ISSN 2454-8596
www.vidhyayanaejournal.org
VIDHYAYANA An International Multidisciplinary Research e-Journal

A Literature Survey on Devices for Wireless Sensor Network

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ISSN 2454-8596
www.vidhyayanaejournal.org
VIDHYAYANA An International Multidisciplinary Research e-Journal

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Abstract— Wireless Sensor Networks have remained an area of research interest globally. Wireless Sensor Network is seen as one of the most promising contemporary technologies for bridging the physical and virtual world thus, enabling them to interact. Wireless Sensor Network has wide domains of interesting application and some of the optimal features like Quick Ad-Hoc deployment, Sleep and Sniff feature, enhanced reach, substantial savings and simplicity due to less number of cables – are some of the key benefits of Wireless Sensor Networks. This paper shows a literature survey of some of the low power devices deployed for WSN applications.

Keywords- *Wireless Sensor Network, Low Power Consumption Devices.*

ISSN 2454-8596
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Introduction

Wireless sensor networks (WSNs) have remained a field of interest for researchers worldwide because it embraces the potential to revolutionize various segments of human life and economy, from military surveillance, to agricultural and environmental monitoring and conservation, to manufacturing and business asset management, to industrial process control, to automation in the transportation, biomedical and health care, to smart buildings and cities. These applications can be considered as significant evidences for the utility of wireless sensor networks. Wireless sensor networks represent an emerging set of technologies that will have profound effects across a range of varied applications. [1]

However, few researches have already been carried out in Wireless Sensor Network Applications. This paper presents a review based survey of various devices consuming less power for Wireless Sensor Network applications. Fig. 1 shows most important fields of application. The emerging field of wireless sensor networks combines sensing, computation, and communication executed with tiny devices that can operate in real world environments. This paper discusses overview of implementation of applications of WNS systems. [2][3]

ISSN 2454-8596
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An International Multidisciplinary Research e-Journal

