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WIRELESS SENSORS NETWORK FOR OPTIMIZING INDUSTRIAL OPERATIONS

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Abstract: **The sensors were designed to be capable of detecting objects and its postion a few centimetres away from the end. They are also used as feedback devices in speed measuring devices. Proximity switches are electronic sensors. They normally have three electrical contacts. One contact for supply voltage , other for ground and third for output signal. In these sensors, no movable contact is switched. Instead, the output is either electrically connected to supply voltage or to ground. A drawback to older electric action organs was the large amount of wiring required for operation. With each signal cable being wired, the transmission cable could easily contain several hundred wires. The great number of wires required between the field input and controller output, the banks of relays and the organ itself, with each solenoid requiring its own signal wire, made the situation worse, especially if a wire was broken which made tracing the break very difficult. These problems increased with the size of the system, and it would not be unusual for a particular organ to contain over a hundred meters of wiring. This problem solved due to wireless transmission of signal. This is the younger of the two and could still be in the debugging and growth stages of its evolution. The main benefit of this type of connection is the comfort and convenience it provides. Another thing about wireless connections is that it doesn't have to originate within the small or large machine size. This resench collaborative makes the best effective use of sensors and wireless communication.**

Keywords: *Proximity switches, Wireless Sensor Networks, Industrial Operations.*

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I INTRODUCTION

Automation is a technology that belongs to the application of mechanical, electrical, electronics and computer-based system use to control and operation the manufacturing system. Although the term mechanization is often used to refer to the simple replacement of human labour by machines, automation generally implies the integration of machines into a self-governing system. A drawback to older electric action organs was the large amount of wiring required for operation. With each stop tab and key being wired, the transmission cable could easily contain several hundred wires. The great number of wires required between the keyboards, the banks of relays and the organ itself, with each solenoid requiring its own signal wire, made the situation worse, especially if a wire was broken (this was particularly true with consoles located on lifts and/or turntables), which made tracing the break very difficult. These problems increased with the size of the instrument, and it would not be unusual for a particular organ to contain over a hundred miles of wiring.

Recently, different types of networks can be seen in every place in home, car, factories and companies. Furthermore, wireless sensor networks (WSN) are becoming more and more important for home and industrial applications, and the need to access these networks from other existing networks is continuously increasing. The benefit of WSN will be largest, if the exchange of data between WSN and other networks is bidirectional and happens in suitable time. In general SCADA systems are used to manage real-time data in industrial automation, where a gateway is used to exchange data between MOD-BUS/TCP and WSN and such gateways are available on the markets.

II NEED AND SIGNIFICANCE OF THE RESEARCH

During the few decades various automation techniques has been introduced in the field of manufacturing in order to enhance the overall industrial productivity. Among the various technologies that are playing important role in rapid growth of Indian industries, fluid power is unique. In the area of Wireless Sensor Networks (WSNs), research is usually concentrated on different aspects of, e.g., protocols, physical layer (PHY), channel management, or energy consumption. In many cases these issues are considered isolated from other aspects. Very few work is published on the expected WSN in terms of energy consumption, and even less on the design of WSN protocols with respect to a complete life cycle of a WSN node from warehouse to the end of operation. Sensor integration is considered in an industrial environment, not only the regular operation of the WSN, which is usually some data acquisition task, is of concern. Also the setup of the WSN and its monitoring and maintenance need to be considered and designed properly. Otherwise the replacement of traditional wired sensor networks by WSNs will fail due to missing acceptance by users.

