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Survey on recent trends and challenges in Mobile Wireless Sensor Network

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ABSTRACT

For a broad spectrum of company applications, wireless sensor networks (WSNs) have appeared as an effective solution. Most of the long-established WSN architectures consist of densely located stationary nodes over a sensing region. Several WSN architectures have recently been suggested to install mobile devices to harness node mobility. The article initially describes portable wireless sensor networks (MWSNs) in this research paper. It then provides an overview of the major problems facing MWSNs. Paper also introduces some models of mobility. Lastly, it focuses on MWSN's dominance in industry applications. Paper also defines latest company apps in which mobile wireless sensors and the difficulties they face have become essential.

1. INTRODUCTION

Mobile wireless sensor network (MWSN) can only be described as a wireless sensor network (WSN) in which the sensor nodes are mobile. MWSNs are smaller, emerging fields of research in contrast to their well-established predecessor. MWSNs are much more adjustable than static sensor networks because they can be installed in any scenario and can cope with rapid topology changes. Many of their apps, however, are equal, such as tracking the environment or tracking. The nodes usually consist of a radio transceiver and a battery-powered microcontroller, as well as some type of sensor to detect light, humidity, heat, temperature, humidity, luminosity, pressure, closeness, etc. [6] as seen below in Figure 1.

- Microcontroller: The microcontroller operates in contrast to traditional processing units at low frequency. It carries out tasks, processes data and controls other component functionality in the sensor node.
- Transceiver: Sensor nodes use Industry, Scientific and Medical (ISM) band, providing free allocation of radio spectrum and global accessibility. Communication based on radio frequencies is the most appropriate communication that can be used in most WSN apps. WSNs tend to use licensed frequencies: 173 MHz, 433 MHz, 868 MHz and 915 MHz and 2.4GHz.
- The transmitter and receiver functionality is combined into a simple device called transceiver. The transceiver' s operating conditions are transmitter, receiver, sleep and idle.
- Memory: The most relevant type of memory is the microcontroller's on-chip memory. Memory requirements usually depend on application. They are used to store information linked to the implementation and to program the machine. Storage of memory is just a few kilobytes (kB).
- Battery / Power Source: The crucial element of the growth of the portable wireless sensor node is to guarantee that adequate energy is always accessible to power the system. Power is consumed mostly by a node in sensing, communicating and data processing. Compared to any other method, the information transmission power requirement is very big. Power source is usually a small battery energy between 1.2 and 3.7 volts.
- Sensor: This is a hardware tool that responds to changes in physical circumstances such as temperature, pressure, etc. and transforms it into an analog quantifiable signal. It measures the monitoring of the physical parameter. An analog-to-digital converter (ADC) digitizes the analog signal generated by the detector and sends it to the controller for further processing. Sensors can be regarded as passive omni-directional, passive narrow-beam sensors and active sensors. Passive omni-directional sensors senses the data without influencing the atmosphere. They are self-powered and require energy to amplify analog signals and have no measuring path.
- Location or Position Finder: The location or position finder unit is used to detect the position of the sensor node.
- Mobilizer: The mobilizer provides mobility for a sensor node.
- Power Generator: The power generator unit is accountable for generating power to meet the sensor node's additional energy demands by implementing any particular methods such as solar cells.

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2. MOBILE WIRELESS SENSOR NODE:

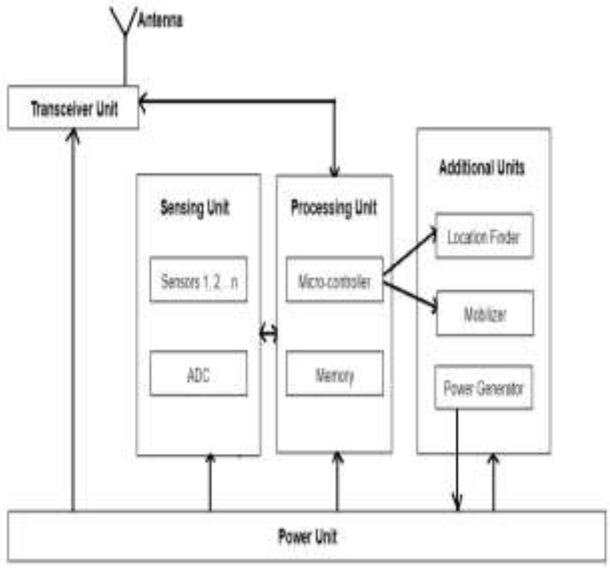

Fig. 1 Mobile Wireless Sensor Node

2.1 Classification of MWSNs:

- **Homogeneous MWSNs**
- **Heterogeneous MWSNs**

It can be categorized into homogeneous and heterogeneous MWSNs according to the resources of the sensor node on an MWSN. Homogeneous MWSN consists of identical mobile sensor nodes and may have distinctive features. However, heterogeneous MWSN includes a number of mobile sensor nodes with separate node ownership capacities such as battery power, computer power, memory size, sensing variety, transmission range, and mobility etc. The setup of heterogeneous MWSN nodes is also more complex than homogeneous MWSN nodes.

2.2 The striking features in MWSN are as follows:

- Scalability[7]: To serve more geographical region and apps, WSN can be expanded to any extent by adding more and more equipment at random. The power of a WSN is in numbers. As nodes are added to WSN, interconnections become stronger, which is contrary to other wireless networks such as cell phone networks, where growing numbers of active cell phones in a tiny region hamper the service. Nodes in the network are self-configuring, so they build up into a substantial collaborative network.
- Adaptability: These networks can adapt dynamically to altering environments or needs. Integrated uncomplicated adaptation mechanisms are quick to respond to changes in network topology or node failure. The network can migrate to a broad range of working states.
- Low cost networks: in relation to reduced node expenses, no cable routing / laying or pre-existing infrastructure is needed to set up these networks. When added to the network, each individual node becomes part of the overall infrastructure known as the wireless sensor network.
- Convenience: The use of wireless communication systems has become omnipresent due to the distributed capabilities, freedom and cost savings they provide. These can provide data that is correctly situated in time / space in accordance with the needs / requirements of customers.

2.3 History of Mobile Wireless Sensor Networks:

Although there has only recently been rapid interest and research in WSN fields, the use of sensors for specialized services is not new. The Sound Surveillance System (SOSUS), which used acoustic detectors, was used to discover Soviet submarines during the Cold War. The National Oceanographic and Atmospheric Administration (NOAA) is currently adopting these systems to detect events in the oceans. Concurrently, Air defense radar networks were developed employing aerostats as sensors. The Internet predecessor, Advanced Research Project Agency (ARPANET), created by US DARPA in 1969, served as a test bed for fresh networking technologies linking different universities and research centers[1]. A sensor network can be assumed to have many spatially distributed autonomous sensors that route the information to a node that can make the best use of the acquired information. The WSN may be traced back to the Distributed Sensor Networks (DSN) program which started in 1980 at Defense Advanced Research Projects Agency (DARPA).

Technology transitions in WSN Recent developments in micro-manufacturing techniques have made it possible to generate small nodes that can house various sensors and have decent processing and communication capabilities. Furthermore, the development of wireless networking standards with security, stability and minimum end-to-end delays has led in the spread of WSN to the control and monitoring region that was not previously heard.

