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A Study on Wireless Sensor Network, Protocol, Application, Challenges

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ABSTRACT

Wireless Sensor Network is a network in which sensor are deployed in a targeted environment to sense the status of area. The data are collected from sensor, processed, computed and perform the communication process to know about the target environment. The study focuses on the application, protocols, challenges of sensor network which helps for learning process about wireless sensor network and special issue on wireless sensor networks for agriculture. The future work of study is measuring the underground growth and water level monitoring in the plant tapioca (manihot esculenta) using wireless sensor network

Key words: Wireless Sensor Network, Protocols, Special issue.

I. INTRODUCTION:

A sensor network is a network which performs sensing, computing, and communicating about particular event. The sensor deployed in a particular environment to sense the status of the environment. The sensor network sense the target area, the data are collected, processed and transform it from the source to base station. A sensor network has four basic components. They are: (i)localized sensor, (ii)an inter connecting network, (iii)a central point of information clustering, (iv) a set of computing resources at the central point to handle data mining, data correlation, status querying and event trending. Sensors are deployed in a distributed manner and in large quantity. A WSN consists of large number of distributed nodes that support sensing, embedded computing, signal processing and connectivity.

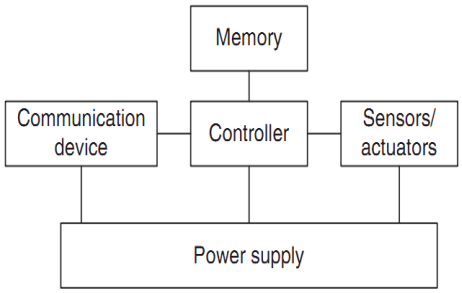

FIG1**:** Overview of Sensor Node

Controller which processes collected data from various sensors and executing the code by using the collected parameter.

Memory is used to store program and processed data.

Sensor and Actuators which sense the environment and performs control operation on the collected data.

Communication device is used for send and receive information over a wireless channel.

Power Supply which provides energy which maintains sensor in active mode.

The challenges in WSN are types of service, quality of service, fault tolerance, lifetime and scalability is also considered as issues in wireless sensor network.

II. TYPES OF SENSOR NETWORK:

2.1 Terrestrial WSN:

There can be large number of sensors are deployed in a geographical location in adhoc manner. The sensor are dropped from the plane and deployed in a random distance and monitor the area.

2.2 Underground WSN:

The sensor is placed in the underground or cave to monitor underground conditions. Source node is placed in the underground or cave and Sink node are placed above ground. Source node senses the condition of underground status and passes the data to the base station and received by the sink sensor node from the base station. If once the sensor node losses its energy consumption it is difficult to recharge or replace a sensor node's battery. It is less cost when compared with terrestrial WSN.

2.3 Underwater WSN:

Sensor cost is very high when compared to terrestrial sensor. Underwater vehicles are used for gathering data from sensor nodes. It is used to sense the condition of ocean. A challenge in underwater is the signal fading issue, long propagation delay and limited bandwidth. The sensor node placed under ocean should have limited number of batteries and it should be reconfigurable by itself.

2.4 Multimedia WSN:

The use of multimedia WSN is in network aggregation, filtering, compression. Output can be displayed in the form of audio, video and imaging. Multi-media sensor nodes are deployed in a pre-planned manner into the environment to guarantee coverage. Challenges in multi-media WSN include high bandwidth demand, quality of service (QoS) provisioning, high energy consumption, cross-layer design, compressing techniques and data processing.

2.5 Mobile WSN:

The mobile WSN can be useful in the dynamic environment to track the person or some other issues. Mobile can be startup with some initial deployment for tracking process. Information gathered by mobile device can communicate with other mobile device. Challenges in mobile WSN include deployment, coverage, energy, maintenance, self-organization, data process, localization, navigation and control.

III. PROTOCOLS IN WIRELESS SENSOR NETWORK:

The various protocol stacks are: Transport layer, Network layer, and MAC layer, Data-link layer and their Cross layer

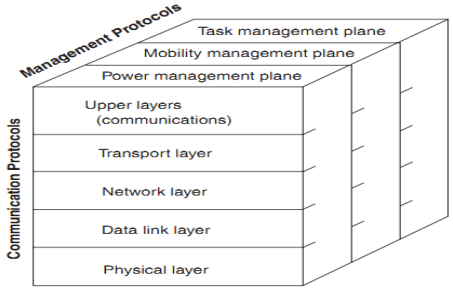

Fig2: protocol stack of WSN

1. Transport layer:

It is used for reliability purpose. By utilising the transport layer the transferred data quality becomes high. The mechanism supported by transport layer is congestion control and packet loss recovery. Detection of packet loss can be

identified and recovered by using two mechanisms: hop-by-hop and end-to-end. A **congestion control** mechanism monitors and detects traffic and finds the mechanism to detect the feasible path to route the packet from source to sink.

2. Network layer:

The function of this protocol addresses issues of efficiency, fairness, fault tolerance and security.

3. MAC layer:

MAC layer provides addressing and channel accessing for shared communication medium. Overhearing, overhead, collisions and idle listening are the issues and challenges in MAC layer.

4. Physical layer:

Physical layer is the fundamental layer of the network which provides a mechanical, electrical and procedural interface to the transmission medium.

5. Datalink layer:

It transmits the data to the adjacent node. The purpose is to protect the upper layer protocols and providing interoperability across different types of networks.

IV. APPLICATIONS OF WIRELESS SENSOR NETWORK:

Disaster relief applications

Intelligent buildings

Surveillance

Medical Monitoring

Precision agriculture

Logistics

Telematics

V. CHALLENGES:

The challenges of Wireless Sensor Network are:

1. Types of Service:

It provides only bit transformation.

2. Quality of Service:

The transferred data between source and sink should not losses its quality. I.e. the data rate of transferred data should maintain its range without any change from starting to end of transmission.

3. Fault tolerance:

The failed node should recover by itself even though there is any failure occurs by itself or during any disaster.

4. Lifetime:

The loss of lifetime of sensor node also affects the data transmission. It may cause the quality of data in a very low range.

5. Scalability:

Even though the number of sensor node increases in a network it should work properly. It should not affect the functions of already existing sensor node.

6. Programmability:

The nodes can perform programming and it should be changeable when it performs operations. If the information is processed in a fixed manner then it becomes insufficient.

7. Maintainability:

The programmed or battery powered sensor node should be maintainable if there is any

fault occurs during transmission of data from source to sink.

VI. Special Issue On: Wireless Sensor Networks for Agriculture

- Agricultural management and agriculture
- Bio-diversity
- Bio-fuel
- Climate change
- Distributed collaborative information processing
- Environmental application tool boxes: tools and environment
- Environmental risks management
- Forestry, forestation, deforestation
- Hardware and software platforms, middleware
- **Land and Water management**
- Land use, land cover mapping
- Mobile adhoc networks and sensor networks
- Modeling, algorithms, and performance evaluation
- Quality of Service (QoS) in wireless sensor networks
- Sustainability Impacts and indicators
- **Underground wireless sensor network**
- Underwater wireless sensor networks

VII. CONCLUSION:

We studied about the sensor network, its various types of application to know about the targeted environment, about various protocols for communication purpose to send data packets from source to sink and about challenges. The future work is to implement the project work in agriculture with the help of wireless sensor network to know the level of water and growth in the plant tapioca (manihot esculenta).

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