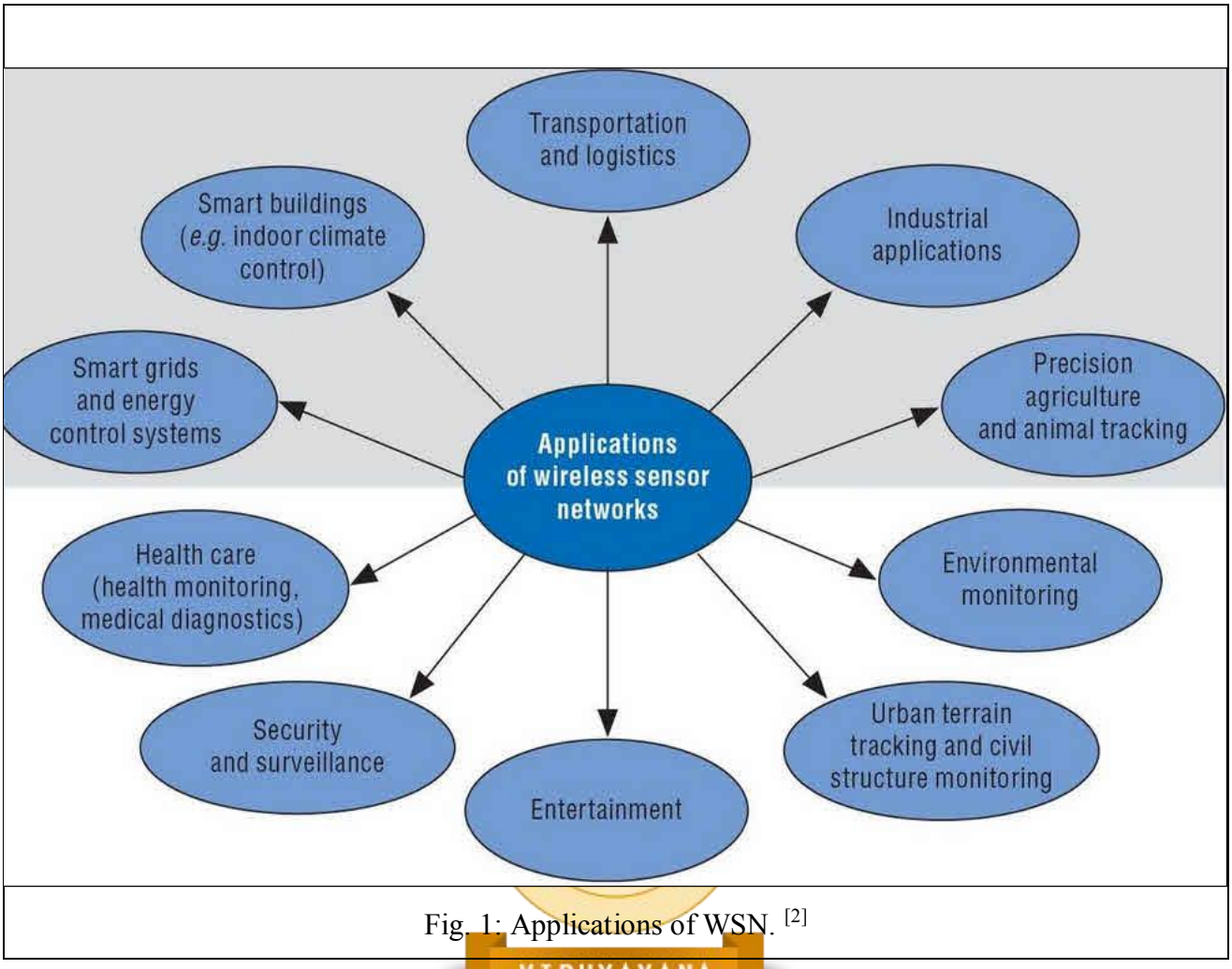

Fig. 1: Applications of WSN. [2]

Challenges:

Some of the major challenges faced for implementation of Wireless Sensor Networks are as under:

i. Scalability of network protocols to large number of nodes
ii. Designing power-saving protocols
iii. Design of data handling techniques that may include data querying, data mining and data dissemination
iv. Localization techniques
v. Time synchronization
vi. Development of interesting applications that exploit the potential of WSN

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Features:

Below are presented key features of Wireless Sensor Networks:

Self-Organization: The network should auto-detect newly arrived nodes or removed/stolen/broken nodes and adapt the tree to route messages accordingly. After the deployment, no human intervention should be required during the network lifetime until battery goes out.

Power consumption: One of the main challenges is to design low-power hardware components and to develop a software platform that minimizes power consumption.

Scalability: Adding a large number of nodes should still keep up with the acceptable performance in terms of packet drops.

Latency: The network should forward messages towards the sink with limited latency.

Compactness: Sensor nodes for various applications should be as small as possible.

Cost: One should keep in mind the financial constraint when choosing each components of the system. Sensor nodes are the simplest devices in the network. As their number is usually larger than the number of actuators or sinks, they have to be cheap.

Robustness: Nodes must be robust to work long term in a potentially hostile environment: high humidity during monsoon, extreme heat during daytime, strong electromagnetic fields during thunder, sun rays, presence of animals and human curiosity all these aspects make it extremely challenging to provide a reliable system.

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Applications for Wireless Sensor Networks

This section refers to illustrations of wireless networks being deployed in real-time environments. As the work refers to the term 'network', single node systems are not considered and only multi-node systems are considered as examples. Also wired networks are not considered.

Deployed wireless network possess the capacity to measure a wide range of phenomenon including heart rate, blood pressure, atmospheric temperature and pressure, soil moisture, and even sound of a missile being launched. Depending on the speed of phenomena, high performing processors are required. [4]

These sensor nodes, sometimes, has to be placed in such a place where humans cannot reach which makes its maintenance difficult (battery replacement). As per the need of an application, sensor node requires to run several years on same battery without getting discharged or being replaced.

A. SMART BUILDINGS/HOME

Smart buildings depend on a set of technologies that enhance energy-efficiency and user comfort as well as the monitoring and safety of the buildings. Current technologies utilize new,
efficient building materials as well as information and communication technologies (ICTs).

ICTs are used in: i) building management systems which monitor heating, lighting and ventilation, ii) software packages which automatically switch off devices such as computers and monitors when offices are empty and iii) security and access systems. These ICT systems can be both found at household and office level.

Few Smart building applications:

a. Heating, ventilation, and air conditioning systems (HVAC)
b. Lightning and Shading
c. Standard household applications (*e.g.* televisions, washing machines)
d. Systems switching on/off devices
e. Air quality and control
f. Security and safety access control.

For example, The headquarters of the New York Times combines different smart building technologies to reduce energy consumption and to increase user comfort. In total, it is found that the building consumes **30%** less energy than non-smart building. [5]

In smart home, WSNs can be used to provide more convenient and intelligent living environments for human beings. Wireless sensors can be embedded into a home and connected to form an autonomous home network. A smart refrigerator connected to a smart stove or microwave oven can prepare a menu based on the inventory of the refrigerator and send relevant cooking parameters to the smart stove or microwave oven, which will set the desired temperature and time for cooking.

