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

**Dr. B. Nageshwar Rao1, V Vijayakumar Dasari2**

**1Associate professor, Dept. of IoT, School of Engineering, Malla reddy University, dhulapally, Hyderabad**

**2Assistant professor, Dept. of CS, School of Engineering, Malla Reddy University, Dhulapally, Hyderabad**

**1**[**nageshwarb@mallareddyuniversity.ac.in**](mailto:nageshwarb@mallareddyuniversity.ac.in)**, 2**[**vijaydasari@mallareddyuniversity.ac.in**](mailto:vijaydasari@mallareddyuniversity.ac.in)

**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.

**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

Challenges in resource management

IoT environment

Heterogeneity Management

Limited Communication

Limited Computational Power

Energy Management

Device Management

Resource Allocation

Scalability

Data Abstraction

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:

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

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

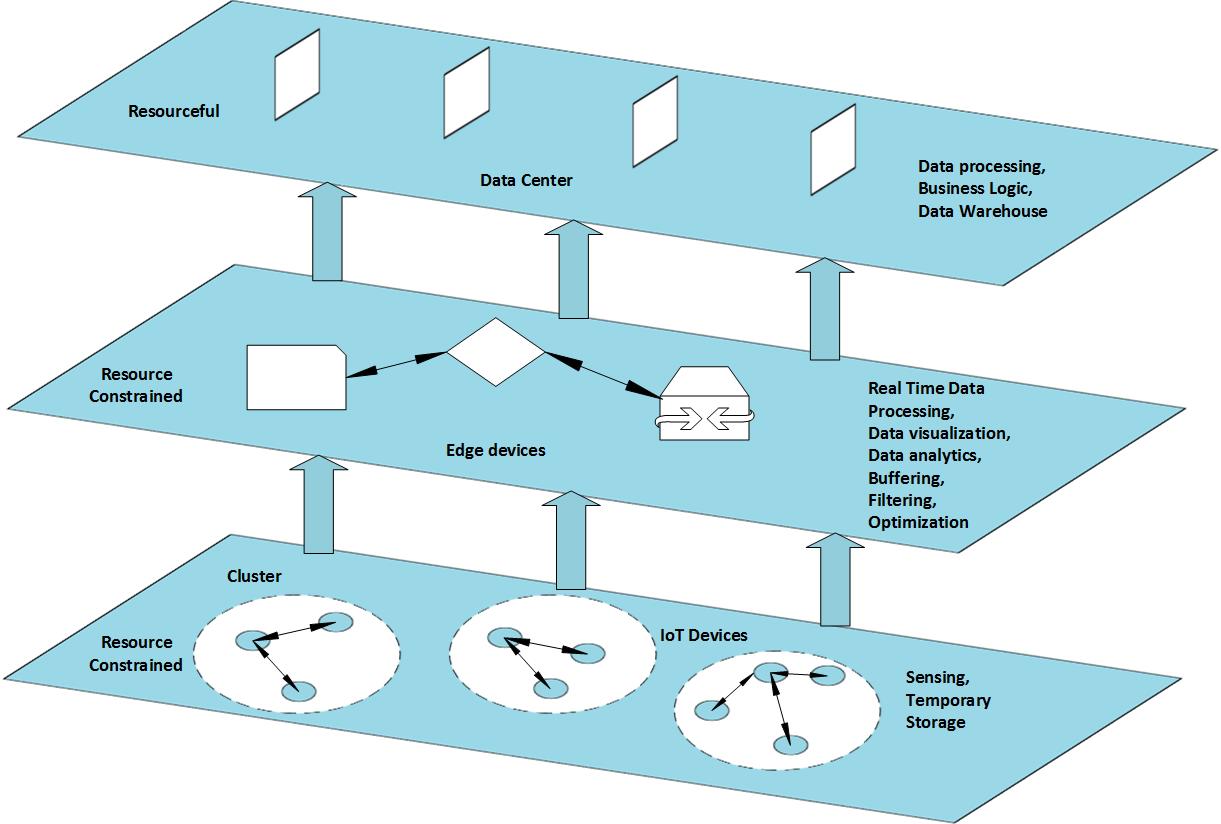


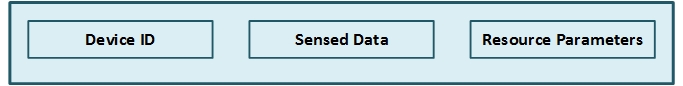
Figure 1: Edge-IoT Layered Architecture

**A. Resource Management IoT**

architectdiag.tif

Figure 2; Resource Management IoT Architecture

**B.Perception Layer**



**C.Communication Layer**

How data has to be shared within its cluster or outside

**D.Processing Layer**

Min-profiles are combined into profile

**E.Application Layer**

Profile combined into compound profiles to give services or recommendations

**IV.PROPOSED RESOURCE MANAGEMENT IOT ARCHITECTURE**

R**e**source Management Layer

Manages limited resources of IoT devices

Storage, energy, processing, bandwidth

Deployed as protocols and algorithms in the IoT framework

Fundamental functions of the resource management layer

Discovering resources

Estimating resources

Monitoring resources

Allocating resources

Optimizes the utilization of the available resources in IoT system

**A. Design and Modeling of Resource Management Edge-IoT Architecture**

IoT nodes and Edge nodes in the network Cluster formation

Dedicated set of IoT nodes assigned to edge node

Sensing, processing and communication of data incurs workload Such as sense, process and transmit