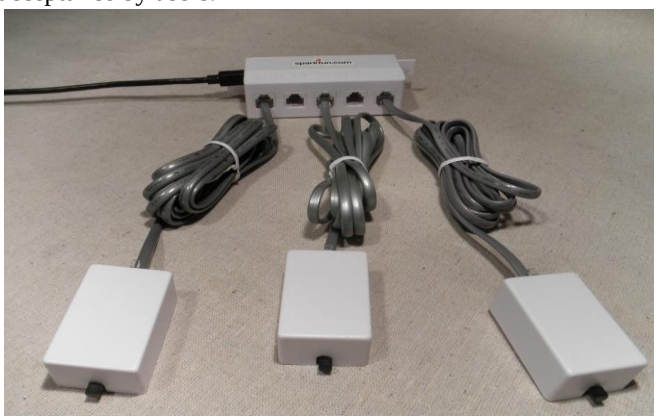

Figure 1 Wired Sensor Connection

Sensor Technology is an asset for the era of modern industry. A smart automatic system provides the most suitable environmental conditions for production growth by regulating. The regulatory wired Sensor network characterizes complex interactions among the existing physical entities. Impose various challenges in accurately monitoring and controlling the environmental condition and the associated energy consumptions, Precision sensor network is an important Practice in modern industry, providing amenities for monitoring and measuring operation status.

People prefer wireless sensor networks of following reasons,

1. Network setup can be carried out without fixed infrastructure.
2. Suitable for the non-reachable places such as over the sea, mountains, rural areas or deep forests.
3. Flexible if there is random situation when additional workstation is needed.
4. Implementation pricing is cheap.
5. It avoids plenty of wiring.
6. It might accommodate new devices at any time.
7. It's flexible to undergo physical partitions.
8. It can be accessed by using a centralized monitor.

III SURVEY OF LITERATURE

Sensors have recently been proposed for a large range of applications in home and industrial automation, and for health and environment monitoring. Especially the smart sensor standard is getting rising attention as it can be used to implement wireless sensor networks, because of its low data rate and low power consumption. Increasingly there is a need to access wireless sensor network services from other based networks. The DPWS has been chosen to implement the integration of the different forms of networking services. DPWS uses web services, xml, WSDL and SOAP protocol to connect various devices and services in home and industrial applications. It allows collaboration and dynamic reconfiguration of network Services and devices. This research will describe our idea of how we used to integrate a wireless sensor network for optimizing industrial operation. Several researchers attempted to develop smart sensor network in different areas of technology. Several papers have been published on the topic of this Environment

In 2017, Hans-Peter Bernhard, Achim Berger, Peter Priller proposed research on title "Life Cycle of Wireless Sensor Nodes in Industrial". In this, they addressed the problem of Energy consumption, largely avoids collisions due to suitable multiple access protocols, and allows tight synchronization even during long sleep periods consumption and even less on the design of WSN protocols with respect to a complete life cycle of a WSN node from warehouse to the end of operation. He introducing Optimized MAC protocol for wireless communication in all life cycle phases by using MAC protocol, we now extend this work by accounting for the whole life cycle of operation of Such a WSN and its nodes Involving Wireless sensor node equipped with a PT100 mounted at an engine test bed, instrumentation of the unit under test (UUT) [1].

Ayman Sleman & Reinhard Moeller, in 2014, integrate a wireless sensor network into other IP-based networks in paper title "Integration of Wireless Sensor Network Services into other Home and Industrial networks". In this ZigBee standard is used to implement wireless sensor networks, because of its low data rate and low power consumption. DPWS (Device Profile for Web Services) uses web services, xml, WSDL and SOAP protocol to connect

various devices and services in home and industrial applications. He use Device Profile for Web Services (DPWS) & ZigBee Hardware to grow this research [2]

Andrew D. DeHennis, in 2006, proposed "A fully integrated multisite pressure sensor for wireless arterial flow characterization". Present strokes uses a guided wire and balloon catheter to steer the unexpected stent through the arterial system which is maximizing the cross section with in treated sectional flow. Fully integrated battery-free sensing system that uses a two-site wireless pressure measurement for detection of arterial flow. This system has been developed to obtain a device that would have the size and performance needed for a stenosis measurement within the carotid artery. BiCMOS circuit with silicon on glass pressure sensor, on chi antenna, vacuum related pressure transducer [3].

