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A Comprehensive Review on Smart IoT Applications

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ABSTRACT

The Internet of Things (IoT) is a network of physical devices that are integrated with technologies including sensors, internet connectivity, and hardware that transfer data continuously. The IoT's linked gadgets can collect, receive, and exchange data with other IoT devices. IoT offers a large range of applications, including smart homes and smart appliances. This paper discusses on the IoT products, and the technologies used in clever home, smart grid and smart health which would help readers and researchers to understand the significant of IoT Domain applications. For homes, several applications such as smart lighting, smart appliances, that can remotely monitor and controlled.

Keywords: *Application, IoT, Smart.*

1. INTRODUCTION

The applications of smart devices are becoming ever more popular and is slowly becoming present into our daily lives. Many modern types of technologies have embedded IOT components which adds extra intelligence towards that specific technology hence making it "smarter" [52-54]. IOT devices can be deployed into different aspects of life and bring about many types of uses. In this specific section, we will be taking a closer look at three specific applications which include Smart Home, Smart Grid [48-51] and Smart Healthcare [55-58]. All of these applications will be discussed in more detail, as it has been considered as very modern and carries an upcoming influence on the way society carries out their daily tasks.

2. SMART HOME

According to [5], the infrastructure of Home Energy Management System (HEMS) in Figure 1 is made up from a smart HEMS center, smart meters, communication and networking system and other home appliances. Whilst all of these infrastructures are being utilized, HEMS can access, monitor, control and optimize the level of performance for different kinds of Distributed Energy Resources (DER's), Electrical Vehicles (EV's), and household appliances. In addition to this, HEMS is able to execute full support integration of any sort of smart appliances and smart homes as well as performing two-way communication with the users and electrically powered utilities. When it comes to communication and networking system, HEMS has been specifically designed following different types of schema alongside with the implementation of certain hardware components. These hardware components include ZigBee, BACnet, Bluetooth, power line communication and human-machine interface systems. Through the help of these active sensor networks which basically consist of various sensor and actuator components, HEMS is able to perform integration of different types of physical sensing information and is able to take control of different types of household devices. Zigbee can also be used the proposed HEMS infrastructure. As stated by [45], Zigbee is basically a wireless communication technology that has brought about many developments in the networking sector. ZigBee takes full advantage of 2.4G–2.4835GHz frequency bandwidth as it is the most common frequency throughout most parts of the world. In addition to this, ZigBee is very beneficial as it is It operates well in industrial settings because it consumes very little power, uses low-cost technology, and can handle a large number of network nodes. Smart meters are another example of advanced infrastructure that can measure energy consumption. to power utilities using a two-way

communication plan. This will then help customers to make suitable decisions to choose the appropriate amount of electricity usage for in-home appliances. The two main functions of smart meters include supporting two-way communication and collecting relevant data through smart gas meters and water meters. The third infrastructure to be discussed is the smart HEMS center. The It is easy to classify the smart HEMS center as the entire brain of the smart electricity home given that it is the main module of HEMS that handles the smart energy management. Generally, Smart HEMS are located in a user's home as home appliances. receiving a huge amount of data sent by smart meters, main control panel and real-time display, offering a friendly human-machine interface and provides full support of any user's real-time browsing, online monitoring and task setting in order to A HEMS final infrastructure is home appliances and energy storage devices. The average type of house appliance and energy storage device can be identified. The application of DERs, energy storage devices, and electricity regulation of EVs plays an important part of HEMS. through various types of characteristics and usage preference. In order to do this, smart home appliances can be subdivided into two types of categories which is schedulable and non-schedulable home appliances. Schedulable home appliances are basically any appliances that can be switched on or off at any time such as washing machine, air conditioner, iron and water heater. The examples of home appliances that are non-schedulable include refrigerator, printer, microwave, hair dryer and television. In addition to this, schedulable appliances can be further subdivided into two more categories which is interruptible Based on the operating time, certain appliances are interruptible and others are non-interruptible. The non-interruptible appliances use fewer resources since they require fewer interruptions. are usually locked down towards a period called 'hold-time'

