

Gathering Information from Wireless Sensor Network to Cloud and Accessing it Using Smart Phone Application

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ABSTRACT: With the progression in Wireless Sensor application's it helps in detection of natural calamities like flood detection, fire detection and various other applications. Cloud Computing is a profitable extension of computing resources which provides scalable resources and economic benefits to its users over the internet. It acts as software and provides data access and storage services which don't need the knowledge of the end users physical location and the systems configuration so as to provides the computing resources. In Cloud Computing, the users use the web browsers as an interface, while the software and data are stored on the remote servers ,

And hence it is device autonomous. With vitality provided in cloud computing, wireless sensor network integrate with cloud. As smart phone application with android platform is in revolution these days, integration of all this technologies makes the availability of data dynamically at mobile phone. In this project I am going to implement integration of all this technologies to get right amount of data instantly as smart phone application.

Index Term: Wireless sensor network, cloud computing, android operating system, functional specification. Overall architecture.

1. Introduction

1.1 WIRELESS SENSOR NETWORK

Wireless Sensor Network is built of nodes from a small number of to several hundreds or even thousands, where each one node is connected to one or several sensors. Each such sensor network node has characteristically several parts, a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth. The topology of the WSNs can differ from a simple star network to an advanced multi-hop wireless mesh network. The propagation technique between the hops of the network can be routing or flooding.

There are plenty of applications that can be approached through the use of sensor networks and nodes. The applications are as follows

- Sensing applications facilitate flexible management of lighting, heating, and cooling systems from everywhere in the home.[5]
- Sensing applications potentially workable one to configure and run multiple systems from a single remote control.
- Sensing applications smooth the progress of the reception of automatic notification upon detection of infrequent events.

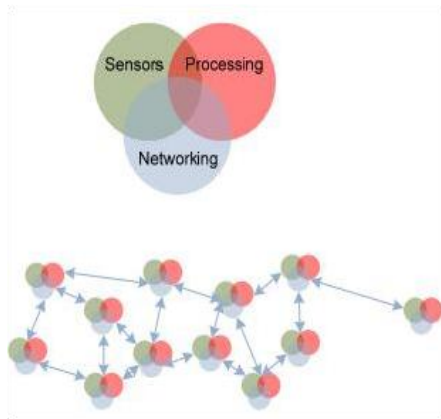


Figure 1.1: Wireless Sensor Network

1.2 CLOUD COMPUTING

Cloud computing is the delivery of computing and storage capacity as to a community of end-recipients. The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing allow you to access data or application from other than your computer or internet connected device most often it will be a distant datacenter. Beauty of cloud is other companies can host your application. This means that they handle the cost if

Service Models-Cloud computing providers offer their services according to three fundamental models: Infrastructure as a service (IAAS), platform as a service (PAAS), and software as a service (SAAS)[4] where IaaS is the most basic and each higher model abstracts from the details of the lower models

Infrastructure as a service (IAAS)- In this most basic cloud service model, cloud providers offer computers – as physical or more often as virtual machines raw (block) storage, firewalls, load balancers, and networks. IAAS providers supply these resources on demand from their large pools installed in data centers. Local area networks including IP addresses are part of the offer. For wide area connectivity, the Internet can be used or in carrier clouds dedicated virtual private networks can be configured.

Platform as a service (PAAS) -In the PAAS model, cloud providers deliver a computing platform typically including operating system, programming language execution environment, database, and web server. Application developers can develop and run their software

solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. With some hat cloud user does not have to allocate resources manually. Examples of PAAS include:

Software as a service (SAAS)-In this model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. The cloud users do not manage the cloud infrastructure and platform on which the application is running. This eliminates the need to install and run the application on the cloud user's own computers simplifying maintenance and support.