Interpreted as resources needed to accomplish specific application tasks

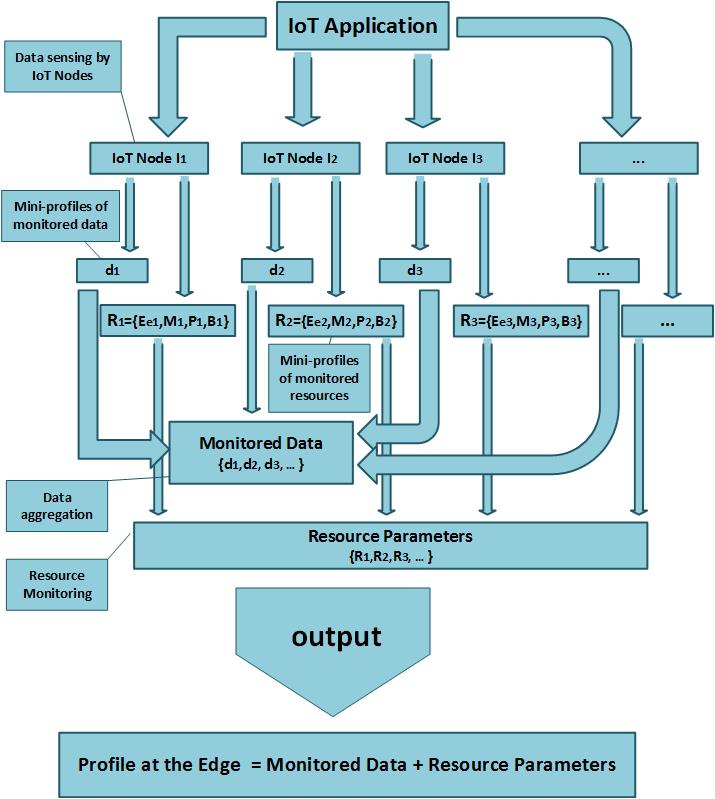


Figure 2; Resource Management Edge IoT Architecture

**B.Edge-IoT Scenarios**

Static IoT and Edge nodes

Static IoT and Random Edge nodes

Random IoT and Static Edge node

Random IoT and Edge Nodes

Static IoT and Edge Nodes

Location of all nodes is pre-determined

Fixed number of IoT nodes associated to a particular Edge node in each cluster

Resource consumption:

Processing and transmission of data

One-time processing in calculating parameters

such as position of nodes, distance among nodes

Static IoT and Mobile Edge Nodes

IoT nodes have fixed locations

Fixed number of IoT nodes are associated to any Edge node

Frequent calculations involved

Position and distance of random Edge nodes

Mobile IoT and Static Edge Nodes

Mobile IoT nodes are assigned to a particular Edge node

Mobile behavior of IoT nodes drains the resources more quickly

Mobile IoT and Edge Nodes

Any IoT node can be assigned to any Edge node

Nearness of distance between the IoT node and an Edge node

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**

**A.IoT Node programming successful**

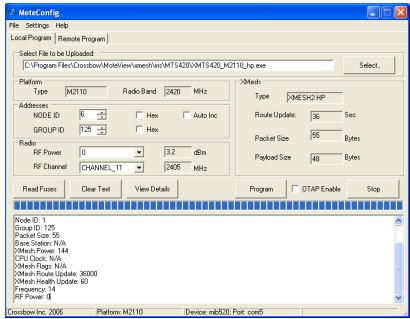


Figure 5

**B.Edge Node Programming Successful**

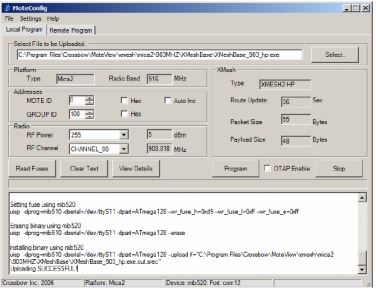


Figure 6

**C.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

**D.Data Analysis**

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

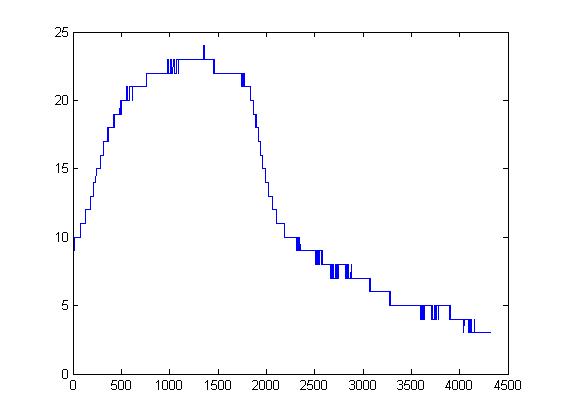


Figure 9.Humidity (In %) versus Time (In hours)

