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A Survey on Research Challenges in Wireless Sensor Network

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ABSTRACT

The wireless sensor network (WSN) has grown significantly in recent years and offers significant potential for a variety of applications, including healthcare, environment and military. Despite its powerful features, successfully developing WSN is a challenge. In modern real WSN applications, various programming approaches have been proposed that focus on low level system problems. In order to simplify the WSN project and to abstract it from the technical details on the lower level, a higher level approach was identified and several solutions were proposed. A Modern Drive enginnering (MDE) in particular is becoming a promising solution. This article describes the existing programming methods and model-based methods for the development of sensor networks. We note and classify existing approaches to WSN development. The main goal of our study is to examine the feasibility and application of high-level approaches to facilitate WSN development. We focus on a number of criteria to underline the shortcomings of each approach. Finally, we point out our future direction to meet the limitations of the existing solution.

I. INTRODUCTION

With the advent of MEMS (Micro Electromechanical Systems) technology, which facilitates the development of smart sensors.In recent years, WSN has attracted widespread attention.[1] Due to their limited computational and computational resources, these sensors are smaller and less expensive than existing sensors. These sensor nodes can understand, measure and store information for the user based on local decision making. Intelligent sensor nodes are energy-efficient devices that consist of one or more sensors, a processor, memory, power supply, radio, and an actuator. [2]Various mechanical, thermal, biological, optical and magnetic sensors can be connected to the sensor assembly to measure environmental properties. [3]Since the memory of the sensor nodes is not limited and is used in hard-to-reach places, a radio device (for example, a fixed infrastructure) is sent to the base station to transmit data for wireless communication[4]. The battery is the primary power source in the sensor assembly. Depending on the compatibility of the environment in which the sensor is used, [5]a secondary power source can be added to the node that draws electricity from the atmosphere, such as solar panels. Depending on the the sensors used, actuators may be included in the sensors.

WSN doesn't have a typical infrastructure.[6] It contains several sensory nodes (from tens of thousands to thousands) that work together to monitor the area and obtain environmental data.[7] Here the WSN are categorized into two norms, such as structured and chaotic. The unpleasantly protected WSN has a dense set of sensor nodes. The sensor nodes can be temporarily used in the field In an unconfirmed WSN,[8] network maintenance is difficult to perform, such as connection management and troubleshooting across multiple nodes. In a based WSN, all or some of the sensor nodes are furnished in a predetermined way[9]. The benefit of a dependent network is that fewer nodes can be deployed with much less network protection and management expenses.[10] Fewer nodes can now be deployed due to the fact the nodes are in unique places to offer coverage, even as regions may be to be had for temporary deployment. WSNs are exceptionally susceptible to a huge style of packages,[11] such as military target monitoring, surveillance, disaster mitigation, biomedical fitness tracking, herbal chance research, and earthquake data collection.[12] WSN can help discover and locate navy targets, in addition to become aware of and locate intrusions. Space and coordinated forces and tank moves are standard examples. In addition to herbal failures, sensor nodes can understand and perceive so that it will predict the surroundings before it occurs. In biomedical applications, sensory surgical implants can be used to monitor patient health.[13] To detect earthquakes, the use of sensors temporarily in a volcanic region can notice the expansion of quakes and eruptions.

Like old-stylenets, WSN has its very own layout and resource limitations. Source limitations consist of a confined quantity of power,[14] an unsuited conversation range, low bandwidth, and restricted processing and storage in step with node. Design controls are for programs simplest and are primarily based at the discovered environment. The surroundings plays an essential role[15] in figuring out the size, deployment plan, and network topology of your community. Network size changes in the observed environment. In a room, fewer nodes are needed to form a

network in the narrowest places,[16] while in a room with dots, more nodes are needed to cover a larger area. If the environment is unreachable to humans, or the network has hundreds to thousands of nodes, a temporary arrangement is preferred over a pre-planned deployment.[17] Environmental barriers can also restrict communication between nodes and affect network connectivity. The WSNS have a look at targets to triumph over the above barriers by announcing new design ideas,[18] creating or enhancing current protocols, growing novelclaims and developing novelprocedures.

II. OVERVIEW OF KEY ISSUES

The sensor skilldelivers solutions for the design and development of a variety of WSN requests[19]. A brief description of the existing sensor technology can be found in Appendix A. The sensors available on the market comprise common nodes and gateway (bridge) nodes[20]. The function of the universal sensor unit is to measure from a controlled environment. It can be equipped with different devices with which properties such as light[21], temperature, humidity, air pressure, speed, acceleration, acoustics, magnetic field etc. can be measured.

Gateway nodes gather data from standard sensors and send it to the base station. Gateway nodes have good performance, [22]battery life and transmission autonomy. Provides a combination of public nodes and gateways to create WSN. To allow wi-fi seek programs the use of sensor technology, the work location can be more or less divided into three agencies, as proven in Figure 2. 1. The first institution is the device.[23] Each sensor node is a separate gadget. Various packages within the sensor gadget require the improvement of new systems, operating structures and garage schemes to assist the software application. The second organization is the conversation protocol that provides communication among the application and the sensor.[24] They also provide communication among sensor nodes. Ultimate Group is a service to improve programs and improve machine overall performance and network performance. It is crucial to prepare the sensor nodes themselves while thinking about software necessities and network control. [25]This means that sensor nodes can be networked so that they can be controlled and effectively controlled. Since sensor nodes are limited in functionality, [26]processing, and storage efficiency, novel communication protocols and management facilities are required to meet these requirements.