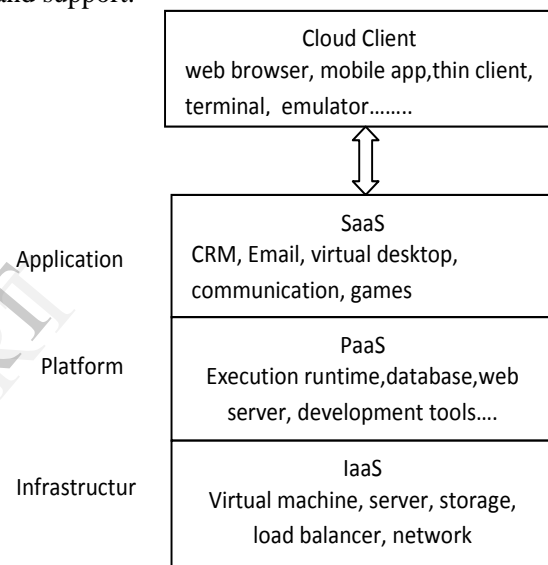


Figure 1.2: Cloud Service Model

1.3 ANDROID OPERATING SYSTEM

Android is a mobile operating system that is based on a modified version of Linux. It was originally developed by a startup of the same name, Android, Inc. In 2005, as part of its strategy to enter the mobile space, Google purchased Android and took over its development work. Google wanted Android to be open and free; hence, most of the Android code was released under the open-source Apache License, which means that anyone who wants to use Android can do so by downloading the full Android source code. Moreover, vendors can add their own proprietary extensions to Android and customize Android to differentiate their products from others. The main advantage of adopting Android is that it offers a unified approach to application development. Developers need only develop for Android, and their applications should be able to run on numerous

different devices, as long as the devices are powered using Android. In the world of smart phones, applications are the most important part of the success chain. Device manufacturers therefore see Android as their best hope to challenge the onslaught of the iPhone, which already commands a large base of applications..

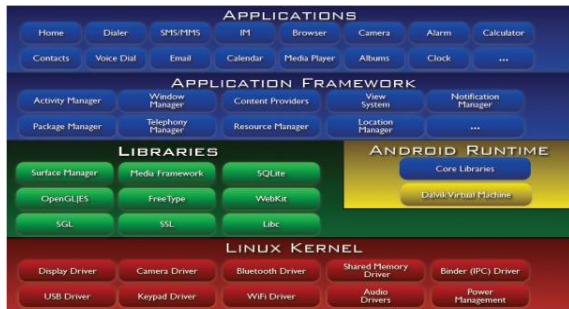


Figure 1.3: Android Anatomy

2. OBJECTIVE OF THE PROJECT

Objective of the project is to gather information from sensor network using tinydb store it onto base station or gateway and by making it available to cloud environment make it easily accessible to android phone through a simple application. By doing this, the information at the remote place can be gathered easily and also natural disasters like flood and fire can be detected very easily.

2.1 EXISTING SYSTEM

In existing system the data gathered from the sensor network is passed over the internet and through java API making request from the sensor GATEWAY. The sensor GATEWAY in turn replies to it by messaging it the requested information.

2.1.1 Issues in Existing System

- Large amount of data not manageable.
- Dynamism is not present.
- Mobile Access is not possible (Anywhere access is not possible).

2.2 PROPOSED SYSTEM

For proposed system, the existing system is modified or enhanced with the technologies of **cloud computing** and **android programming** for the development of the application. Information collected at the base station is transferred to the cloud by doing so large amount of database can be managed without the intervention of the receiver. Cloud management is done by the third party, so no complexity of managing the data by the receiver. Dynamism problem is also solved by the cloud computing.

Android application is made to be installed on smart phone and make the data available instantly at one click.

Data is gathered from the wireless sensor network and send to the cluster in network. When cluster head see the data, it transfers the useful information to the sink node. Sink node in turn transfer the information to base station. Tinydb installed in each and every node will make it easy to get the useful information from the nodes in network. From nodes it saves the data to the postgresql database platform and through query processing it will go directly to cloud.