In 2016, LEI SHU, MITHUN MUKHERJEE, MITHUN MUKHERJEE, KUN WANG, AND XIAOLING WU, Survey on Gas Leakage Source Detection and Boundary Tracking with Wireless Sensor Networks. The manufacturing and production point of view, real time information about the distribution area of hazardous. Toxic gases in large-scale industry is needed to ensure safety precaution for the first-line working staff during various operations in production, storage, transportation, and usage. This survey provides a comprehensive overview of the existing and emerging work on gas leakage source detection and tracking of continuous objects with WSNs. He advice different models like GAS DIFFUSION MODEL, GAUSSIAN PUFF MODEL, BRITTER AND McQUAID (BM) MODEL, 3-D FINITE ELEMENT MODEL (FEM-3), SUTTON MODEL, GAS TURBULENT DIFFUSION MODEL. This survey can applicable for Fixed Cable-Based Sensing, Big Mobile Robots, Small Autonomous Mobile Robots, WSN-Based Localization and Tracking [4].

In 2017, XINGZHEN BAI, MAOYONG CAO, JOHN PANNEERSELVAM, QIAO SUN, HAIXIA WANG, published paper on Complex characteristics of greenhouse impose various challenges in accurately monitoring and controlling the environmental changes and the associated Energy consumptions. Under title "Collaborative Actuation of Wireless Sensor and Actuator Networks for the Agriculture Industry". WSNs are capable of facilitating constant monitoring of various environmental parameters for enabling precision control over the greenhouse Climatic variations. Sensor nodes Conduct a local estimation based on the Kalman filter for enhancing the estimation stability and further transmit data to the actuator nodes under a multi-rate transmission mode for enhancing the overall energy efficiency of the wireless network. The authors used PID control scheme based on fuzzy algorithm and the genetic algorithm (GA) [5].

In the study of wireless network adapter, found significant economical saving in annual infrastructure cost per use compared to the cost of wired network as shown in the comparison table,

Annual Infrastructure Cost Per User	Traditional	All Wireless	Wireless Advantage
Hardware	$110	$74	33%
Software	$48	$24	50%
Facilities and bandwidth	$33	$29	13%
Power	$7	$4	43%

IV OBJECTIVES OF RESEACH

The interest of wireless solution to do control and monitoring has been increasing. Available solutions on the market are mostly wired and very expensive. Furthermore, the wired solution requires operation, which is not the preferred way Wireless solutions on the other hand can offer flexibility when deploying the network.

The great number of wires required between the field input and controller output, the banks of relays and the organ itself, with each solenoid requiring its own signal wire, made the situation worse, especially if a wire was broken which made tracing the break very difficult. These problems increased with the size of the system, and it would not be unusual for a particular organ to contain over a hundred meters of wiring. This problem solved due to wireless transmission of signal. This is the younger of the two and could still be in the debugging and growth stages of its evolution. The main benefit of this type of connection is the comfort and convenience it provides. Another thing about wireless connections is that it doesn't have to originate within the small or large machine size. This resench collaborative makes the best effective use of sensors and wireless communication.

An integrated wireless sensor network (IWSN) generally consists of compact low power sensors, which collect information and pass the information via wireless networks to achieve a high level of desired monitoring and control in coordinated manners. IWSN applications can be found in areas such as environmental monitoring, smart energy systems, battle field surveillance, home automation, medical monitoring, mobile computing, industrial monitor and control etc. IWSN has integrated network engineering, embedded system engineering and sensor technology. This research covers fundamentals of wireless network technology and distributed sensor networks.

Networks of wired sensors have long been used in industrial fields such as industrial sensing and control applications, building automation & access control. However, the cost associated with the deployment and the maintenance of wired sensors limits the applicability of these systems. While sensor-based systems incur high deployment costs, manual systems have limited accuracy. Instead, WSNs are a promising alternative solution for these systems due to their ease of deployment, high granularity, and high accuracy provided through battery-powered wireless communication units. Some of the commercial applications are monitoring material fatigue; monitoring product quality; constructing smart office spaces; environmental control of office buildings; robot control and guidance in automatic manufacturing environments; monitoring disaster areas; smart structures with embedded sensor nodes.

