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Designing and Experimenting the Innovative, Alternative and Complimentary Wireless Communication Technique Used For the IOT Application

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Abstract – Internet of Things (IoT) is a new computing worldview that visualizes changing over regular common articles into keen items. Wireless technologies will be the most ideal choice to associate IoT devices on account of its advantages over wired technologies including simpler establishment, cheaper frameworks, portability backing, adaptability, and simplicity of association. There are various types of wireless technologies applicable for IoT; these technologies range various spaces from not many centimeters to numerous kilometers. In this paper the Internet Engineering Task Force (IETF) presented 6LowPAN protocol and ZigBee union created ZigBee protocol over low power IEEE802.15.4 protocol. Sensors in wireless sensor networks applications are assembled as bunches to inform hubs called sensor hubs. These hubs are typically powered by battery power supply. In IoT applications these hubs should do its capacity for years without change their batteries. IoT helps making choices upheld by real data gathered utilizing large number of ordinary day-to-day devices that have been augmented with knowledge through the installation of detecting, processing and communication capabilities. IoT devices mainly utilize wireless communication for communicating with different devices.

Keywords – Innovative, Wireless, Communication, Technique, IOT, etc.

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1. INTRODUCRION

Internet of Things (IoT) is a new computing worldview that visualizes changing over regular common articles into keen items. IoT has been recognized as one of troublesome technologies of the here and now that will change the way sees and understands our general surroundings and responds to its changes. The Internet of things portrays the organization of actual articles "things" that are embedded with sensors, software, and different technologies for the motivation behind associating and trading information with different devices and frameworks over the Internet. Advances made in universal and inescapable computing, embedded devices, communication technologies, sensor networks, Internet protocols and online applications are the basic hidden technologies that help make normal devices keen ones and consequently made IoT conceivable. Thus, these technologies are regularly known as the empowering technologies of IoT. As of late, the advances in different wireless Communication protocols in technologies, for example, 5G, RFID, Wi-Fi-Direct, Li-Fi, LTE, and 6LoWPAN have significantly helped the likely capacities of IoT and caused it to turn out to be more common than any time in recent memory, which additionally quicken the further reconciliation of IoT with arising technologies in different territories, for example, detecting, wireless reviving, information trading, and handling. However, how these technologies particularly the relating wireless communication protocols can be very much lined up with IoT to boost their advantages on such performance as adaptability, administration quality, energy productivity, and cost viability is as yet open to examination and consequently calls for novel arrangements. And the elaborate protection and security issues likewise should be painstakingly inspected and tended to.

2. WIRELESS TECHNOLOGIES FOR INTERNET OF THINGS APPLICATIONS

In IoT frameworks, IoT devices gather information from actual frameworks, speak with entryways for information total, and associate with the Internet to forward the information to the cloud or edge computing devices for additional preparing and examination. By associating IoT devices to the Internet, the IoT environment vows to carry enhancements to our nature of lives, climate and framework performance in the home, building, city, electric force lattice, vehicles, transportation,

coordinations, medical care, and some more. Figure 1 represents some of arising IoT application situations. Albeit wireless sensor networks (WSN) are one of the principle segments of IoT frameworks, in contrast to WSN devices, IoT devices are savvy enough to take ideal choices with or without negligible human mediation. As per the new Cisco report (2018), the quantity of IoT devices associated with the Internet will arrive at 50 billion by 2020. Diverse communication technologies (wired, optical, and wireless) can be used for information communications among an enormous number of IoT devices and for backhaul network situations. Wireless technologies will be the most ideal choice to associate such IoT devices on account of its advantages over wired technologies including simpler establishment, cheaper frameworks, portability backing, adaptability, and simplicity of association. Therefore, in this work, we just spotlight on wireless technologies.

Figure 1: Emerging IoT application scenarios

While all IoT devices communicate and get information wirelessly, they don't do it in the very same manner. There are various choices for network, and some are more qualified to specific applications than others. Components like battery life, range of inclusion, power prerequisites and bitrate should all be considered when choosing which choice to use for a given application.