From cloud it will be easy to get the information from with the help of android application.

- I. Data is gathered at the base station and through the sensor nodes cluster head transfer the data to base station.
- II. From the base station data is transferred over the cloud.
- III. From the cloud storage data is accessed to the android application.

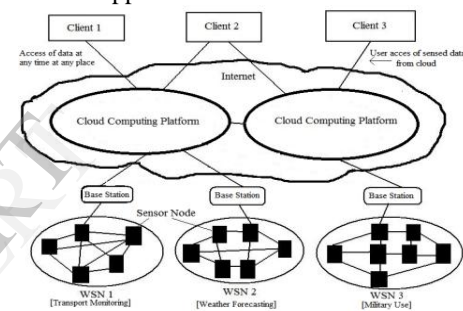


Figure 2.1-proposed Architecture

3. LITERATURE SURVEY

3.1 PAPER ONE:

Kwang-il Hwang, Jeongsik In, NhoKyung Park, Doo-seop Eom "A Design and Implementation of Wireless Sensor Gateway for Efficient Querying and Managing through World Wide Web".

➤ Proposed System

Present the architecture of the sensor gateway for web-based management and its implementation details. Assuming that wireless sensor networks have 3-level regional hierarchy, but our gateway is flexible enough to cooperate with other type sensor networks

➤ Methods/Algorithms

To achieve the web-based management for wireless sensor networks, the sensor gateway to connect a sensor network and the fixed Internet is inevitable. Here paper has presented the architecture of the sensor gateway for web-based management and its implementation details. For managing sensor

networks efficiently, paper newly defined the three layers for the sensor gateway; DAP (data analysis process), SQML (sensor query management layer) and SDAL (sensor data aggregation layer).

3.2 PAPER TWO:AKhan AkBULUT, M.Ali Aydin, Tulin ATMACA, A.Halim Zaim, “Accessing to DATA in WSN’s”

➤ Proposed System

The goal of this paper is to provide a comprehensive review of different data transfer techniques in WSN middleware.

➤ Methods/Algorithms

Describes the implementation of the WSN and accessing it using middleware’s such as pub/sub systems. Other method of study is Database Inspired Solutions, Service Discovery Based Approaches, Tuple Space Solutions and Virtual Machine Approaches.

3.3 PAPER THREE.

Kevin Lee, David Murray, Danny Hughes, Wouter Joosen “Extending Sensor Networks into the Cloud using Amazon Web Services”.

➤ Proposed System

Paper demonstrates that Amazon EC2 [6] can meet the dynamic computational needs of environmental applications. Paper also demonstrates that EC2 can be integrated with existing sensor network technologies to offer an end-to-end environmental monitoring and modelling solution.

➤ Methods/Algorithms

Integration of Sensor network with Cloud Computing gives the dynamism to load balance the system by using EC2 and also Amazon S3 storage.[6] Creation of a fresh AMI machine with amount of memory at the Amazon platform. Whenever a load comes to it, it will divide the load by using **load balancing algorithm**.

3.4 PAPER FOUR

Carlos Oberdan Rolim, Fernando Luiz Koch, Carlos Becker Westphall, Jorge Werner, Armando Fracalossi, Giovanni Schmitt Salvador “A Cloud Computing Solution for Patient’s Data Collection in Health Care Institutions”.

➤ Proposed System

Paper propose a solution to automate patient’s data collection[8] process by using “sensors” attached to existing medical equipments that are inter-connected to exchange service. The proposal is based on the concepts of utility computing and wireless sensor networks. The information becomes available in the

“cloud” from where it can be processed by expert systems and/or distributed to medical staff. The proof-of-concept design applies commodity computing integrated to legacy medical devices, ensuring cost effectiveness and simple integration.

