

## Wireless Sensors Based System for City Energy Consumption

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### What is IoT

- The world is moving towards automating things using IoT
- IoT build a network of connected physical objects that are accessible through the internet.
- This enables these objects to connect and exchange data



### Motivation and Goals

1- The main goal is to rationalize household energy consumption, and to facilitate electrical energy management for the electricity company .

2- We built a network based on a wireless sensor connected to an electricity meter (SENSOR) that sends data to the electricity company's server.



### Similar projects

- Smart Parking System with Dynamic Pricing,Edge-Cloud Computing and LoR
- Data Mining Techniques Applied to Wireless Sensor Networks for Early Forest Fire Detection



### Technology

- 1. NRF technology(nLRF401)
  - a. Low power consumption.
  - b. Cheap.
  - c. Act as CM to send the data to CH inside Cluster
- 2. WiFi technology(ESP8266)
  - a. High availability in homes and large coverage area.
  - b. Act as a CH to send the data to server Electricity company.



### Architecture of the smart-Electricity meter

• What hardware is needed for project?

- Radio module ( nRF24L01):
  - 2.4 2.5 GHz ISM band.
  - Current consumption only 9.0mA and works with 3.3V
  - Range of 100 meters.
- WiFi module (ESP8266):
  - Is a very user friendly and low cost device to provide internet connectivity to your projects.
  - The ESP8266 module works with 3.3V only
  - Range of 360 meters .
- Arduino Uno



### Architecture of the smart-Electricity meter

• PZEM004T :to measure the voltage, current and power using Arduino

Working voltage 80 ~ 260VAC

Current measurement 0 – 100 A

- Rated power 22kW
- Operating frequency 45-65Hz

### Architecture of the smart-Electricity meter





### Assumption

 The device we built does not require a battery, while the electricity is supplied from a meter (meter) by placing a 5V transformer.



### Node Types

• Cluster head (CH): This node elected by cluster member ,and this node choose the gateway node , this node receive the data form cluster member to send to server

• Cluster member(CM) : This node is member in the cluster, and send data to cluster head (CH).

• Gateway node: This cluster member node selecting by CH because this node more than connectivity in cluster and may send the data to other CH, or other gateway node to server.











#### Flowchart in general



EPROM	ID
212	3
88	1
100	8

#### Neighbors Table in node 2

#### Flowchart Broadcast

### Flowchart Election CH





### Flowchart selecting gateway node

CM send the connectivity node to cluster head

CH select the more connectivity node as gateway node

Set the gateway node









### Message Format

Broadcast

Source ID	Destination ID	Packet size	Message type
(4 byte)	(4 byte)	(2 byte)	(1 byte)

Connect

Source ID (CM)	Destination ID (CH)	Packet size	Message type
(4 byte)	(4 byte)	(2 byte)	(1 byte)

Connectivity

Source ID	Destination ID (CH)	# connect node	Packet size	Message type
(4 byte)	(4 byte)	(4 byte)	(2 byte)	(1 byte)

Data

Source ID (4 byte)	Destination ID (4 byte)	Data (4 byte)	Packet size (2 byte)	M	essage type (1 byte)
			Ν	Message Type:	
			1	Broadcast: 00000000	
			(	Connect: 00000001	
			0	Connectivity: 00000010	
			Γ.	Data:	00000011
			-	CH: Cluster Head	

### Advantages & Disadvantages

#### Advantages:

- 1. Powerful and accurate and good performance on many problems.
- 2. Build cluster dynamic
- 3. It reduces the load on the network created

### **Disadvantages:**

1. Clustering required construction and maintenance cost money and time.

### Parameters Table

Parameter	Value		
Routing protocol	DSR		
Number of Nodes	30, 50, 150, 300		
Simulation Time	10 sec		
Simulation area	900*700m		
Interface Type	Queue		
Mac Protocol	802_11		
Packet Size	80		
Radio Propagation Model	Two Ray Ground		
Channel type	WirelessChannel		

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### Future work

Sometimes there will be an isolated area that we cannot access, We are thinking of solving this problem by setting an antenna repeater for remote areas to access the data.

### Conclusion

This paper explain the implemented creating two networks using NRF and WiFi technology ,also the network splits nodes into group, each group that is tree using forest algorithm ,However, node chosen the PN that considered max of degree connectivity denied node within the group, the sink node chosen randomly in tree .also, the server advertises itself and connects to the nearest tree on it and through DD routing protocol, our protocol was implemented using the ns2 simulator and it was evaluated in terms of delay and delivery ratio and as we saw the results were better for our protocol.



# Thank You