3. SMART GRID

According to [32], smart can simply be defined as something which is very intelligent and stylish that functions in an automation. A grid is basically a network of electoral conductors that send or transmit electricity to specified areas. The main difference between a smart grid (Figure 2) and a conventional grid is that a conventional grid can only transmit electric power whereas a smart grid is much more intelligent as it can accommodate the actions of all the users that are connected to it such as generators and consumers. In addition to accommodating these actions a smart grid goes one step further by delivering efficient and sustainable electricity to various supplies. From the research done by [18], it clearly shows the differences between a conventional utility grid and a Smart Grid based upon various characteristics. The infrastructure of the Smart Grid system always follows a certain set of rules. When a Smart Grid is deployed it can vastly increase the capability and capacity of the grid. The National Institute of Standards and Technology (NIST) developed a conceptual model which clearly follows the planning, requirements of development, documentation and the organization of all the connected networks that represents the Smart Grid. NIST has divided and explained the Smart Grid into seven domains that also consists of some sub-domains. In addition to this, the model can also be categorized based upon actor devices such as smart meters and solar energy generators, systems such as control systems, programs and also stakeholders. All of these mentioned actors are responsible for making final decisions and swap information wherever necessary for performance of any sort of applications. Actors that are grouped in the same domain often share the same objectives.

4. SMART HEALTH (S-HEALTH)

On the basis of Figure 3, Smart Health (s-health) can be characterized as the use of smart city sensing infrastructure to coordinate various health services. According to [41], s-health can be classified as a part of e-health because it is based on e-technology. When it comes to s-health, for example, there's always the possibility that the specified mode of communication will be mobile or not. Figure 4 depicts the known examples in detail to assist eliminate any ambiguity and to further illustrate the essential points. aim of the mentioned concepts. Case 1 – This is where traditional health and treatment takes place. A doctor will visit a patient and treat them with the traditional medical tools, this whole process does not involve any sort of ICT device. Case 2 – E-Health usually means the application of databases and using electric health records to store medical details of the various patients. Case 3 – M-Health, this category of medical action is when a patient is able to check their medicines in a remote manner in personal mobile devices to always be informed on what medications they need to take.

The m-Health which was just mentioned is a subsection of e-Health, in which makes full usage of medical devices for approaching the medical related diagnosis or statistics. Case 4 – S-Health, this activity is where the patient will receive information from a cooperative information in which it will be able to check the level of dust recorded and in addition to this, checks the pollution for which any individual has any sickness.

This interactive pole serves as a source of information for patients, assisting them in avoiding locations that may be detrimental to their health. Patients will also be able to determine the optimal route to a location based on this new information, as well as learn about nearby pharmacies where they may acquire medical medicines. Case 5: M-Health and s-Health in Relationship This notion can be

shown by a biker wearing a bracelet with built-in accelerometers, with accident detection as the device's primary monitoring feature.

The body sensor network supports in detecting a person's fall and it provides immediate feedback. When the system obtains the alert, the traffic condition is assessed, and an ambulance is initiated via the best route possible. Furthermore, this can be made possible by dynamically adjusting the municipal traffic signals to drastically reduce the amount of time the ambulance spends stuck in traffic before arriving at the scene.

These explanations reveal that s-major Health's goal is to assist promote health to older citizens in a community in a more efficient and secure manner by employing smart city qualities, whereas m-Health is identifying new examples of pervasive fitness.

5. CONCLUSIONS

This paper discusses on the IoT applications and the technologies used in smart home, smart grid and smart health which would help readers and researchers to understand the significant of IoT Domain applications. For homes, several applications such as smart lighting, smart appliances, that can remotely monitor and controlled.

Besides, for energy system, application such as Smart Grid delivering efficient and sustainable electricity to users. Wearable IoT devices such as bracelet or wrist band help in continuous health and fitness monitoring. All of the applications create and provide much value to end users and community.