➤ Methods/Algorithms

Cloud Computing is integrated with the Sensor network in the hospital to keep track record of the patient’s body temperature, blood pressure, sugar, methods for resource management, including indexing, discovery and monitoring, methods for ubiquitous communication between mobile computing and stationary computing devices, methods for implementing security, including confidentiality of the transferred data, authentication, authorization and programming interfaces for mobile computing and stationary computing devices.

3.5 PAPER FIVE:

Wei Wang, Kevin Lee, David Murray “Integrating Sensors with the Cloud Using Dynamic Proxies”

➤ Proposed system

This paper proposes a generic architecture to support the integration of sensors with the Cloud. It uses a lightweight component model and dynamic proxy-based approach to connect sensors to the Cloud.

➤ Methods/Algorithms

The proposed architecture based on the LooCI [2] (A Loosely-coupled Component Infrastructure for Networked Embedded Systems), architecture with the addition of dynamic proxies, which enables any sensors to connect to the Cloud. The purpose of Component Factory is to parameterize the gathered data and then dynamically generate node components for different types of sensors. In the proposed architecture, a group of sensors send data to a sink node, and then the sink node passes a stream to the Component Factory through a serial port. The gathered data contains multiple-lines of text. Each line is received from a unique sensor node with its own data structure.

4. FUNCTIONAL SPECIFICATION

Describes the different functional components and modules that are present in the project.

Functional specification first gives the details of the overall architecture which specify what all things the project will contain and their functional details. It will have overall architecture diagram. It specifies the module details and their description in detail.

4.1 OVERALL ARCHITECTURE

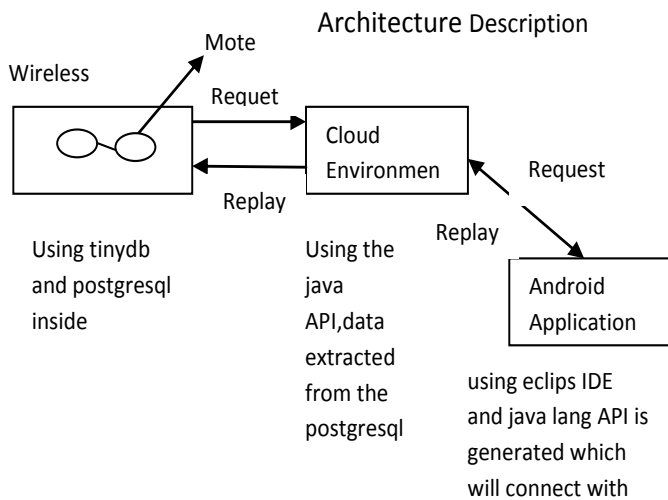


Figure 4.1: Overall Architecture

4.2 MODULE DESCRIPTION: Using the above over all architecture the designing part is divided into different modules.

4.2.1 Deployment of Sensor Network

- I. Sensor network is a collection of some smart sensor nodes which collaborate among themselves to form a sensing network.
- II. Smart sensors are wireless computing devices that senses information in many varieties of environments to provide a multidimensional view of the environment.
- III. After sensing the environment based on the query provided by the mobile node, the sensor node provides the sensed data in an encrypted format to their cluster head.
- IV. Each sensor node is installed with the tinydb software to extract the useful information from the motes in the network.
- V. Tinydb is in turn integrate with the postgresql database because tinydb is not meant for data storage, it only retrieve the data from sensor motes.
- VI. At the base station data is get through a java API from where it will transfer the data to cloud.

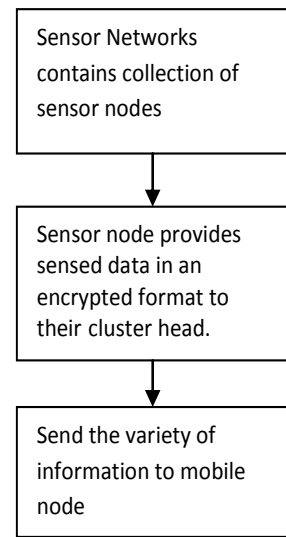


Figure 4.2: Implementation of Network

4.2.2 Setting Up of Cloud Environment

Setting up cloud environment is done to organize the data in the cloud storage area.