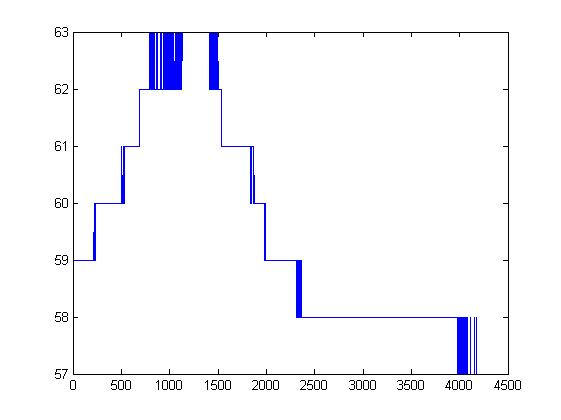


Figure 10.Soil Temperature (In Celsius) versus Time (In hours)

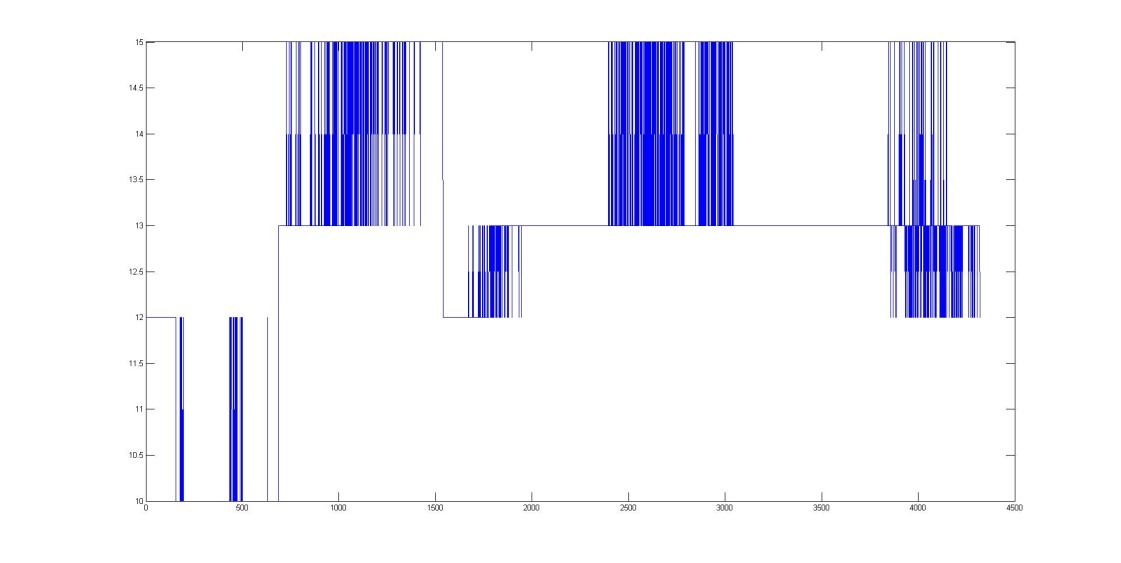
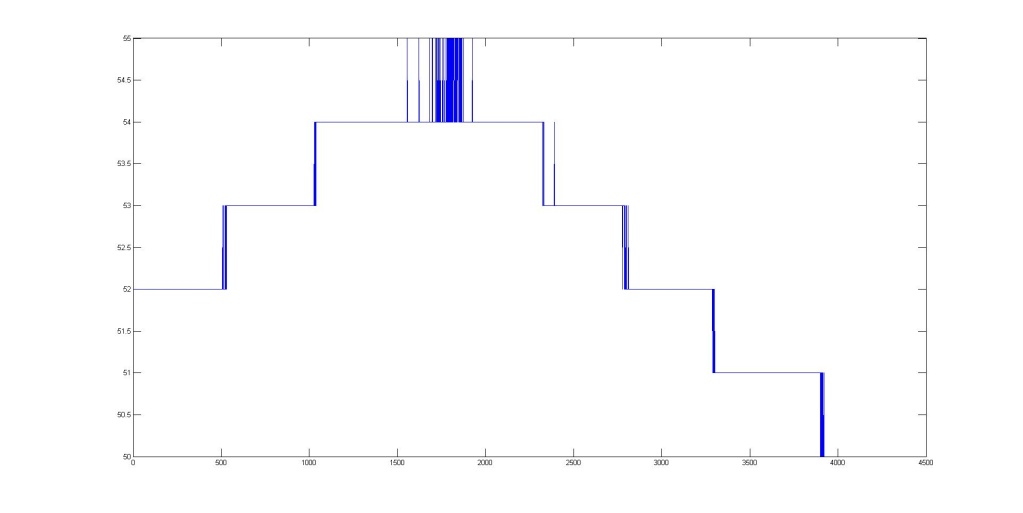


Figure 11.Moisture (In %) versus Time (In hours)



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