AN EFFECTIVE INVESTIGATION ON RESOURCE MANAGEMENT OPTIMIZATION AND CASE STUDY ON SMART IOT AGRICULTURE

Abstract

The use of Resource Management Layer Manages limited resources of IoT devices such as Storage, energy, processing, bandwidth, Deployment of various IoT protocols and algorithms in the IoT framework model, also with the usage of Fundamental functions of the resource management layer such as Discovering resources, Estimating resources, Monitoring resources Allocating resources leads to final Optimization in IoT system. In this paper, detailed case study of utilization of these resources in smart IoT agriculture using various nodes and detailed result discussion are executed using MATLAB

Key words: Application layer, Processing layer, Perception layer, communication layer, Cloud layer, Edge layer, IoT layer.

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I. INTRODUCTION

Internet of Things is complex environments encompassing many heterogeneous components. IoT embodies a vision of merging heterogeneous smart things utilizing Internet as a backbone of communication. IoT is a platform Everyday device become smarter Processing becomes intelligent Communication becomes informative. Huge number of things connects to the Internet, IoT applications fall in two categories into Resourceful and Resource constrained Resourceful IoT applications. A lot of work is done Most work is to improve the services offered in such applications Resource-constrained IoT applications. A lot of issues and challenges are yet to be taken for research especially in resource constrained IoT applications Resource constraints at different levels Challenges in Implementation. Data aggregation, Heterogeneity, Node Deployment, Resource Allocation, Data Management, Resource optimization in IoT at Node and Network level

1. Challenges in resource management
2. IoT environment
3. Heterogeneity Management
4. Limited Communication
5. Limited Computational Power
6. Energy Management
7. Device Management
8. Resource Allocation
9. Scalability
10. Data Abstraction
11. Data Management

IoT resource management at the architectural level addresses real-time constraints of pervasive applications. Emphasis is on Optimizing resource management and allocation. Multiple factors are considered to ensure proper resource management: Energy, Bandwidth, and Latency Considerable work includes:

- Fog based architectures IoT architectures for pervasive applications like smart cities
- Cluster based IoT architecture No standard solutions has been proposed for IoT resource management

II. MOTIVATION

IoT applications fall in two categories into Resourceful and Resource constrained
Resourceful IoT applications:

1. A lot of work is done
2. Most work is to improve the services offered in such applications
3. Resource-constrained IoT applications:
4. A lot of issues and challenges are yet to be taken for research
5. Especially in resource constrained IoT applications
6. Resource constraints at different levels
7. Challenges in Implementation:

8. Data aggregation, Heterogeneity, Node Deployment, Resource Allocation, Data Management

   Resource optimization in IoT at Node and Network level

III. DESIGN AND MODELING OF RESOURCE-CONSTRAINED EDGE-IOT APPLICATIONS

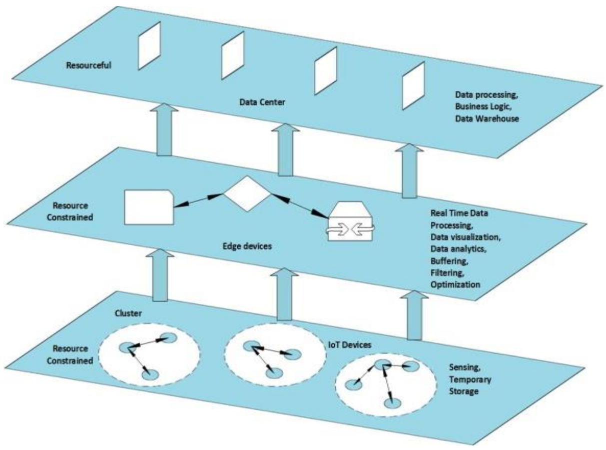


Figure 1: Edge-IoT Layered Architecture

1. **Resource management IoT**

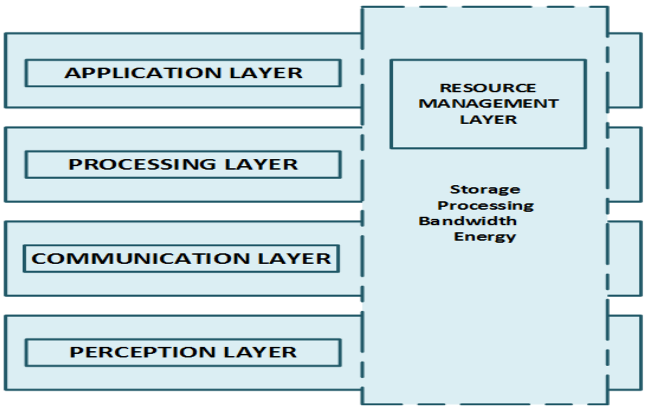
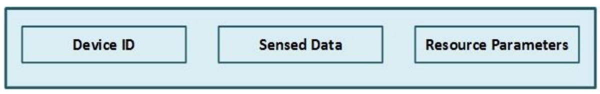


Figure 2: Resource Management IoT Architecture

2. **Perception Layer**



3. **Communication Layer**: How data has to be shared within its cluster or outside

