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State-of-the-art Prototypes and Future Propensity Stem on Internet of Things

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Abstract*: We all are living in the era of the internet that too up to the next level where each and everything has been connected to the internet. IoT has become much more popular these days with the advancement of technology and connecting physical world with the virtual world making the life of individual's and organization easier. Recently IoT becomes more popular in the research area where many research articles have been published and reviewed. Its capacity to get associated with everything whether it's human, object, innovation, things, and so forth drawn numerous chances of advancement and extension in future. The way the technology has been evolved recently in every field we see rapid changes in the products, services, things that we are using in our daily life. IoT is platform that has becoming popular due to its simplified technology which benefits the individual's as well as organization and end-users. Today's IoT has given many opportunities to make easier life, effective communications and stay connected to our close and society by enabling many technologies but there are some issues which are the major concern of IoT and these issues must be resolved so that IoT can be used as revolutionary technology in future. This paper focuses on state-of–the-art porotypes on IoT, basic prerequisite in the IoT, role of big data in IoT. Enabling technologies, technology used in various applications such as smart city, agriculture, health-care, lifesaving, smart parking, urban planning. We also explore the applications of IoT and its future propensity, its architecture and comparison of IoT with H2M and M2M.

I. INTRODUCTION

Today we all are using internet in our daily life whether we were aware of technology or not but everyone was using internet through there smartphones, personal computer. IoT has taken the internet to the next level where it connects physical things to the virtual world and all of us were benefitted by using its enabling technology. It's not wrong to say that that we all are living in the world of internet and all of us were much dependent on internet due to dynamic network and making it efficient and easier. Here the questions arise what is IoT? Basically, IoT connects everything's whether it is an object, things, humans, heterogeneous devices to the internet through which communication and transfer of data were done [1]. Another important thing about the internet of things is that it is main source of big data and voluminous amount of data were generated by devices such sensors, digital devices, social media, gadgets, wearable devices and many more where the role of data analytics plays an important role [2]. The data generated by applications are of various types such as unstructured, semi-structured data and structured these data named as "big data" [3][76]. There are 5 v's of big data namely volume, variety, velocity, value, and veracity [75]. Now of some us get confused with the meaning of big data analytics what it means actually, basically big data analytics involves the processing and analysis of data by using technology, methods, and tools that reconstruct the heterogeneous data i.e., unstructured, semi-structured data and structured data into that format which is suited for analytical process and also in understandable format for the users [2]. Most of data sources were from different sources, formats, devices with relatively high speed and volume, therefore, we have to integrate multiple sources and formats for analytical solution. Therefore, today the performance of algorithms become a challenge in terms of time and cost with increasing resources of data [4].

Now we are talking about the vision of IoT what does it mean, we need to know about the vision because as a human we see the things from various point of view. Vision of IoT is to associate things over web at anywhere, anytime and anything by using the smart environment [5]. By studying about IoT many readers may get confused what actually the meaning of internet of things, basic idea about this concept and reason behind this confusion is due the name "Internet of Things" as it itself contains two things one is internet and second is things. The first name gives the concept of internet and second focuses on the things that to be integrated into IoT architecture [6]. But as we know that almost everything is connected in internet and all of these objects must need to uniquely identified as we all humans have our owns identity, so to avoid unauthorized accessed and reducing privacy issues each object must have unique identity. The third concept that runs behind the IoT is the semantic oriented means the meaning of each data and attribute should be known so that no ambiguity takes place as many of the data were closely related to each other and if their metadata is maintained then how to represent these large data and their storage will very much easier in this semantic technologies and tools will play an important role [7]. There are three vision of "Internet of Things" i.e. Things oriented, Internet-oriented and semantic oriented.

