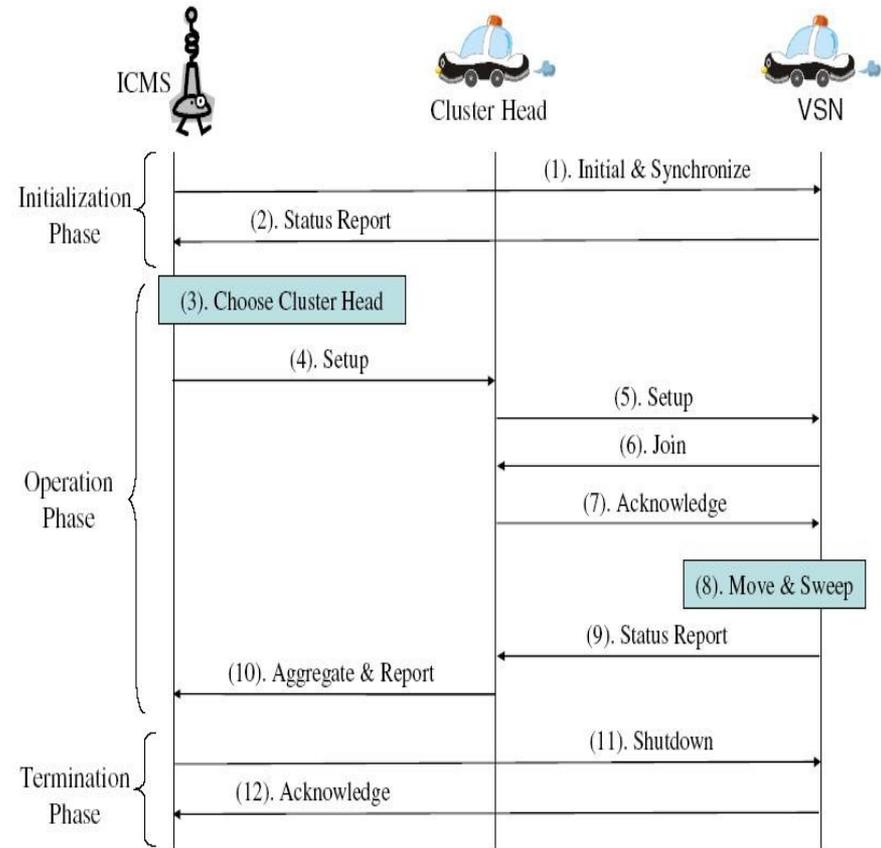
[1] Authors: "Information Flow of Smart Home Vacuum System"

step 7: each CH ACK of the  
VSN

step 8: all VSN move and  
sweep corresponding clock  
cycle

step 9: VSN sends its status to  
its CH at the end of this clock  
cycle

step 10: cluster head  
aggregate information, reports  
to ICMS



[1] Authors: "Information Flow of Smart Home Vacuum System"