2.4 Challenges in Mobile Wireless Sensor Networks:

- Hardware: Limited battery power and low cost requirements are key hardware constraints. The restricted power implies energy-efficient nodes are essential. Price constraints often require low-complicated algorithms for easier microcontrollers and use of a simple radio only.
- Environment: The shared medium and varying topology are the major environmental factors. The shared medium says that there is some way to regulate channel access. This is mostly performed with a medium access control (MAC) system, such as multi-access frequency division (FDMA), multi-access carrier sense (CSMA) or multi-access code division (CDMA) scheme[5]. The changing topology of the network comes from the mobility of nodes which means that multi-hop paths from the sensors to the sink are not stable.
- Design: Hardware costs, system architecture, deployment, memory and battery size, processing speed, dynamic topology, sensor node / sink mobility, coverage, power consumption, protocol design, location, scalability, key data / node, network heterogeneity, node failure, QoS, fusion / redundancy information, cross-layer design, self-configuration, traffic equilibrium, fault, fault tolerance, wireless connectivity, programmability and security.

3. CASE STUDY

Why are mobility models considered in MWSNs?

The MWSN is usually a self-configuring and self-healing network consisting of interconnected wireless mobile sensor nodes to form an arbitrary topology[3]. A good network coverage ensures higher network connectivity, reliable communication, lower energy consumption and hence longer service life of sensor nodes. Mobility models differentiate the mobile motion patterns of the sensor nodes, i.e., the distinct node behaviors. MWSNs took into account several mobility models to set the mobility of mobile nodes. The movement of the sensor nodes is considered as being dependent or independent of each other.

WSN Network Components consists of devices (motes / nodes) capable of sensing the area under study environment. The node sensed information is transferred via single hop or multi hops to the sink (Base Station (BS)) node. As multi-hop economizes energy, the method of communication is preferred and most widely used method of communication. These nodes may be moving or stationary, heterogeneous or homogeneous and be aware of their location or not. Main components of a wireless sensor node are various sensors, a micro controller, battery, memory, transceiver as given below in the Fig. 2.

Wireless Sensor Node:

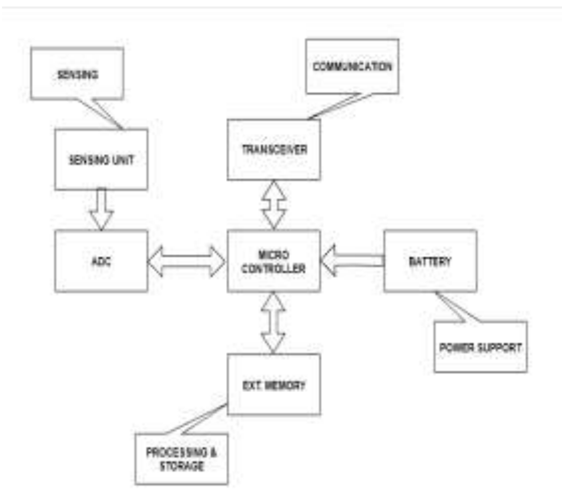

Fig. 2 Wireless Sensor Node

4. THE MOBILITY MODELS CAN ALSO BE DIVIDED INTO THE FOLLOWING AREAS

• Models of individual / entity mobility: this model reflects the mobility pattern of the mobile node. For example, random waypoint, random walk, boundless simulation area, realistic random direction, random walk probability version, deterministic, geographic constraint, semi-Markov smooth, fluid flow, gravity, mobility vector, correlated diffusion, particle-based, behavioral, steady state generic, hierarchical influence, graph-based and smooth random mobility models.

• Models of group mobility: the cooperative group movement towards / away the mobile nodes operates as a group in synchrony in this model. Here, the mobile node movements are mutually dependent. The feature also describes the clustered conduct or the mobile nodes are linked with a goal or group leader in some way. There are many group mobility models, such as Reference Point Group Mobility (RPGM) (i.e. column and pursue, nomadic community), Exponential Correlated Random Mobility Model (ECRMM), Reference Velocity Group Mobility (RVGM), Structured Group, Virtual Track Group, Drift Group, Group Force, Temporary Based Model and Extending Group of Individual Mobility Models[4].

• Autoregressive models of mobility: the mobility pattern of each individual sensor node / group of sensor nodes that correlates the mobility status and may consist of speed, position and acceleration at successive instants of moment. For example, autoregressive model of individual mobility, autoregressive model of group mobility, etc.