- **WiFi:** WiFi turns into a regular instrument as of now for Internet access in our regular daily existences. The WiFi standard IEEE 802.11 was first delivered in 1997 and numerous changes were affirmed after that.It has been allocated the standard 802.11 by the Institute of Electrical and Electronics Engineers (IEEE), and works at either 2.4 Ghz or 5 Ghz. Most switches offering a greatest range of 100 meters.

- **Bluetooth:** Next we have Bluetooth. That little sans hands earpieces for your telephone has been around for a spell now, yet this technology can accomplish such a great deal more. Bluetooth (IEEE Standard 802.15.1) is used in a wide range of clinical and mechanical devices. Like WiFi, it additionally works at 2.4 Ghz, yet it has some key contrasts that make it ideal for implanting in more modest items.

- **Zigbee:** Zigbee (IEEE 802.15.4) is a wireless standard which is normally used for mechanical applications, yet additionally in some home items. Like WiFi, it utilizes 2.4 Ghz bandwidth, yet has lower power necessities and is intended for considerably more restricted data trades, working at 250 kbits/second.

3. COMPETENT POWER CONSUMPTION WIRELESS COMMUNICATION TECHNIQUES FOR IOT APPLICATIONS

A sensational change towards a general association between each thing and processing will prompt a third modern upheaval named Internet of Things (IoT). This unrest gathers a few sciences and technologies with one another, for example, Data Acquisition, Power Consumption, Wireless Sensor Networks, Radio and Mobile Communications, Data Analytic and Processing, Internet Technology. IoT takes its name from its wide spread applications from wearable wellness trackers to associated vehicles, traversing the ventures of utilities, transportation, medical care, purchaser electronics, and numerous others. The customary utilization of the Internet has gotten insufficient to meet the mechanical and common necessities. The IoT is the candidate object to add new technologies to internet technology by empowering communications with and among keen items, accordingly prompting the vision of "whenever, anyplace, any media, anything" communications. To this reason, the IoT should be considered as a component of the general Internet of things to come, which is probably going to be significantly not quite the same as the Internet use today.

IoT is a framework dependent on billion keen sensors and actuators and to fabricate such a framework, novel thoughts regarding clever sensors and data calculations and processing should be presented. Notwithstanding, the main inquiry should be presented, that is the means by which these sensors and actuators are interconnected, Ethernet cabling look like not a smart thought. Undoubtedly, just wireless offers the adaptability, versatility and cost proficiency expected to guarantee practical take-up of the Internet of Things. The radio recurrence wireless communication with its huge number and existing framework offers a best answer for data traffic in IoT frameworks. A restricted power supply issue thinks of a wireless network between sensors. In a perfect world, a framework where a sensor can run on a solitary AAA battery for years is favored in IoT applications. The arrangement which tackles the issue of restricted power supply is the IEEE 802.15.4 standard. IEEE 802.15.4 standard determines a wireless connection for low-power personal area networks (LoWPANs). This standard is embraced by ZigBee Alliance to present ZigBee gadget which is a low cost, low power, wireless

cross section organizing standard focused at wireless control and observing applications. As a rule, while choosing a wireless technology for associated devices, a couple of contemplations should be considered relying upon the last application.

- Maximum throughput
- Power consumption
- Maximum distance range

4. WIRELESS IOT CONNECTIVITY TECHNOLOGIES

There are various types of wireless technologies applicable for IoT; these technologies range various spaces from not many centimeters to numerous kilometers. For short to medium range communication Wireless Personal and Local Area Network technologies (WPAN\LAN, for example, Bluetooth, ZigBee, 6LowPAN, and Wi-Fi are suggested. For long range communication the proposal is for Wireless Wide Area Network technologies (WWAN) and these can be isolated into two types whether to utilize authorized (Cellular 2G/3G/4G and 5G in future) or authorized excluded technologies (LPWA LoRa, SIGFOX, and other). Connectivity is the establishment for IoT, and the type of access required will rely upon the idea of the application. Numerous IoT devices will be served by radio technologies that work on unlicensed range and that are intended for short-range connectivity with restricted QoS and security prerequisites commonly appropriate for a home or indoor climate.