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Things oriented means objects which is connected to the internet for communication and transfer of information, here the object means human, things, objects, spime, RFID, UID, smart items, everyday objects. As for our situation, we as a whole have our very own personality in the public eye with which we are recognize in world also the things associated over web need to particularly distinguish to process the information created from gadget for finding valuable bits of knowledge. Many institutions focused on the concept of "things" in IoT and if IoT has to fully deploy then it must focus on things intelligence first. Thus, the concept of spime means an object that be traced lifetime having unique identity, sustainability through space and time [8]. Therefore, there must be given prior focus on things so that objects connected to devices have unique identity and analyzing these objects gives us accurate results. CASAGRAS focus on "world where things automatically connected to each other and communicate to computers and gives benefits to the humans". Next is internet-oriented vision this vision is necessary for making the things connected to the internet and objects connected to the internet must follow IP protocols which is necessary for any object in the world to be connected to internet. It needs powerful addressing policies and day by day IPV4 addressing nodes were decreasing and it is not wrong to say that it will soon become zero. So other policies must have to be used in future such as IPV6 have been proposed to address the node having 128 bits in context with 6LoWPAN [9]. Third vision is semantic oriented as some data are very closely related to each other and some having same meaning so to make efficient prediction and decision making we need to know the exact meaning of the data i.e. the metadata of the data. As number of devices and items involved in the future of internet thus the issues regarding how to representation of data, analyzing it and storing it need strong semantic methods and they will play important role. If we were able to analyze the raw data, differentiates between them and able to make homogenous, non-homogenous sets and how to interpret the data reduce the issues regarding the processing of data and also enhances our ability to understand the data well. Fig.1 demonstrates the vision of IoT which make us all the more understanding about the network.

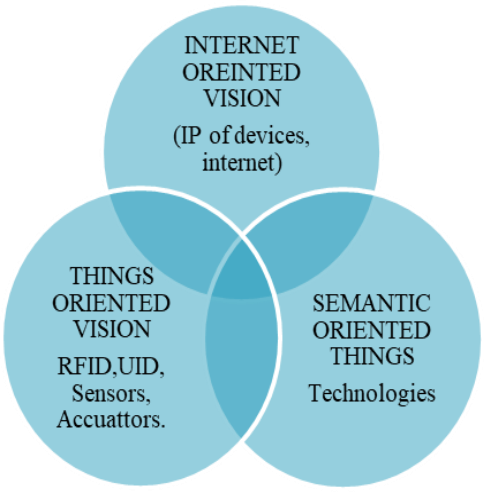

Fig. 1.Vision of IoT

In this paper, we have discussed the various works done in the field of IoT i.e. literature review. Next section we have discussed the enabling technologies emerging in IoT after that service-oriented architecture of IoT also listed some projects which were not based on service-oriented architecture. Next section focused on the applications areas of IoT and some of the issues in particular application were listed and after that lifesaver tools used in IoT was also discussed in detailed. Lastly, the open issues and challenges faced in IoT environment were discussed in from the future point of view. In Table I the abbreviations utilized this paper has been recorded as it is preposterous to expect to compose the full structure everywhere:

Table- I: Abbreviations

Abbreviations	Full-Form
IoT	Internet of Things
RFID	Radio Frequency Identification
SoA	Service-Oriented Architecture
QoS	Quality of Service
UUID	Universal Unique Identifier
VANET	Vehicular Ad-Hoc Network
SVM	Support Vector Machine
LDA	Linear Discriminant Analysis
NB	Navie Bayes
WSN	Wireless Sensor Network
EPC	Electronic Product Code
UV	Ultra Violet Rays
CAPS	Centralized Assisted Parking Search
PGIS	Parking Guidance And Information System
COIN	Car Park Occupancy Information System
ABGS	Agent-Based Guiding System
NAPS	Non-Assisted Parking Search
TBIS	Transit Based Information System
OAPS	Opportunistically Assisted Parking Search

II. RELATED WORK

With the advancement in IoT technology and its popularity among people that everyone now using IoT based applications, our motivation in this research study is toward its applications, opportunities, standards, challenges in IoT environment and its architecture.

Table II summarizes surveys done in the various applications, security and protocols conducted in the application of IoT:

Table- II: Works conducted in the application of IoT

Citation	Protocol	Security	Lifesaver	Smart agriculture	Smart city	Forensic	Health-care	smart transportation
[1]	✓	✓	✓	✓	✓		✓	✓
[61] [62] [63] [64]		✓				✓		
[41]		✓		✓				
[44] [45] [46] [47]	✓	✓		✓				

Country	Projects	Contributions/objective	References
European	IERC	They have sponsored number of projects for the fundamental research on IoT.	
	ETSI	Responsible for making the policies regarding the IoT.	[12][13][14]
Japan	u-Japan x ICT, 2008	Implementing IoT in daily life work.	
	I-Japan strategies, 2009		
US	ITIF	New IoT technology in ICT improves the traditional communication system.	[15] [16]
		Positive impact on innovation and productivity	
		Focused sectors were health-care, energy, broadband technologies, and rural utilities.	
South Korea	RFID/USN, new IT strategies	Enhance the IoT infrastructure	`
China	Sensing china	Objects have identity tags so that they can be traced on internet.	