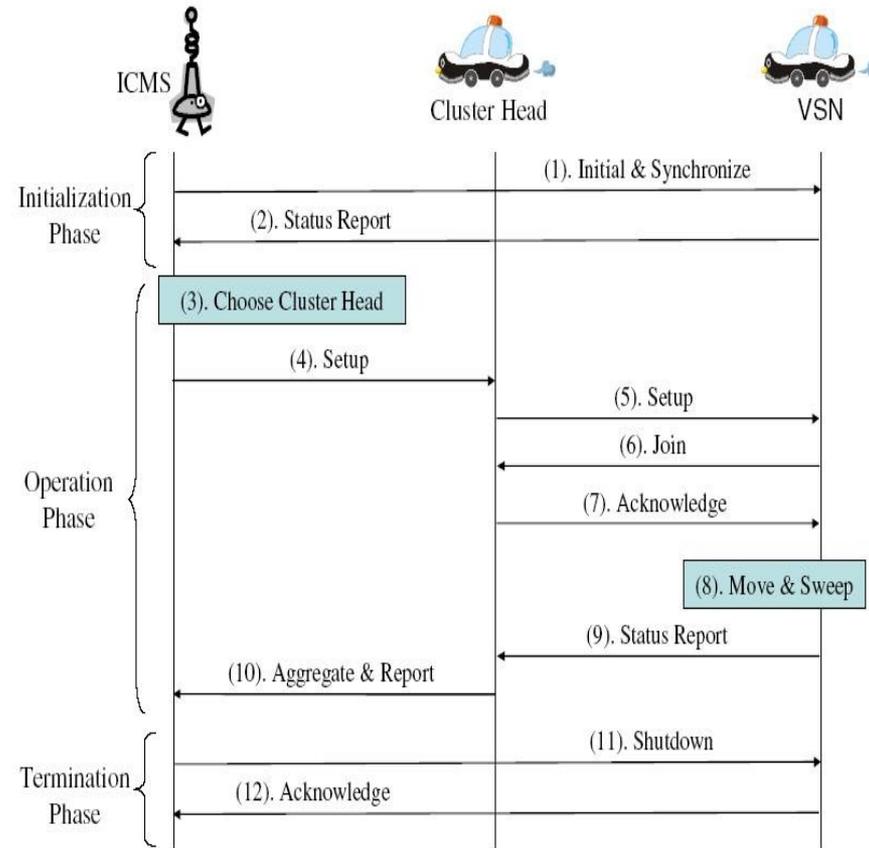
## termination phase

### step 11

ICMS broadcast the “shut down” message to power off the system atomically

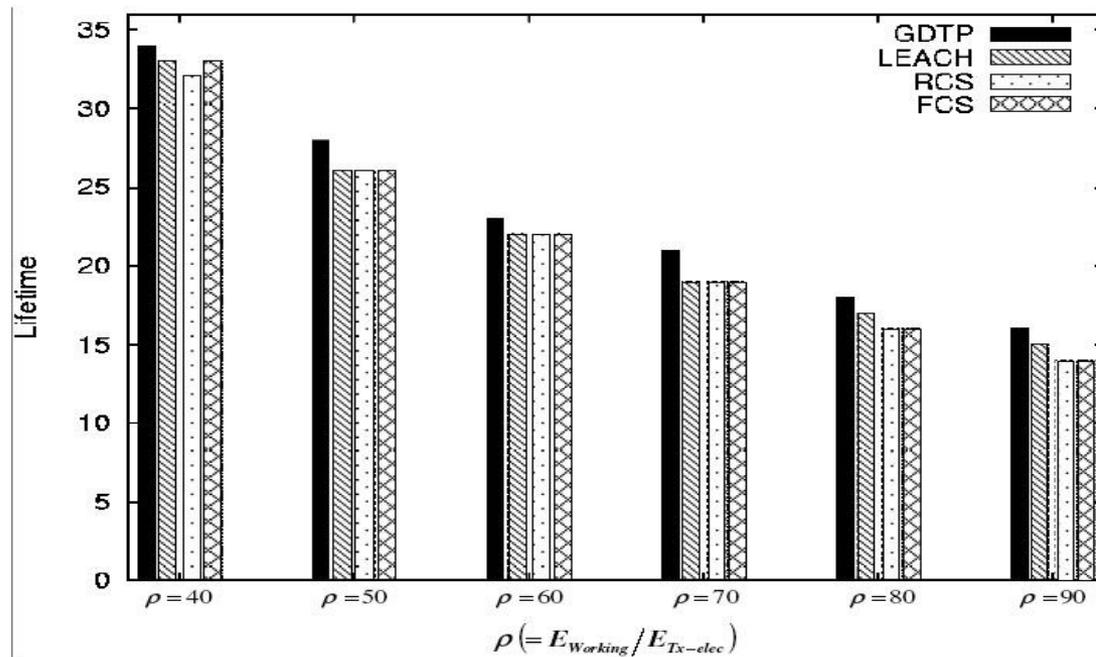
### step 12

sensor reply ACK message to ICMS



[1] Authors: "Information Flow of Smart Home Vacuum System"

## performance: network life time



[1] Authors: "energy consumption: network life time"

## goal driven task planning routing algorithm

- energy efficiency routing
- minimum energy
- minimum hop
- least cost path from source to destination
- energy efficiency cluster head selection schema

- smart home sensor networks pose goal-driven solutions to wireless vacuum systems

Huan Chen, Bo-Chao Cheng, Chih-Chuan Cheng and Li-Kuang Tsai

- “a fault-tolerant routing algorithm for wireless sensor networks”

Ibrahim Abdul Rahim