• Models of flocking and swarm group mobility: a collective action of a huge amount of mobile cooperative agents with a shared community objective. Ants, bees, fish, penguins, birds and crowds are the agents ' examples. A synergic motion task carried out by dynamic mobile nodes or mobile agents in a flocking mobility model through self-organized nature networks. The self-organizing characteristics of flocks / groups / schools provide a higher knowledge of MWSN design. Because random walking (RW) and random waypoint (RWP) models are not accurate and appropriate for realistic settings, swarm group mobility model is implemented to produce realistic motions of living organisms or items guided by living organisms through psychological activities, physics, and mimicking perceptions is explained.

• Virtual game-driven mobility models: it is based on user requirements and characterizes an individual / group of mobile sensor nodes from real time to virtual agents working with mobile user groups. It models the user, group, communication, and environment's real-world features. A virtual world is used here for mobility simulation and contains all the features of mobility models.

• Model of social-based community mobility: In this model, each mobile sensor node is regarded a member of a community cluster, whereas distinct groups may be part of a society as a whole. The model must capture mathematically tractable non-homogeneous operations in both space and time that are usually recognized in certainty. For example, mobility in the time-varying society (TVC), home cell community-based mobility (HCBM), orbit-based mobility, community-based mobility (CBM), entropy-based individual/community mobility and knowledge-driven mobility (KDM) model.

5. APPLICATION

The benefits of utilizing the sensors to be mobile amplify the number of applications beyond those for which static WSNs are used. Sensors can be used with a number of platforms[2]:

- People
- Animals
- Autonomous Vehicles
- Unmanned Vehicles
- Manned Vehicles

1. In order to distinguish the requirements of an application, it can be categorized as either constant monitoring, constant mapping event monitoring or event mapping.
2. Constant type apps are time-based and as such information is produced on a regular basis, whereas event type apps are event oriented and information is produced only when an incident happens.
3. Monitoring applications are continuously operating over a period of time, whereas mapping applications are generally deployed once to assess the present state of a phenomenon.

Health surveillance: may include heart rate, blood pressure, etc. This may be continuous for a patient in a hospital or for an event powered by a wearable sensor that automatically reports your place to an ambulance team in the event of an emergency.

Animals Movement Monitoring: Animals can have sensors connected to them to monitor their motions for migration patterns, feeding practices or other study purposes.

Unmanned Aerial Vehicles (UAVs): Sensors for monitoring or environmental mapping may also be connected to unmanned aerial vehicles (UAVs). In the case of independent UAV assisted rescue and search, this would be regarded an application for event mapping, since the UAVs are deployed to search for an region, but only transmit information when a individual is discovered.

Some other examples of Mobile Wireless Sensor Network Applications: It can be used in big duck island bird observation, glacier monitoring, cattle herding, cold chain management, ocean water monitoring, grape monitoring, energy monitoring, rescue of avalanche victims, vital sign monitoring, military vehicle tracking, assembly of components, self-healing mine field, and sniper place. Mobile sensor nodes therefore play an important role in apps in the actual globe.

6. REFERENCES

[1] Vandana Jindal - History and Architecture of Wireless Sensor Networks for Ubiquitous Computing
[2] Mobile Wireless Sensor Networks: Applications and Routing Protocols - Tom Hayes (University of Sussex, UK) and Falah Ali (University of Sussex, UK)
[3] R. Velmani, and B. Kaarthick, 2014. An Energy Efficient Data Gathering in Dense Mobile Wireless Sensor Networks.
[4] Velmani Ramasamy-Mobile Wireless Sensor Networks: An Overview
[5] Ubiquitous Computing: Smart Devices, Environments and Interactions Hardcover - by Stefan Poslad
[6] Wireless Sensor Networks by Raghavendra Sivalingam Znati
[7] Fundamentals of Wireless Sensor Networks by Christian Poellabauer Waltenegus Dargie