[60] [61] [66]	✓	✓	✓	✓	✓	✓	✓	✓

IoT grab the attention of researchers, as a result, many research studies have been made in this field and were conducted its review. In last decade, applications based on RFID were widely used in logistics, retails but with advancement in the sensors, wireless sensor network with low energy consumption came up and were used for communication, applications, transfer of data with increase in numbers of connecting devices and nodes [69]. Objects connected in IoT with sensor devices must independently able to transfer data and communicate with each other [70]. The evenness of Internet of Things depends which provide reliability, interoperability, scalability, compatibility, effectiveness, and connectivity with everything made it successful. To achieve this many standard and protocols have been developed and much country's which realize the power of IoT whether it's a developed or developing country has given their national strategies. Information technology and innovations foundation (ITIF) of united stated designated that to advance the infrastructure of traditional information technology and to have greater impact on productivity and innovation new ICT will be very powerful. The strategies given by developed and developing countries listed in Table 3:

Table- III: Strategies given by countries

Reference [10] has compare the data mining algorithms for confusion matrix, accuracy and execution time for IoT data namely SVM, KNN, NB, LDA C4.5, C5.0, ANN and deep learning ANN from which c4.5, c5.0, ANN, DLANN outperforms in term of accuracy, NB AND LDA have fast execution time in which LDA has better execution time compared with NB. Some authors also introduce a framework where they study the underwater things that is internet of underwater things (IoUT) where they used MapReduce to process and analyze these data and find the in comparison to SQL, MapReduce shortens the processing time of query, having many advantages of this framework but the application of scalability protocol and trust-based admission control need to address for the future generation [11]. Some reviews were done on the enabling technologies in industries but M2M not discussed by the reviewer in [57]. Many things now as days were done in the field of agriculture and many literature reviews also have done specifying their challenges, areas where IoT can be applied and benefits [60]. Reference [58] focused on the technologies applied in the smart city, transportation and health care from physical layer to application layer. Here in my literature survey, we had also reviewed lifesaver tools where it can be applied and [59] discussed the applications that were used in healthcare and also proposed some solution. In smart parking, much work had been done and many surveys were done focusing on their advancement, methods, challenges and some issues also. These days IoT has becoming more important and its application in transportation and parking influencing for the smart city and better urban planning by intelligence systems and sensors and it is also helpful for sustainable environment condition for future [17]. Smart parking recent advancement, work, future need, enabling technologies, sensors, importance of data reliability, security, privacy, hard and soft design factors and lastly open research issues and also recommend a conceptual hybrid parking system were discussed [18]. VANET (Vehicular Ad Hoc Network) where several vehicle can communicate with each other having nearby range and roadside units which provide better navigation for parking system and if drones were integrated with vehicles sensors then many problems regarding smart parking will be solved [19]. As now a day everything were connected to the sensors same in the case of vehicles and for this faster and efficient wireless communication needed such 5G but the hardware and software need of system will degrade the performance of system [20]. Table IV consists some of the work done in IoT field:

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Table- IV: Related work done in IoT

S. No	Authors	Findings	Tools /Technology	Result Or Application	References
1.	Bashir and Gill	Proposed IoT based big data analytics framework for analyzing and storing smart building data.	Framework: Cloudera Hadoop Analytics: PySpark.	Framework can be used as generalized for smart city and smart airplane.	[65]
2.	MM Rathore, A. Ahmad, A. Paul,	Proposed smart city management system,	Using MapReduce Hadoop ecosystem in real environment. Hadoop with Spark is used for data processing	Developed smart system yet to be developed and accuracy was not tested	[66]
3.	Arora	Use big data and analytics techniques to classify network-enabled devices, compare four algorithms SVM, KNN, random forest, Naive Bayes	Machine learning algorithms	Random forest has highest accuracy and naive Bayes has lowest accuracy.	[67]
4.	Rathore	Proposed that deals with issues of smart cities	Using Hadoop framework	Proposed is more scalable and efficient in throughput and processing time but lacks intelligent decision making.	[68]
5.	Idris	Proposed image processing technology	RFID Technology	Recalling of parking spot contain duration which	[21]
			with SPS	calculate the fees of parking.	

