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A Review Paper on Emerging Areas and Applications of IoT

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Abstract

This paper reviews the emerging areas of IoT (Internet of Things) and their applications. Over the past decade, IoT has risen to prominence, driven by the rapid growth of smart devices and associated technologies, both from industrial and research perspectives. This connection to the internet has revolutionized the business world by enabling devices to collect and transmit data automatically. This data can be leveraged to automate tasks, enhance efficiency, and provide new insights into business operations. Consequently, machines have grown smarter, delivering greater value to businesses. As a promising addition to the business landscape, numerous industries are incorporating IoT technology into their processes and products.

Keywords—IoT, Review Paper on IoT, IoT Emerging Areas, IoT Recent Trends, Internet of Things

I.INTRODUCTION

In this paper, we have discussed what IoT is, how it is emerging, and how it automates business processes across various industries.

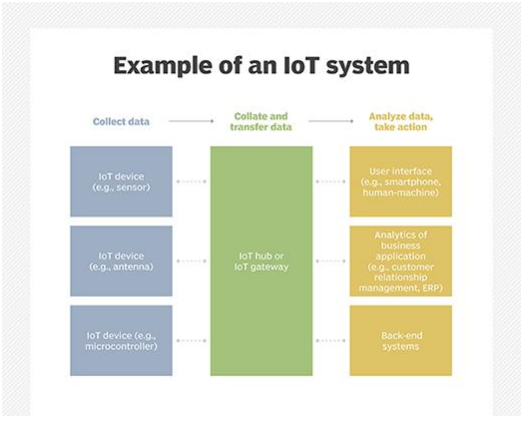

Fig.1 –IoT System

[1] Likitha's definition of IoT as the interconnectedness of physical devices, including appliances and vehicles, embedded with software, sensors, and connectivity, enabling these objects to connect and exchange data, is accurate. This technology facilitates the collection and sharing of data across a vast network of devices, creating

opportunities for more efficient and automated systems.
[2] The term "thing" in the context of the Internet of Things (IoT) refers to any object that can be assigned an Internet Protocol (IP) address. These objects have the capability to transfer data over a network, and they encompass a wide range of entities, including individuals with heart monitors, farm animals equipped with biochip transponders, or automobiles fitted with built-in sensors. These IoT devices operate by utilizing embedded systems to collect and respond to data from their immediate surroundings. They share sensor data with an IoT gateway, which can either transmit it to the cloud for analysis or analyze it locally. Smart devices often engage in communication with other interconnected devices within an IoT ecosystem, taking actions based on the information they exchange with one another. The majority of these interactions occur autonomously without direct human intervention, although individuals can interact with the devices for initial setup, provide instructions, or access the data they generate.

2. IOT ARCHITECTURE

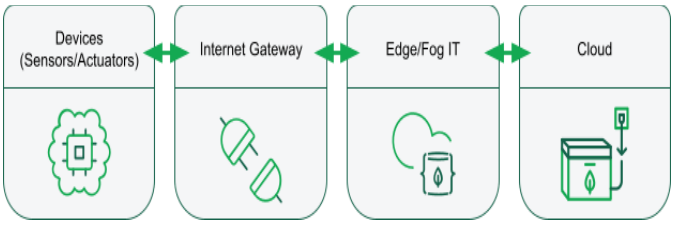

Fig 2 – Architecture of IoT

2.1 Devices

Devices maybe sensors or actuators in the Perception coating. Those tools will create dossier (in the case of sensors) or take action their atmosphere (in the case of actuators). The dossier presented is convinced in a mathematical form and communicated to the WWW entrance stage. Unless a detracting conclusion must ought, the dossier is usually shipped in a inexperienced state to the

next stage on account of the restricted possessions of the schemes themselves [3].

2.2 Internet Gateway

The Internet gateway stage serves as an intermediary between the devices and the cloud. It receives the raw data generated by the devices and performs pre-processing on it before transmitting it to the cloud. This Internet gateway can take various forms, either physically connected to the device or operating as a stand-alone device. It often communicates with sensors using low-power networks, enabling it to relay the data efficiently to the Internet, ensuring that the data is ready for further analysis and utilization in the cloud. [3].

2.3 Edge or Fog Computing

The concept of "Fog Computing" was introduced by Cisco Systems as a novel approach to streamline wireless data transfer within the Internet of Things (IoT) network framework. This model differs from the traditional approach where data, processing, and applications primarily reside in the cloud. In the Fog Computing model, these elements are concentrated in devices situated at the network's edge. The rationale behind this approach is to expedite data processing. By sending data to the edge of the cloud, it becomes possible to analyze the data rapidly and identify situations that demand immediate attention. This edge-based processing reduces latency and can be particularly beneficial in scenarios where real-time or near-real-time analysis and decision-making are critical.