Cloud data storage, a user stores his data through a CSP (Cloud Service Provider) into a set of cloud servers, which are running in a simultaneous, the user interacts with the cloud servers via CSP to access or retrieve his data.

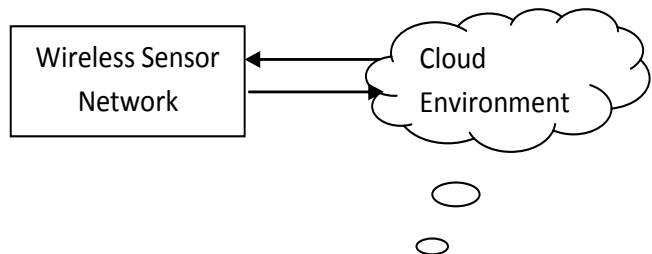


Figure 4.3: Sensor Network to Cloud

4.2.1.1 Setting up a IAAS Cloud

For running the project a cloud environment is needed, so only a private IAAS cloud is setup which will provide infrastructure services such as storage service, virtual machine, and load balancer. It can be done either by taking a service from any one of the cloud provider available such as Amazon, after getting the service we will start the access of virtual machine. It is also an easy technique as the cloud provider is in good number and they are providing service at reasonable rates. But it is

always better to setup a private cloud of our own as it will help to configure the project easily, because our server and custom made settings match well with the API and we could include built in features while establishing the cloud itself, now about setting up that IAAS cloud. First and the most we need is an either an Ubuntu 10.4, 12.4 server or a centos server to deploy the cloud on it. While installing them be careful that you install Walrus cloud storage tool, CLC and CC in order to set cloud storage. Be carefully that the installation each of this software in client machine as well as server. Then we need to install eucalyptus which is a cloud platform which is suitable for IAAS especially. While installing eucalyptus u need to be careful about the version and packages that is installed. Then next things is to make virtual machines

For this we are using XEN hypervisor, which helps to create multiple VM easily and allot them functionality of easy access to resource

Then it is important that we give the network settings of the cloud. Cloud storage must be well established in order to support IAAS service .After creating cloud we must specify the client and server configuration settings such that on demand services easily run on them.

4.2.1.2 Accessing virtual resources and creating the API

Virtualized resource are an important part of the cloud , so accessing of those resource like storage , virtual machine ,load balancer should be done in a uniform manner so that there is no chance of error in access. Especially as the project is concentrating on the on demand services focus for this module is high module also concentrated on the creation of the API which controls the access of data. Creating a API in the cloud makes data in the cloud to be more secure and easily accessible. Data accessed through the cloud is given to the android application.

4.2.3 Setting up a Android Environment

After setting up of an android environment by using Eclipse IDE, we can create the android application. Following are the steps for setting up of android environment:

I. Installing of Android SDK on windows XP

- Create a folder called "c:\android" in your c: hard-drive.
- Goto http://developer.android.com/sdk/1.5_r2/index.html.
- Click on the android_sdk_windows... link, download and save it to c:\android.
- Unzip the downloaded file: **android-sdk-windows-1.5_r1.zip** and place its contents in **c:\android**.
- Now, set your **Environment Variable** by right click on **My Computer**, and select
- **Properties**.
 - In the dialog that comes up, double-click on **path** under **System Variable** add the full path to the tools/ directory to the path, in this case, it is: C:\android\tools.
 - Then click OK, OK, and OK.
 - Now, create an Android Virtual Device (AVD).
 - Test Android Emulator.
 - Install JAVA.
- Install Eclipse IDE.
- Install Eclipse's ADT plug-in.
- Android Manifest file declares which permissions the application must have in order to access protected part of the API and interact with other applications.
- An android application is made to access the data from the cloud. So mobile information is gathered at the cloud and on the smart mobile phone

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