III. TECHNOLOGY EMPOWERED IN IOT

As internets of things were widely used by various applications, their main work is to transfer the data through devices over the network. As the large number of devices were connected to the devices and large data were generated we need improve and advance technology for efficient working of IoT application. Instead of using traditional technology we need to give emergence of new technology for proper communication and analysis of data. Many technologies has been developed in IoT such as barcode, WSN, ZigBee, RFID, EPC, IPV6, Bar code but the cost of deployment and its efficiency is major concern of any technology used in IoT. Working with IoT technology need some important technologies and we need to understand the different technologies i.e how it establishes the connection with object to the internet which components were needed to make connection, communication and how the things were processed through which we retrieve the data. Here is key idea of such things which gives an overview of things:

A. Identification, Sensing and Communicating Technologies:

Internet of things in the physical worlds with virtual world needs integration of various technologies to enable the communication for information exchanges. Nowadays we get any information within an instance of time, we were connected to our close ones and using the application which makes our everyday routine very simple. All we need our mobile phones to get connected with people and share our feelings, doing work, tracking direction and much more. These were possible on by using IoT concepts. How do we get connected to the things and do lots of work, first of all, we need to connect with objects that senses and generate data. Today we access information “anytime, anywhere, any media” this is ere of internet through we reach all over and many advancement has been made in communication technologies. Wireless technologies play an important role in the communication with reduction in cost, energy consumption, processing time and the ratio between human and radio is nearly one to one [22].

RFID systems are the key component of the IoT composed of readers, one antenna and RFID tags. Tags are the unique identifier which identifies the object whether it is anything i.e. human, object, animal, and readers generate the signal through which the objects were connected with internet. As RFID were implemented using radio waves they don’t need line of sight for making communication between uniquely identified object and system they only need the range of the object. There are two types of RFID one is passive and other is active. Passive RFID do not have power supplies they harvest energy supplies from query signal for transmission. Active RFID they batteries for energy supplies and they have wide range but having higher cost.

Sensors network is another important component of IoT and has been widely used in many applications such as in military, transportation system, e-health, education many more. Sensor network with RFID system can help in better tacking of things such as location, environmental condition, and temperature. If we integrate sensor network with RFID system new applications with increased capacity can be used.

B. Protocols and standards in IoT

The security, privacy, networking, communication issues in IoT environment, some protocols have been defined which works on these issues and some standards have also been provided so that everyone should follow standards. Many organizations have given their standards which plays a major role in the achievement of IoT. These standards were mainly for the middleware which provide IoT to work properly.

Many research studies have been done in this particular area which mainly focuses on the policies and architecture, user security and privacy, network security, development of new standards and new technologies enabled. Many countries focuses on the standards of the IoT and many have given their standards also. Many organizations were working on the primary standards defined for IoT but they need to be integrated with other standards which manage its consistency and adaptability between all standard bodies. Various standards have been made for different technologies in IoT the glimpse of it listed in Table V:

Table-V: Various standards for different technologies in IoT

IoT TECHNOLOGIES	RESPECTIVE STANDARDS
Communication/ Network	ZigBee, IETF, IEEE 1588, CoAP, RPL, 6LoPAN, IEEE 15.1, IEEE 15.6, IETF SNMP WG, ITU-T SG 2
RFID	ISO 18000-1, 18000-2,18000-3, 18000-3,18000-4,18000-5,18000-6,18000-7, RFID tags, RFID interface protocol- ISO 11785
Data	EPC
Sensors	ISO/IEC JTCI SC31, IEEE 1451.x, EPC global, ISO TC 211
Quality Of Services	IETF

These standards have their own objectives some of them were used and some of them were use in future. I talk about the EPC global it mainly focuses on the unique identification of tags which are accepted globally also known as electronic product code [71]. European Committee for standardization (CEN) interested in the RFID involved in IoT, some of their working groups are WG 5 RFID and WG 1-4 BARCODES which was 2 years project done by GS1. Apart from this ISO [72] focuses on the technical part of the IoT due to which it was facing the issues and challenges. European telecommunications standards institute in this machine to machine (M2M) committee was launched and it is real things happening in the IoT but few standards were made regarding this. IETF groups were focuses on IPV6 with low power in personal area [73] and ROLL [74] were focused by them which was routing protocol. Table VI consists the meaning of various standards used in IoT:

Table-VI: Various Standards and It's meaning in IoT

Standards	Meaning
Machine to Machine	Is an ongoing standards used in the market having cost-effective implementation for M2M.
ROLL	Is used for the routing protocols having low power consumption for different nodes.
EPC global	Combining RFID into EPC due to the haring the information's of products become easier.
ZigBee	Cost-effective, reliable, low power products
GRIPS	Mainly focuses on RFID standards
NFC	Used for two communication protocols and low power consumption
Wireless network	Self-healing, self-organizing

IV. SERVICE-ORIENTED ARCHITECTURE OF IOT

Much IoT architecture has been proposed till date but not a one architecture is considered its basic model architecture, the reason is its dynamic network applications and dynamic users using it according to their need. Basically, the reference models of IoT describe the bonds between the various things connected to it and also define the rapport of other applications how they were interlinked with each other. Many architecture were upon the data abstraction considering it as standard and several architecture were found in the literature study [23][24][25], some of them considering cloud computing at the center and provide end to end connection to the end-users. One of the architecture were given [26] based on the combination of big data analytics and IoT having sensor layer, network devices, IoT gateway, upper layer mainly focused on big data analytics containing API and dashboard. Today many of the architecture were now using SoA approach but some of them were not using this approach. An important aspect of IoT is that everything must be interconnected and the architecture should be like that which covers the gap between the interconnection of physical world with the virtual world. Architecture of IoT must consider some important factors such as security, scalability, networking, considering its business model and most important the operability between the different devices connected to the IoT, by keeping the fact in mind that thing in the architecture move geographically anywhere and should interact in real-time. Architecture must be adaptive in nature that it can communicate with each other in dynamic network inefficient way and have decentralized dynamic nature.

In context to these factors SoA based architecture can fulfill this requirement to provide the users service they need. SoA based architecture support the interoperability of devices and make complex system into simple set of objects [27]. The fig. 2 shows SoA approach architecture consisting of four layers:

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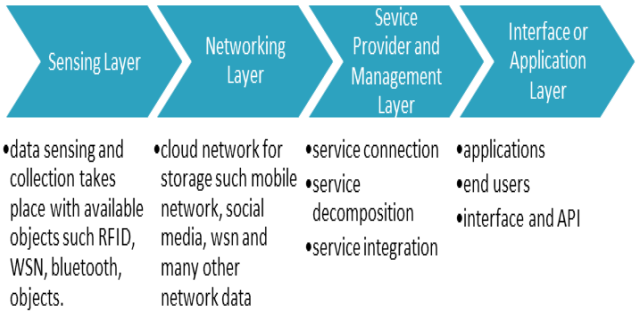

Fig. 2.SoA for IoT

The service-oriented architecture of IoT consists of mainly four layers namely:

- Sensing layer: this layer sense the objects with the help of sensors and collect the data.
- Networking layer: it provides the connectivity of devices and objects with the network with help of wireless or wired connection.
- Service provider and management layer: is used to manage and create new services for the users.
- Application layer: it provide interface between the users and the services.

Some of the software and hardware component can be reused in IoT and some objects are used again so based on this SoA architecture now days were used widely in the world. When service-oriented approach used in IoT then it provide scalability, reliability, add functionality to it and extend it capability to connect the things and move things geographically [28].

A. Sensing layer:

As we all are generating the data by using various devices and voluminous amount of data were generated in the world as earlier mention. In sensing layer the smart sensors and devices are there which sense the surroundings and collects the data automatically and transfer the data. As in a world, every human has its own identity similarly the objects connected in an IoT environment have their digital identity which identifies them uniquely and tracked easily. UUID is the technique which provides the identity. There are some factors which need to be considered:

- Network: which types network were used for connecting things
- Cost, resources, energy consumption: devices should be designed in a way which optimized the used of resource consume less energy.
- Accessibility: the devices must be able communicate with themselves and must be retrieve
- Protocols: is must as IoT connect heterogonous devices and there must be rules to deploy them in-network

The basic functionality of sensing layer is sensing, actuating, identifying, interacting and communicating.