4.1 Short Range Connectivity Technologies

Wi-Fi is an extraordinary candidate to guarantee connectivity in IoT applications because of its huge development over the previous years, despite the a lot higher power consumption. Today, most places where there is something to send or some data to be sent, there's Wi-Fi inclusion. Unfortunately, Wi-Fi has been far off for sensor communications because of the genuinely enormous energy consumption with its customary protocols. Since 2006, this has changed when the Wi-Fi people group began to apply notable technologies, for example, obligation cycling, that is, placing contributes a rest mode for more often than not and low power Wi-Fi modules see lights, for example, Microchips RN171 module which is a standalone, embedded 802.11 b/g Wireless Local Area Network (WLAN) modules. Another great candidate for short range connectivity is IEEE 802.15.4 technology. A few driving radio makers have actualized IEEE 802.15.4. The Internet Engineering Task Force (IETF) presented 6LowPAN protocol and ZigBee union created ZigBee protocol over low power IEEE802.15.4 protocol. Specifically the IETF 6LowPAN characterize the casing format and a few components required for the transmission of IPv6 bundles on top of IEEE 802.15.4 networks. 6LowPAN is the abbreviation for IPv6 over low-power personal area networks.

4.2 Long Range Connectivity Technologies

Presently, there are two alternative connectivity tracks for the numerous IoT applications that rely upon wide-area inclusion:

i. **Cellular Technologies:** 3GPP technologies like GSM, WCDMA, LTE and future 5G. These WANs work on authorized range and truly have principally focused on great mobile voice and data administrations. Presently, nonetheless, they are by and large quickly developed with new usefulness and the new radio access technology narrowband IoT (NB-IoT) explicitly custom fitted to form an alluring answer for arising low power wide area (LPWA) applications.

ii. **Unlicensed LPWA:** New restrictive radio technologies, given by, for instance, SIGFOX and LoRa, have been created and planned exclusively for machine-type communication (MTC) applications tending to the super low-end sensor portion, with restricted demands on throughput, unwavering quality or QoS. One approach to section IoT applications is to sort them as per inclusion needs and performance necessities, (for example, data speed or inactivity demands). Figure 2, represents the various types of technologies that can be used for IoT with various inclusion area and inside the unlicensed range.

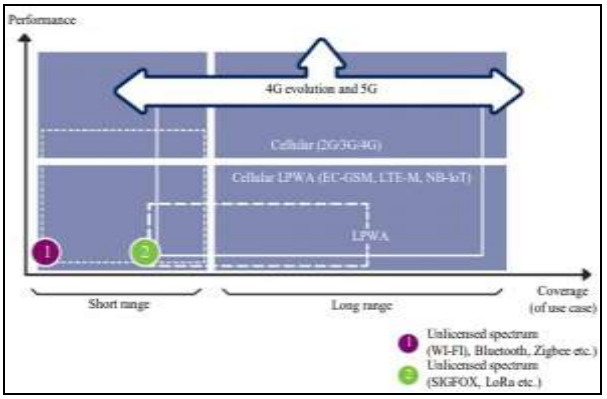

Figure 2: Technologies addressing different segments

Applications of cellular connectivity remain concentrated in traditional applications, for example, transportation, automotive, and location management. Cellular 2G connectivity gives the benefit of overall Nevertheless; there are limitations to cellular connectivity which LPWA addresses.

5. WIRELESS SENSOR NETWORKS FOR IOT APPLICATIONS

Sensors in wireless sensor networks applications are assembled as bunches to inform hubs called sensor hubs. These hubs are typically powered by battery power supply. In IoT applications these hubs should do its capacity for years without change their batteries. Thus, the battery lifetime is the main parameter in the plan of sensor hubs for IoT applications.

