ENERGY EFFICIENT SMART WIRELESS SENSOR NETWORK FOR BORDER MONITORING

By

Islam Wagih Mahdy

A Thesis Submitted to the

Faculty of Engineering at Cairo University

In Partial Fulfillment of the

Requirements for the Degree of

MASTER OF SCIENCE

In

Electronics and Communications Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY

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Title of Thesis:

Energy Efficient Smart Wireless Sensor Network for Border Monitoring

Key Words: Wireless sensor network, intrusion detection, fuzzy logic, Neuro-fuzzy, border monitoring.

Summary:

In this thesis, we firstly consider the power problem in wireless sensor network and solution for this problem through software and hardware architectures, secondly we survey the fuzzy logic controller and how it works and different types of the fuzzy logic, thirdly we define energy efficient smart protocol for border monitoring and classify the intruder by two different techniques, the first one is to reduce the monitoring cycle period without effecting the efficiency of the system and the second is the power gating technique to reduce the losing power due to switching and leakage current and voltage in inactive blocks in the circuit, finally we implement the system on arduino mega 2560 then the total saved power are measured and compared with the power without using these technique

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted foe a degree qualification at any other university or institute.

I further declare that I have appropriately all sources used and have cited them in references section.

Name: Date:

Signature:

Dedication

To the soul of my father, who is my source of inspiration.

To my beloved family, for its endless support.

Acknowledgements

In the name of Allah the most merciful the most gracious; all thanks to *Allah* the Lord of the Heavens and Earth and peace is upon Mohamed and his companions.

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Nomenclature

ACO	Acoustic
ANFIS	Adaptive neuro fuzzy interference system
B-MAC	Barkeley media access control
C_L	Load capacitance
d	Distance between transmitter and receiver
D-MAC	Data gathering
E_{elec}	Energy required to run radio electronics for one bit
E_{tx}	Energy required to transmit
ЄFS	Energy required for bit/m^2
E-MAC	Energy efficient MAC
E/Trans	Energy per transmission
f_{clock}	Clock frequency
FLC	Fuzzy logic control
I_{peak}	Short circuit current plus current required to charge the internal capacitance
LEACH	Low energy adaptive clustering hierarchy
MAG	Magnetic
P	Desired percentage of cluster heads
P_{dyn}	Dynamic power loss
PEGASIS	Power-efficient gathering in sensor information systems
PIR	Passive infra-red
P_{SC}	Static power
P_{SW}	Switching power
S-MAC	Sensor MAC protocol
SMACS	Self-organized medium access control for sensor network
SPIN	Sensor protocol for information via negotiation
T (n)	Threshold value
t_{sc}	Duration of short circuit
T-MAC	Time out MAC

TEEN	Threshold sensitive energy efficient sensor network protocol
V_{dd}	Supply voltage
V_{th}	Threshold voltage
WSN	Wireless sensor network
α	Probability of transition