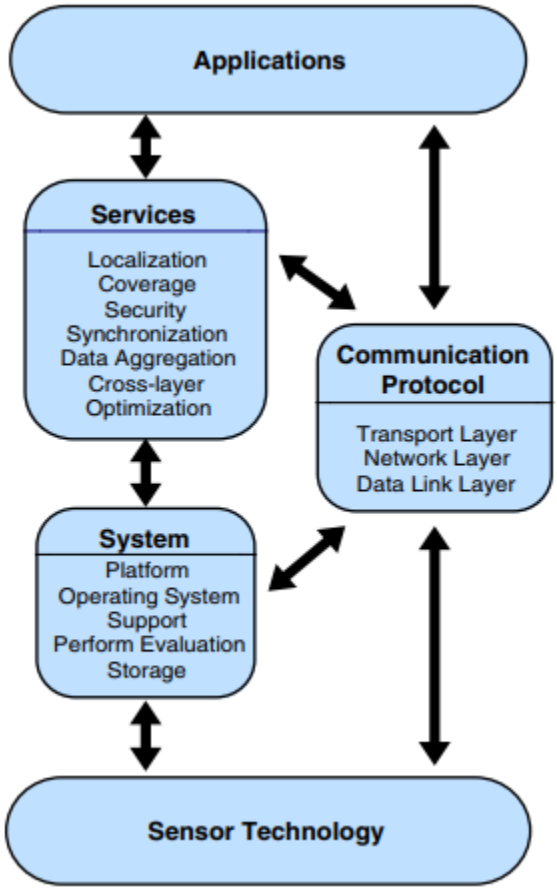

Fig. 1. Broad classification of several issues in a WSN.

The protocol contains of five popular protocol degrees for packet switches: software level, [27]site visitors degree, community stage, data link degree, and bodily degree. In this assessment, we will have a look at how protocol community mobility and electricity efficiency are measured at one-of-a-kind ranges.[28] Activities along with place, get right of entry to, garage, synchronization, security, statistics collection, and compression are taken into consideration sensor community offerings. Implementing protocols at one of a kind tiers inside the protocol stack may have a sizable impact on electricity intake, cease-to-stop latency[30], and device performance. It is crucial to optimize conversation and decrease strength intake. Traditional community protocols do not paintings well on WSN because they do no longer meet these necessities.[31] Therefore, new electricity performance protocols are proposed in any respect ranges of the protocol stack.[32] These protocols use layered optimization to guide conversation among protocol layers.

In particular, all levels share protocol state information on a given layer to meet a given WSN requirements.[33] Since the sensor nodes operate on a limited battery charge, power consumption in the WSN is a very

important issue. It was an important area of research focusing on energy fluctuations and deficiencies. [34]When the touch node is terminated, it dies and is disconnected from the network, which significantly affects the performance of the application. Therefore, energy must be used efficiently to increase the life of the network[35]. When energy is stored, the nodes are filled with energy from the energy source. In terms of generation of energy from the atmosphere, solar energy is currently the most mature technology for obtaining energy from light.[36] Mobile power supply robots are also working to supply power. Robots are responsible for charging energy and supplying power to the nodes.

The lifestyles of the WSN energy-saving community is enhanced via green and reliable wireless communications,[37] sensible sensor placement for good enough insurance, protection, green storage control, and aggregation and facts compression. The above techniques are supposed to satisfy the strength restriction and offer QoS to the application.[38] Reliable communications require offerings such as crowd control, active buffer tracking, packet loss detection and recovery to ensure dependable packet transport. The communication power depends on the position of the sensor nodes[39]. The monetary positioning of the sensor ends in long-range transmission and excessive power intake, even as dense positioning of the sensor ends in long-range transmission and occasional energy consumption.[40] Coverage is related to sensor placement. The entire quantity of sensors inside the network and their area determines the quantity of community coverage. Depending on the utility, a better grade may be needed to improve the accuracy of the information amassed. The survey introduces novel protocols and procedures advanced in this region.

III. TYPES OF SENSOR NETWORKS

Currently WSN supplies underground, underground and underwater.[41] Depending on the environment, the sensor network has various problems and limitations. There are five types of WSN: Underground WSN, Submarine WSN, Multimedia WSN, and Mobile WSN. [42]Terrestrial WSNs usually consist of hundreds or thousands of low-cost WSN node that are temporarily or systematically distributed.[43] In custom layouts, sensor nodes can be removed from the aircraft and placed randomly in the target area. The pre-planned distribution has a mesh positioning model, the optimal position, and two and three positions.[44] The ground sensor nodes at the base station must be able to transmit data efficiently. Although the battery power is limited and cannot be recharged,[45] the ground sensor nodes have a secondary source of energy, such as a solar cell. In any case, it is important for sensor groups to save energy. For Terrestrial WSN, you can save energy by using multi-hop routing, a shorter transmission interval,[46] integrated network data, eliminating data repetition, reducing delays, and reducing cycle activity.