B. TRANSPORT AND LOGISTICS

Information and communication technologies (ICTs) and wireless sensor networks in particular have the potential to contribute to increased efficiency in passenger transport as well as a potential reduction of overall transportation. But the increased use of ICTs can avoid passenger transport through a, digitization. Digital content is delivered electronically and video conferences and teleworking reduce passenger transport. However, ICTs add to better traffic and transport management providing safety along with saving cost and time and reduced CO_2 emissions.

For example, sensor technology contributes to better tracking of goods and vehicles which might result in lower level of inventories and thus energy savings from less inventory infrastructure as well as a reduced need for transportation. [5]

ISSN 2454-8596
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C. MILTARY SURVEILLANCE

In military application for area monitoring Wireless Sensor Network was utilized and the concept came into wide application. For detection of intrusion by enemy or to detect presence of vehicles and tracking of vehicles, this technology is used. When the sensors detects any event (movement/vibration, heat, pressure, etc.), it sends the signals and informs the remote base station, which then takes appropriate actions. In this manner, enemy intrusion via any means can be detected and helps in avoiding certain unusual circumstances.

D. INDUSTRIAL MONITORING

The industrial sector is one of the important emitter og Greenhouse gas emissions. Sensor networks enable real-time data sharing on industrial processes, on the fitness condition of equipment and the control of operating resources to increase industrial efficiency, productivity and reduce energy usage and emissions. [5]

Traditionally, equipment is usually maintained on a schedule basis, for example, every 3 months for a check - up, which is costly. In today's increasingly competitive market, reduced maintenance costs and increased manufacturing outputs are expected without compromising quality of the product. Tiny sensors can be embedded into the regions of a machine that are inaccessible by humans to monitor the condition of the machine and alert for any failure.

In the control engineering field, during production processes, sensors and sensor networks measure different properties as well as the amount of available resources during production. This allows them to be employed in an efficient and thus precise manner resulting in energy savings and the reduction of pollutants. [5]

E. HABITAT MONITORING

Wireless sensor networks helps to get a better understanding of the behavior of animals. For cattle, data of their grazing habits, herd behavior and the interaction with the surrounding environment can be obtained and studied. The information provided by these sensors helps famers to understand the state of the pasture and to find optimal ways to use the resources.

Farmers are able to manage grazing areas based on information on herd behavior and pasture status. As a result, overgrazing of pastures as well as land erosion can be prevented. Limited pasture resources can thus be effectively managed. [5]

Also these technologies help in preventing extinction of many species from the world. By monitoring on continuous basis or attaching a node to animals, their counting becomes easier job. Their location can be continuously monitored or can be determined from the attached nodes.

F. PRECISION AGRICULTURE

In agricultural sector, WSN is seeking attention since few years. Many issues like soil erosion, salinity, excessive use of water and fertilizers are faced by farmers.

Land over-exploitation, one of the major concerns of agriculture, leads to problems such as soil erosion, salinity and declining water levels. Sensor networks play a critical role in measuring and monitoring the health of the soil and water quality at various stages, from pre- to post-production.

In the field of crop monitoring, wireless sensors can be deployed to gather, for example, data on leaf temperature, chlorophyll content and plant water status. Based on these data, farmers can detect problems at an early stage and implement real-time solutions. The health and moisture of soil is a basic pre-requisite for efficient plant and crop cultivation. Sensors contribute to real-time monitoring of variables such as soil fertility, soil water availability. [5]

Using such a technology helps the farmer by making them free from maintenance of wiring. By implementing event based system concept, pumps can be controlled wirelessly using wireless I/O devices, water utilized in irrigation can be measured and this data can be transmitted wirelessly to the central server for billing purpose. The efficient usage of water, fertilizer as well as electricity is done

Wireless sensors are further used for precision irrigation, and systems developed for remotely controlled, automatic irrigation. Sensors may assume the tasks of irrigation control and irrigation scheduling using collected data together with additional information such as weather information.

Conclusion

A review covering different areas of wireless sensor network conveys that these technologies can contribute significantly to more efficient and optimal usage of available resources and reduced power consumption as well as reduced greenhouse gas emissions.

This paper gives an overview of wireless sensor networks applications and their influence on the environment. It discusses selected fields of application which possess high potential to tackle many environmental challenges and reduce greenhouse gas emissions along with reduction in power consumption for certain fields.

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