4. **Processing Layer**: Min-profiles are combined into profile

5. **Application Layer:** Profile combined into compound profiles to give services or recommendations

IV. PROPOSED RESOURCE MANAGEMENT IOT ARCHITECTURE

1. Resource Management Layer
2. Manages limited resources of IoT devices
3. Storage, energy, processing, bandwidth
4. Deployed as protocols and algorithms in the IoT framework
5. Fundamental functions of the resource management layer
6. Discovering resources
7. Estimating resources
8. Monitoring resources
9. Allocating resources
10. Optimizes the utilization of the available resources in IoT system
11. Design and Modeling of Resource Management Edge-IoT Architecture
12. IoT nodes and Edge nodes in the network Cluster formation
13. Dedicated set of IoT nodes assigned to edge node
14. Sensing, processing and communication of data incurs workload Such as sense, process and transmit
15. Interpreted as resources needed to accomplish specific application tasks

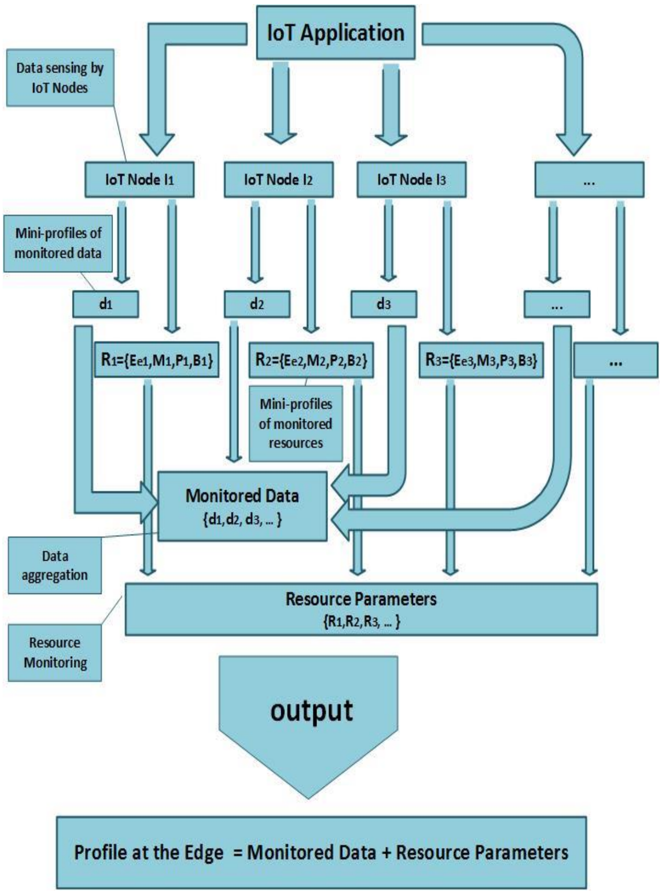


Figure 2: Resource Management Edge IoT Architecture

V. B.EDGE-IOT SCENARIOS

1. Static IoT and Edge nodes
2. Static IoT and Random Edge nodes
3. Random IoT and Static Edge node
4. Random IoT and Edge Nodes
5. Static IoT and Edge Nodes
6. Location of all nodes is pre-determined
7. Fixed number of IoT nodes associated to a particular Edge node in each cluster
8. Resource consumption:
9. Processing and transmission of data
10. One-time processing in calculating parameters
11. such as position of nodes, distance among nodes
12. Static IoT and Mobile Edge Nodes
13. IoT nodes have fixed locations
14. Fixed number of IoT nodes are associated to any Edge node
15. Frequent calculations involved
16. Position and distance of random Edge nodes
17. Mobile IoT and Static Edge Nodes
18. Mobile IoT nodes are assigned to a particular Edge node
19. Mobile behavior of IoT nodes drains the resources more quickly
20. Mobile IoT and Edge Nodes
21. Any IoT node can be assigned to any Edge node
22. Nearness of distance between the IoT node and an Edge node
23. Resource consumption is highest

V.CASE STUDY: SMART IOT AGRICULTURE

Node Programming

For programming of IoT and edge nodes, MoteConfig application is used.
MoteConfig is windows based GUI utility for programming IoT and edge nodes.
We can configure node's ID, RF channel and RF power using MoteConfig.

In Smart IoT Agriculture, IoT nodes were randomly distributed in an agricultural field to monitor the environmental and agricultural parameters such as air temperature (in Celsius), air humidity (in %), soil temperature (in Celsius) and soil moisture (in %).

Node Configuration

The IoT node consists of an IRIS mote fitted on MTS 420 sensor board.
20 IoT nodes are randomly deployed in which 16 IoT nodes act as sensing nodes and 4 IoT nodes act as aggregator nodes.
The edge node consists of an IRIS fitted on MIB520.