V HYPOTHESIS

Sensors have the task of measuring information and passing this on to the signal processing part in a form that can easily be processed. In Electro Pneumatic controllers, sensors are primarily used for the following purposes:

-To detect the advanced and retracted end position of the piston rod in cylinder drives

-To detect the presence and position of work pieces

These elements interface directly and physically to the process equipment and machines. The sensing elements translate the physical process signals such as displacement to convenient electrical or pneumatic forms of information, so that these signals can be used for analysis, decisions and finally, computation of control inputs. These computed control inputs, which again are in convenient electrical or pneumatic forms of information, need to be converted to physical process inputs such as, heat, force or flow-rate, before they can be applied to effect the desired changes in the process outputs. Such physical control inputs are provided by the actuation elements. Then this sensors output is transmitted through wireless module and received by receiver module connect with directional control solenoid valve and this DCV will actuated according to sensor output.

Maintenance are some other issues to look at when looking at the wired connection. The maintenance of a wired network is pretty simple but can at times be costly. If a wire goes out, gets cut, or succumbs to some other misfortune, the wire itself is relatively cheap to replace. The down side is that if the wire is in a wall it can be very costly to get to it, replace it, and fix the wall. If the wire is outside the industry, or some other building, the technician of the line could take a long time to fix the problem leaving you with nothing but down time. The wired connection can by really secure.

The major downside to the wired connection is all the exposed wires. They can be unsightly, costly to conceal, and downright annoying, you have to install a new set of wires every time which adds to the overall cost, and Complexity of the network which is possible money and time sink. The other type of connection is the wireless connection. This is the younger of the two and could still be in the debugging and growth stages of its evolution. The main benefit of this type of connection is the comfort and convenience it provides. As long as there is a signal you have a connection. The downside here is that the signal can suffer from interference, and somewhat slower transfer speeds. These problems may not be a severe in the future as the technology gets better, and the signals get stronger and more specialized. This can be a major benefit when it comes to getting a wireless connection. It also makes the maintenance costs and hassles go way down. You may have to wait a few days or hour for the technician to come out, but the cost is included in the regular service price. Another thing about wireless connections is that it doesn't have to originate within the small or large machine size. This increases the potential for a wireless network to be anywhere. As this technology increases in power and decreases in cost the potential and value of the wireless network can only increase.

VI METHODOLOGY AND TOOLS

Sensor were designed to be capable of detect object and its postion a few centimetres away from the end. They are also used as feed back devices in speed measuring devices. A drawback to older electric action organs was the large amount of wiring required for operation. With each signal cable being wired, the transmission cable could easily contain several hundred wires. With the recent advances in micro electro-mechanical systems (MEMS) technology, wireless communications, and digital electronics, the design and development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate untethered in short distances have become feasible. The ever-increasing capabilities of these tiny sensor nodes, which include sensing, data processing, and communicating, enable the realization of wireless sensor networks (WSNs) based on the collaborative effort of a large number of sensor nodes.

A sensor node typically consists of two components and can be either an individual board or embedded into a single system:

1. **Communication module**: Turning nodes into a network requires a device for sending and receiving information over a wireless channel. A wireless module are the key components of the sensor network as they possess the communication capabilities and the programmable memory where the application code resides. A mote usually consists of a microcontroller, transceiver, power source, memory unit, and may contain a few sensors

2. **Sensor/Actuators Module**: The actual interface to the physical world. Devices that can observe or control physical parameter of the environment. A sensor module is mounted on the mote and is embedded with multiple types of sensors. The sensor board may also include a prototyping area, which is used to connect additional custom- made sensors.