Underground WSN includes sensor nodes buried in caves or mines that screen floor situations. [47]Additional receiver nodes are positioned above the floor to transmit records from the sensor nodes to the bottom station.[48] Geographical WSN is extra high-priced than terrestrial WSN in kit, distribution and maintenance. Underground sensor nodes are high priced because the relevant components of the system must be selected to make certain dependable communique via soil,[49] stone, water and different minerals. Underground environments make wireless verbal exchange tough because the sign and density are terrible. Unlike the terrestrial WSN, the implementation of an underground WSN requires cautious making plans, cost, and strength saving. Energy is a chief hassle within the WSN underground network. [50]Like ground WSN, the battery runtime on underground sensor nodes is limited, and once installed on the ground the sensor node battery is difficult to recharge or replace. As before, the main goal is to save energy by prolonging the life of the network.

Below the WSN is a large sensor node and under the drive shafts[51]. Unlike the WSN territory, under-sensor nodes are more expensive and disadvantageous many sensor nodes. Popular underwater vehicles are used to search or collect information from mosquito nodes[52]. Rarely are sensor nodes stored underwater compared to the mass density of terrestrial WSN sensor nodes. Under normal water flow wireless communication is established by transmitting acoustic waves. Limiting bandwidth, long delayed delays[53], and reduced emissions are some of the challenges under voice noise. Sensor node failure due to environmental conditions is another difficulty. Underwater power plants should be able to withstand and adapt to harsh marine environments. Below the sensor nodes limit the lifespan that cannot be changed or renewed. The issue of renewable energy for underwater WSN involves the development of underwater and road networks.[54] Multimedia WSN aims to be able to view and monitor events in the form of multimedia such as video, audio and video. Multimedia WSN includes low-cost sensor nodes used in a camera and microphone. These sensor nodes are connected to each other through wireless networks for data recovery, activation, connection and amplification.

It is possible to extend the various broadcast nodes into the environment in a pre-designed system to ensure insurance[55]. Multimedia WSN challenges include high bandwidth requirements, high power consumption, QS provisioning, database management, integration methods, and cross-section design. Different media formats such as video ads require high bandwidth to deliver content. As a result, the higher the relative correlations the higher the energy consumption.[56] Sending devices make support of high bandwidth and low power consumption should be developed.

Sharing QOS with WSN multimedia is a big challenge due to the many delays and the ability to change routes. Achieving a high level of QoS is essential for reliable shipping. Processes, installation and integration into the network interface can improve network utilization by filtering, deleting and aggregating unwanted information[57]. In a similar vein, cross-functional interactions between enhancements can improve performance and delivery of activities. WSN Mobile has a number of hidden nodes that can travel on their own and interact with the physical environment. Such as static nodes, mobile space configuration, design and communication.[58] An important part of mobile nodes is having the ability to transmit and operate them over the network. Mobile WSN can start with some pre-assembled and expanded node data collection. Information collected by one mobile node can be connected to another mobile phone while inside. Another important factor is the distribution of data. Data can be collected using the conventional or flooding method when the most powerful methods are used in static WSN or WSN mobile. [59]WSN mobile challenges include installation, local, personal, control and management, insurance, energy, maintenance and operation operations WSN mobile data includes, but is not limited to, monitoring environments, focus on search, retrieval, rescue, and direct monitoring of hazards. It is not possible. Using mobile data, they can move on to what happened after it was done. Mobile sensor nodes in military surveillance and surveillance can work together and make decisions on targets. Mobile sensor node can achieve higher limits and connectivity than static sensor node. With a built-in firewall, mobile data sets can be pre-configured to improve the hardware performance and move towards the wall.

3.1 Open research issues

WSN offers integrated applications and some key features to facilitate the search. There are several applications for specific functions and needs.[60] These technologies and application requirements integrate and implement these technologies, leading to innovative areas of software and software development.[61] Many machines and technologies have been developed over the years. However, several business models are needed to make these applications more powerful and reliable in the real world. WSN can improve and change the way people interact with the world of technology. The future of WSN lies in meeting the real needs of companies and industries. Intervention between research and development is essential to bridge the gap among existing knowledge and the development of business solutions.[62] Using knowledge in business requests can increase business efficiency and open up other problems for researchers.

IV. CONCLUSION

Like other networks, WSNs are intended for definite applications. Which include environmental monitoring, industrial vehicle surveillance, surveillance systems and military target tracking. Each application differs in its functions and requirements. Supporting various applications of this type requires the development of new communication protocols, algorithms, designs and services. We covered three different sections of this document: (1) back-end platforms, integrated operating systems, (2) communication protocol stacks, and (3) network services, regulations, and deployment issues. We have collected and compared the various proposed projects, algorithms. We also reported on possible enhancements and research in each area. WSN applications still face many problems such as communication architecture, security, and administration. By solving these problems, we can bridge the gap among technology and applications.

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