2.4 Cloud

In the final stage, the data is stored for future processing. This stage is dedicated to in-depth analysis and resource-intensive operations, such as machine learning training. [3].

3. APPLICATIONS OF IOT

Many daily life applications are already "smart," but they often lack the ability to communicate and share useful information with each other. Enabling these applications to communicate and share data with each other has the potential to create a wide range of innovative applications. [4].

3.1 Biomedical

One of the advantages of medical IoT is its efficiency, which can address one of the most challenging issues in the medical field: accessing the correct information in highly dynamic environments. By leveraging IoT, we can guide medical staff and patients toward the most appropriate course of treatment, ultimately leading to higher levels of patient satisfaction. [5].

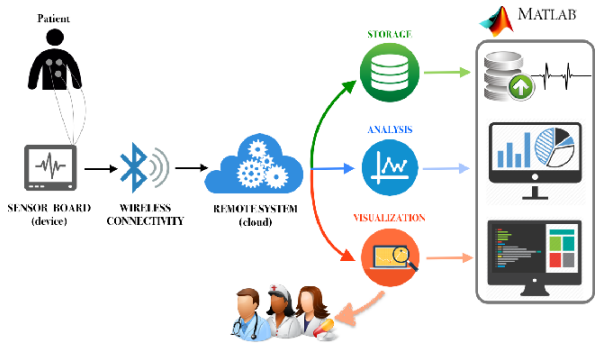

Fig 3 – Bio Medical of IoT

3.1.1 Remote Patient Monitoring

Healthcare professionals can remotely monitor patients thanks to various sensors capable of conducting specific tests on the patient's body. This remote monitoring capability is particularly advantageous for individuals who are chronically ill or elderly, as it allows for continuous healthcare supervision and timely intervention when needed. [5].

3.1.2 Real-Time Monitoring

Medical IoT devices have the capability to collect and transmit patient data, including information such as blood sugar levels, weight, and other vital data, directly to healthcare professionals. This capability enables constant patient management and timely intervention, contributing to improved healthcare outcomes. [5].

3.2 Mechanical

One of the significant contributions of the Internet of Things (IoT) is the establishment of a robust connection between mechanical systems and software-driven applications. With the emergence of Industry 4.0 and the continuous advancement of IoT and cloud computing technologies, the integration and control of mechanical equipment have become more efficient and streamlined. Industrial IoT has introduced a new opportunity for the seamless control of heavy machinery in factories through the use of actuators and smart sensors, ultimately enhancing manufacturing processes. [6].

3.2.1 Predictive Maintenance

In today's industrial landscape, machines used in factories and industries are maintained using IoT-based solutions. The days of conducting routine manual checkups to assess working conditions are fading away, as the modern world increasingly relies on digital solutions powered by IoT for the seamless maintenance of machinery. [7]

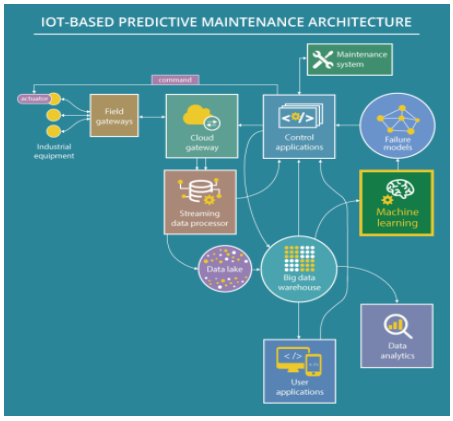

Fig 4 – IoT Based Predictive Maintenance Architecture

3.3 Agriculture

In IoT-based smart farming, a device is developed to collect data from the atmosphere and manage the irrigation of crop sectors efficiently. Farmers can monitor their fields from anywhere using satellite technology. IoT-based smart farming proves to be more effective than conventional methods. These IoT implementations not only focus on traditional, large-scale farming activities but also have the potential to support emerging trends in agriculture such as organic farming, family farming (including complicated or limited spaces, specific livestock or crops, and the preservation of particular high-quality varieties), and enhance transparency in agriculture. [9]