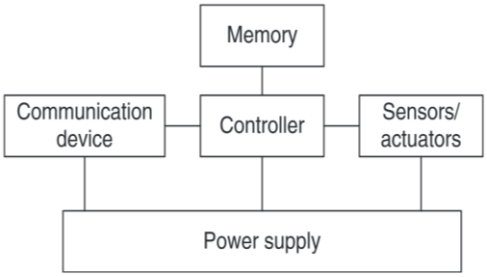

Figure 2 Main sensor hardware components

3. **Controller:** A controller to process all the relevant data, capable of executing arbitrary code.
4. **Memory:** Some memory to store programs and intermediate data usually, different types of memory is used for programs and data.
5. **Power supply:** Some forms of batteries are necessary to provide energy. Sometimes, some form of recharging by obtaining energy from the environment is available as well.

Comparison of Possible of Wireless sensor network protocol:

	GPRS/GSM 1xRTT/CDMA	IEEE 802.11b/g	IEEE 802.15.1	IEEE 802.15.4
Market name for standard	2.5G/3G	Wi-Fi	Bluetooth	Zig-Bee
Network target	WAN/MAN	WLAN and hotspot	PAN and DAN (desk area n/w)	WSN
Application focus	Wide area voice and data	Enterprise applications (data and VoIP)	Cable replacement	Monitoring & control
Bandwidth (Mbps)	0.064–0.128+	11–54	0.7	0.020–0.25
Transmission range (ft)	3000+	300+	30+	300+
Design factors	Reach and transmission	Enterprise support, cost	Cost, ease of use	Reliability, power, cost

Wireless sensor networks (WSN) have recently been proposed for a large range of applications in home and industrial automation. It consists of many tiny nodes, which have several sensors and a radio interface that depends on the IEEE 802.15.4 standard that supports large number of embedded devices in one network. Integrated WSN can be used for many applications such as environment monitoring, medical applications, robotic systems and home and industrial automation. WSN uses ZigBee standard (IEEE 802.15.4), which is a standard for low-rate wireless personal area networks (LoWPAN).

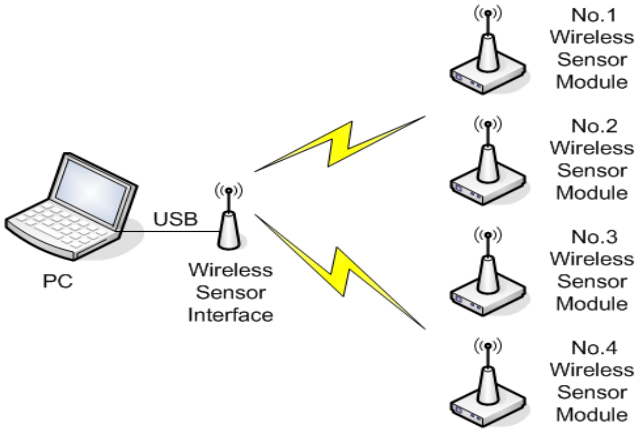

Figure 3 Wireless sensor module interfaces

This IEEE 802.15.4 standard defines two layers of the OSI model: the PHY (physical layer) and MAC (media accesses control layer). The main features of a ZigBee standard device are:

- Low data rate (maximum 127bytes/s).
- Low power
- Low cost.
- Uses three frequencies: 868, 915 MHz and 2.4 GHz.
- Low bandwidth (250 kbps in the 2.4 GHz band).
- Supports three network topologies (star, tree, mesh).
- Supports a large number of modes in the network.

VI CONCLUSION

Wireless sensors are used in those hostile and harsh environments where wired networks can't be deployed. For example, in a boiler, long distance conveyer line, assembly line, Production line. Wireless sensor nodes are dropped from the air because going down there and deploying a wired setup is not possible. This type of wireless sensor networks is scalable. That is why they are actively being used in applications such as Structural Health Monitoring where there is a need of dense deployment and with a dense wired set up networks, it may lead to a chaos at the time of deployment. Moreover, a dense wired set up will prove to be very costly. On the other hand, wireless sensor nodes can easily be deployed without any hustle and maintenance and troubleshooting is easy as compare to wire network.

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