6. FIGURES AND TABLES

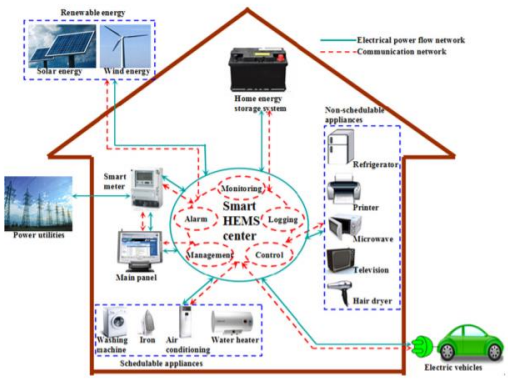

Figure 1 Home Energy Management System (HEMS)

Source: Zhou *et al.* 2016

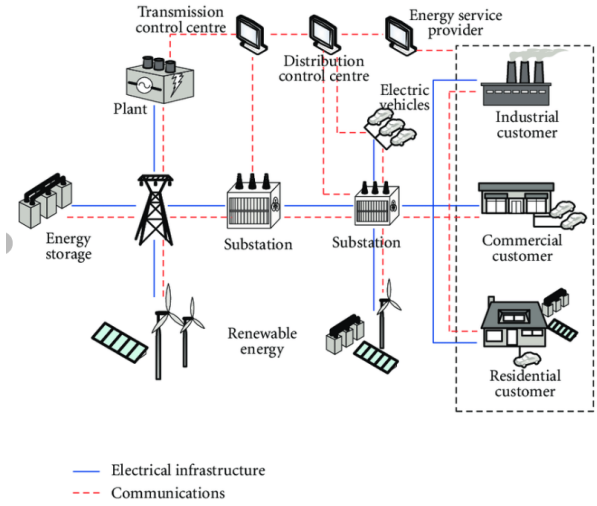

Figure 2 Smart Grid

Source: Tuballa & Abundo 2016

Table 1. Domain Description of Smart Grid.

Domain	Description
Customer	Where is electricity used? Customers are divided into three sub-domains: residential, business, and industrial. Energy can be generated, stored, and managed by actors.
Markets	A grid properties are transacted in this market. The participants and operator in the power markets are termed as actors.
Service provider	The support services are received by the customers, producers and distributors. Actors are companies that provide electricity customers and utilities with services..
Operations	Where the electricity system's correct operation is guaranteed. Actors are in charge of the flow of power.
Bulk generation	The point at which power is delivered to the customer. Actors are large-scale generators of electricity who can also store energy for subsequent distribution.
Transmission	Where power is exchanged in bulk between generation and distribution. Actors are considered as the higher distance transporters of electricity.
Distribution	Actors are the people responsible for distributing electricity from and to clients. They are involved with distributed generation, distribution metering, and distributed storage..

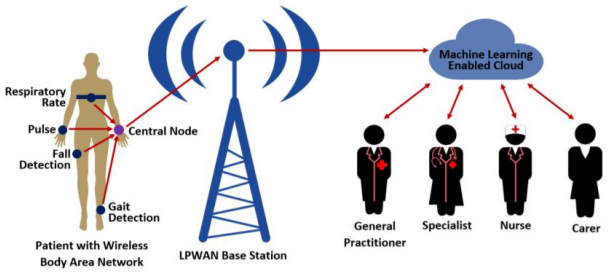

Figure 3 Overview of proposed model

Source: Baker *et al.* 2017

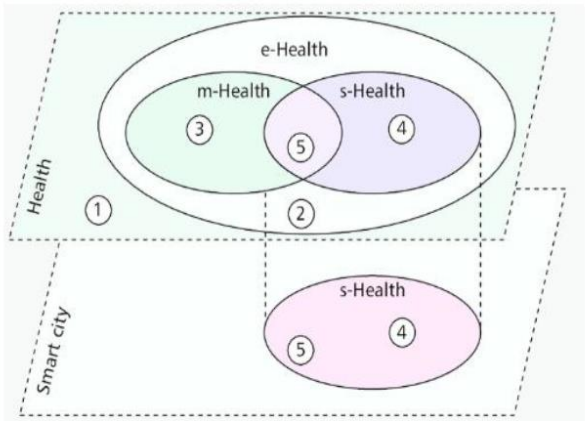

Figure 4 Smart City and Smart Health

Source: Al-azzam & Alazzam (2019)

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