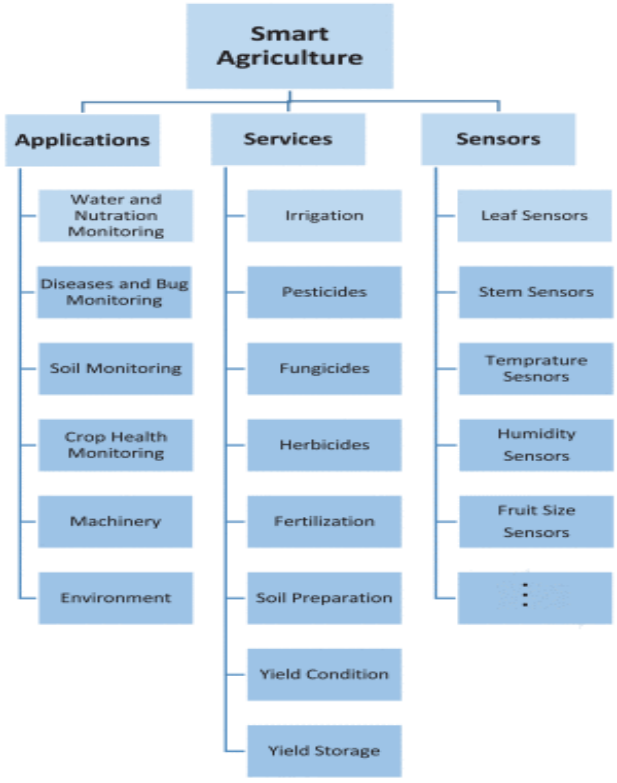

Fig 5 – IoT Based Smart Agriculture

3.4 Automobile

3.4.1 Real Time Automobile Monitoring System

The applications of IoT are vast and numerous. One such application can be applied to the automobile industry to enhance the quality and safety of vehicles. [10].

3.4.1.1Real time Monitoring.

Data is collected through sensors integrated into the automobile, and this data is then transmitted to a computing device functioning as a gateway. Subsequently, the sensor data is uploaded to a cloud database or a data visualization platform.

This data can be accessed by a mobile application, which provides live feeds and real-time information. Furthermore, users have the capability to set up an alert system to notify them when the driver exceeds a specific speed limit, when tire pressure is low, or when the driver deviates from the intended route. [10].

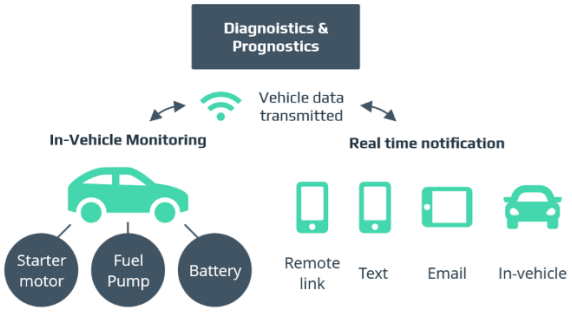

Fig 6– Real time Monitoring

3.4.1.2 Emergency Alert System

In the event of an accident, the system detects vibrations and impact. If the impact surpasses or equals the predefined average impact threshold that poses a threat to human life, an alert is promptly dispatched to the designated users. This alert includes details about the accident's location and the car's status at the time of the incident.

Additionally, this crucial information can be relayed to the ambulance service, ensuring that prompt assistance is dispatched to the accident scene, facilitating timely help for the victim. [10].

3.4.1.3 Vehicle Health Analysis

Data acquired from the vehicle can be logged and utilized for various classification and analysis purposes. The key parameters considered for classification include engine

temperature and tire pressure. Threshold values can be established for both maximum and minimum temperature as well as pressure to determine acceptable operating conditions and identify potential issues. [10].

3.5 Energy

IoT smart energy management aims to optimize energy efficiency by collecting energy information, managing demand response, and facilitating energy sharing and trading through the development of IoT-based smart energy platform technology. This approach opens up the possibility to create and implement new energy services that address critical societal issues, including the ever-increasing energy demand, peak power management, and adaptation to future energy trends.. [11]

3.6 Traffic Regulation

Traffic lights serve as the primary means for regulating traffic flows, and computer controllers are commonly employed to switch the signals of traffic lights in response to the constantly changing traffic intensity. To enhance the control process, controllers equipped with multiple programs (such as peak hour, daytime, and nighttime) are utilized. While multi-program hard-coded regulation helps reduce delays, it is not entirely optimal as it cannot account for the unexpected arrival of vehicles at intersections.

The solution to this challenge lies in adaptive control with real-time feedback to manage the traffic flow effectively. In this approach, controllers receive continuous information regarding the state of the traffic flow from transport detectors strategically placed within intersection areas. These transport detectors are designed to detect passing vehicles and gather data about the traffic flow's parameters.12].

4. CONCLUSION

IoT has been steadily ushering in a wave of technological transformations in our everyday lives, contributing to simplifying and enhancing our daily experiences through a multitude of technologies and applications. The applications of IoT span across numerous domains, encompassing medical, manufacturing, industrial, transportation, education, governance, mining, habitat, and more. This paper elaborates on the utilization of IoT in various applications, highlighting its current and future role in shaping a "connected" and "smart" human life.

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