5.1 Used Module for a Certain Wireless Communication Protocol

► Low Power Wi-Fi Modules for Short Range Connectivity:

The low-power Wi-Fi chip/module has an impact factor in diminishing the power consumption of battery used in Wi-Fi sensors. Low-power WI-Fi modules increase years of battery lifetime in same time they giving easy installation to existing Wi-Fi network without any extra gateway. New low-power Wi-Fi modules have been presented in the markets that help IEEE 802.11 protocols. The famous available low power Wi-Fi chips/modules in markets today are G2M5477 module from G2 Microsystem, RN171 module from Microchip, QCA4004 module from Qualcomm, GS1011M from Gain Span, RS9110-N-11-02 Module from Red pine and RTX41x arrangement Modules from RTX. A particular comparison between these modules in term of power consumption is illustrated in Table 1.

Table 1 Particular comparison for different low power Wi-Fi modules

Company	Module	IEEE Protocol	V_{DD} (Volt)	I_{TX} (mA)	I_{Rx} (mA)	Isleep (µA)	Max. Bit Rate (Mb/S)
Microchip	RN171	802.11 b/g	3.3	190	40	4	54
Qual Comm	QCA4004	802.11 n	3.3	250	75	130	10
Gain Span	GS1011M	802.11 b	3.3	150	40	150	11
G2 Micro system	G2M5477	802.11 b/g	3.3	212	37.8	4	11
Redpine	RS9110-N-11-02	802.11 b/g/n	3.3	19	17	520	11
RTX	RTX41x Series	802.11 b/g/n	3.3	0.760	0.760	3	10

5.2 Wireless Communication Protocols

a) Comparison between Different IoT Protocols:

Table 2 summarizes the main contrasts between Low Power Wi-Fi, ZigBee, 6LowPAN and LoRaWAN protocols. This table has been filled according to the data sheet for each fruitful candidate module. According to the data appeared in Table 2, impact of distance between hubs on transmission power can be considered. Also, the impact of transmission time on power consumption can be examined.

Table 2 Main differences between protocols that may be used in IoT applications

Standard	Low Power Wi-Fi	ZigBee	6LoWPAN	LoRaWAN
IEEE spec.	802.11 b/g/n	802.15.4	802.15.4	802.15.4
Max Data Rate	10 Mbps	250 Kbit/s	250 Kbit/s	5468 bps LoRa Technology modulation
Nominal range	70 m² indoors and 225 m² Outdoors	10-100m	25 -50m	5-15km
Frequency band (GHz)	2.4/5	2.4	2.4	433/868 MHz
Nominal TX power (mW) dBm	19.95	52.22	2.23	Adjustable with Max. Value + 14 dBm

b) Transmission Time and Power Consumption:

The transmission time relies upon the data rate, the message size, and the distance between two hubs. From Table 2, it is noticed that the transmission time for the ZigBee and 6LoWPAN protocols is longer than the low power Wi-Fi, because of its low data rate (250 Kb/s) and its long-range reasons. In long range connectivity, LoRaWAN requires more transmission time compared to small range connectivity protocols because its low rate data rate.

6. CONCLUSION

Internet of Things has gained the attention of almost everyone because of its capability of checking and controlling the climate. IoT helps making choices upheld by real data gathered utilizing large number of ordinary day-to-day devices that have been augmented with knowledge through the installation of detecting, processing and communication capabilities. One of the main and important aspects of any IoT gadget is its communication capability for transferring and sharing data between different devices. IoT devices mainly utilize wireless communication for communicating with different devices. It's seen that the decision of module for each protocol plays a vital job in battery life because of the distinction of power consumption for each module/protocol. The maximum range for transmission and accepting relies upon modules and protocols type. In this way, in feeling of distance impact on power consumption, there is no certain module or protocol can be candidate for IoT applications, because the distance relies upon the nature of application.

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