Figure 3: IoT Device

Figure 4: Edge Device

VI RESULT&DISCUSSION

1. IoT node programming successful

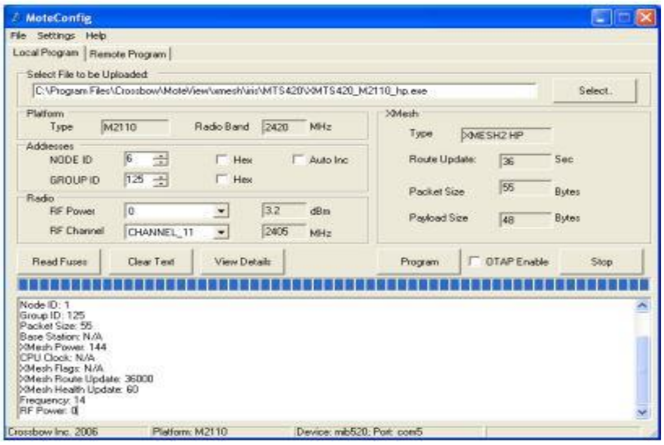


Figure 5

2. Edge node programming successful

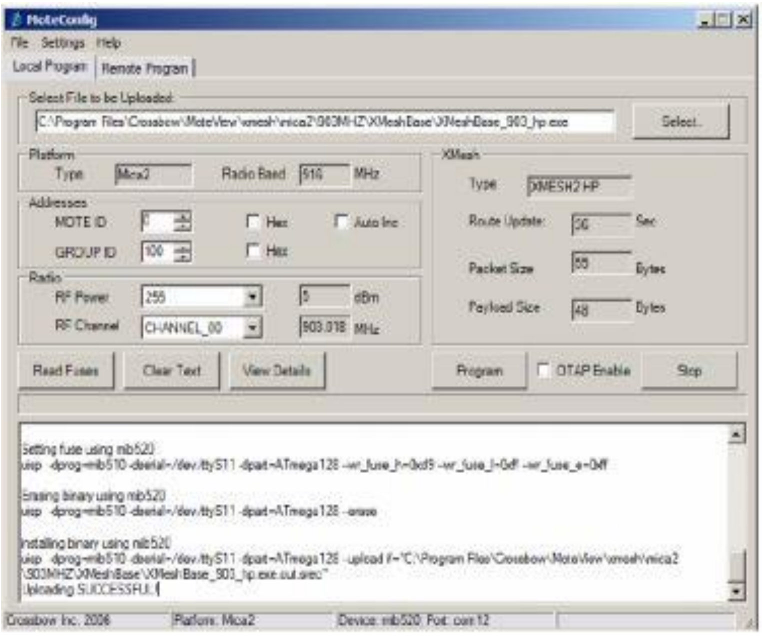


Figure 6

3. **Data collection:** After the IoT nodes were successfully programmed, data was sensed and collected about a selected agricultural field for a period of 30 days. The sensed data from the IoT nodes was easily logged into the database by MoteView

Figure 7

4. Data analysis

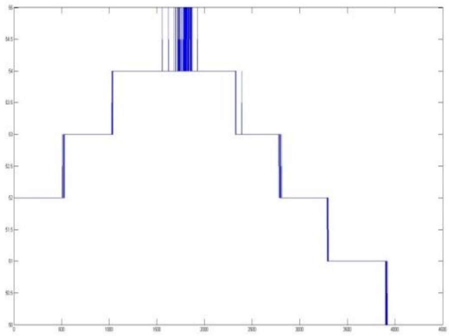


Figure 8: Temperature (In Celsius) versus Time (In hours)

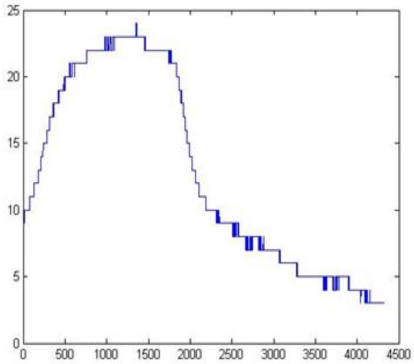


Figure 9: Humidity (In %) versus Time (In hours)

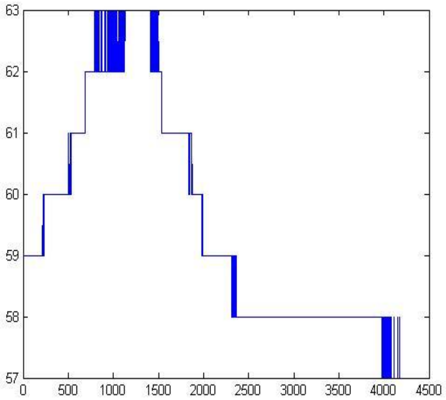


Figure 10:Soil Temperature (In Celsius) versus Time (In hours)

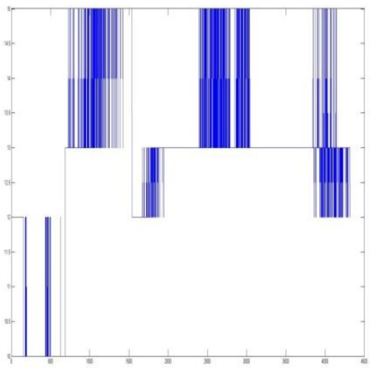


Figure 11: Moisture (In %) versus Time (In hours)

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