B. Networking layer:

In this layer, the devices are connected in the network and communicate with each other to transfer the information and here the objects were aware of everything. Here the data can be exchanged and used for decision making, also can be used in complex system. We must assure that we can interlink the relevant things so that our communication can be reliable and authentic. The communication involve in the network must have QoS (quality of service) so that users can get reliable service [29]. There are some issues in network layer which need to address in future:

- Security and reliability
- Privacy
- Authentication and Authorization
- Energy Efficiency and Network Management
- QoS
- Robustness

C. Servicing layer:

This layer basically lies on the middleware which is between the network layer and application layer. It hides the information which is not necessary for the user it only provide the useful information to the user as well as to the programmer. Programmer needs not to worry about the things or issues which were not relevant to his/her need for the deployment of the application. Middleware nowadays following the SOA approach in their layers which makes the integration of complex system into simple and easier manner. SOA approached architecture use common protocols standards to which is enabled many business enterprises to interact among themselves by reducing time in context to change in the market prediction situation. It provide the functionality such as create new services, service API's where it provides the interaction between the services needed by the users and service composition.

D. Application or Interface layer:

Here it provides the compatibility among the users and application so that they use the service efficiently and properly interact with the devices. They provide trust to the end-users and platforms to perform their actions.

V. FUTURE PROPENSITY & APPLICATIONS IN IOT

As IoT has extended its capability in almost all area but only in some areas the IoT environment used very efficiently but in most of the places due to some issues it can't be used very easily. But as we see changes in our society in respect with technology it has changed the lives of individuals and most of us taking benefits by using the online services. Can we think what made human different from other living being?? The answer is that we humans can think and have curiosity of knowledge of everything and questioning about everything which make take internet to the next level and thus we developing IoT technology solving our problems. There are many applications or areas where IoT has been used and they were briefly explained below. Here an overview of IoT applications was listed in fig.3:

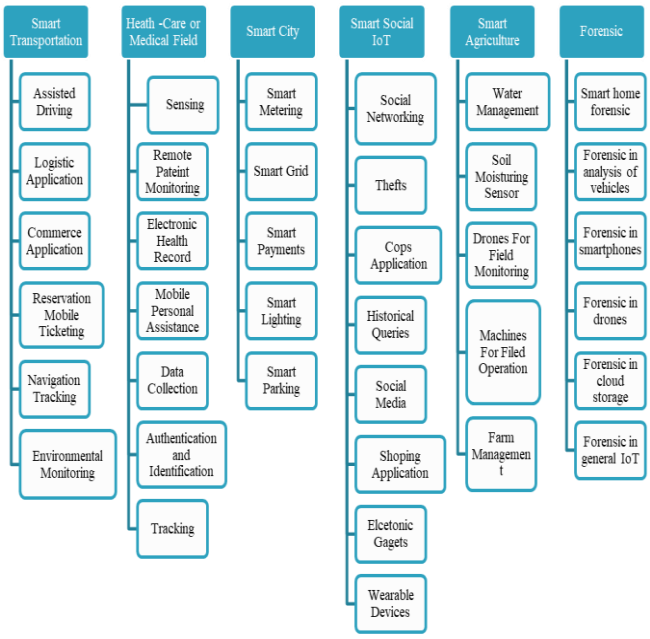

Fig. 3. Applications of IoT

A. Health-Care or Medical Field

Health-care for every living being is an important part which cannot be neglected and plays an important role in everyone's life.

Whether we develop many things and earn large amount money but if our health is not in right all things are useless, therefore we can't neglect our health issues. Keeping this point in mind the IoT has developed many things in the health domain but it considers that a lot of things need to be developed and many issues regarding it must be address to make it successful. Many of the research in health care were going on and many studies have done. We address some of the work done and in what areas the IoT has applied in the health care has been discussed. Above in the figure listed that where internet of things has been applied in the health care. Some of the lifesaver tools were also used in the medical field to help the patient and doctors. In Table VII some of the lifesaver tools were listed:

Table- VII: The lifesaver tools

IoT Lifesaver tools in medical field	**Specification or Application**
3 D Printing Pills	• This is the recent application in the medical field and came into existence because of the personalized health care routine for patient having based on their body type [30]. • 3D pills have built-in chip within themselves which upon swallow in the body study and record the medicine effects given to the patient and then transmit the data to the wearable devices used later by the patient or expert [31].
Google glasses	• It is a special types of glass by wearing it detect and record the patient's disease and various health-related information in the body and these records were analyze by the specialist so that it can properly give advice to the patient [32]and can be used globally to connect with the specialist and make improvement in the patient health .
Wearable Devices	• Now a day's many of us wearing the devices which record our health-related problem and store it in the cloud so that specialist can analyze the record and it is proves as well-being for the individuals that gives them health-related information [33].
Wheelchair	• Handicapped people or old age people were much dependent upon others for their daily work so to eliminate their dependency smart wheelchair were developed[34] • Their primary motive is to reduce the time required for the movement of wheelchair by integrating it with sensors and artificial intelligence [35].
Chips on organ	• They are the microchip used for the development of primary functions part by imitating cellular structure and replicating organ [36]. • They gives us real-time analysis of our body organs and basically used in the drug testing [37].

We also know that in medical fields everything recorded by the devices, even we can itself record or measure our BP, sugar level and many things. Their many intelligence devices integrated with sensors which generates data, analyze them. Many of us can contact to the doctor online if we are not able to reach or vice versa and we can also make appointment for our close ones if we were not present there physically. Now a day's UV level can be monitored by the ultraviolet radiations and tell us which are have high radiations at a time [38]. Now sportsmen care notifies them by monitoring their daily activity when finds degradation in their performance. Smart health management regarding the respiration of patients and their need of emergency were now focused [39].

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B. Smart Transportation:

Today the transportation systems are becoming smarter by using IoT technology. All cars, bikes, truck; buses were now using smart systems for their protection. IoT can also help them for avoiding any kind of accidents or robbery on runways. There are many areas where we are using IoT technologies such as transportation and logistics where we can track our products and vehicles on system. We can easily track our product these facilities were now used in almost every field. Assisted driving used where we vehicles along with rail, road equipped with sensors providing information to the driver which gives them better navigation and provide them safety and our government can also get benefit from this. Mobile ticketing is also is used.

C. Smart City and Urban Planning:

As we all are living in the environment where we can't imagine our lives without internet and internet support systems. Large population were moving in urban areas, today we are living in the era of internet and thus we need to plan for urban areas by using internet of things. The concept of smart city is also enabled in which many of the application such as smart agriculture, smart metering, smart grid, and smart health care, smart parking many more we're going online. By using the data generated in smart cities via sensor, Devices we can predict the future need for better urban planning. Many of the works were done on smart parking where we will put some lights on the recent work done in this area.

Smart parking system classification, its software and hardware design factors, parking trends in ecosystem and issues such as privacy, security, interoperability discussed in [40]. Fig .4 shows the various types of parking systems:

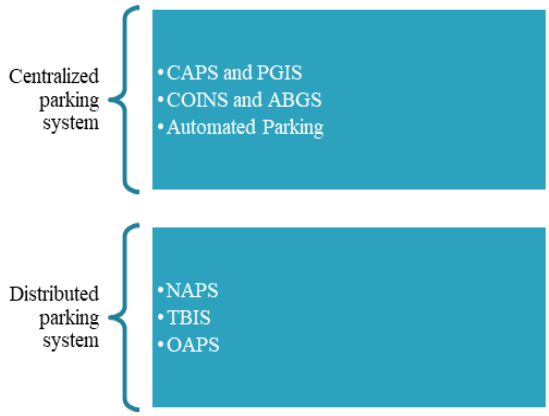

Fig. 3.Types of Parking System

PGIS has mainly has four sub-part and can be implemented in city or for individual parking lots where driver can find the vacant place in parking lot by navigating. COINS uses video sensor to find out whether the vehicles is present or not based on single source and then this information send to the control server of parking lot. Many recent work have done in this field we are just briefing some work not all.

D. Smart Agriculture:

As we were moving toward the world of internet, IoT has been applied to almost every area. In agriculture, smart technology were used to coherently interlink the products, services, knowledge to yield better quality products, sell, and increase the productivity of farmers. Several benefits of IoT in agriculture, their challenges and how data analytics combined with IoT is implemented in agriculture have been discussed [41]. There are many areas in which the workers were going on in agriculture and many literature survey have been done such as in crop production and livestock [42][43], water management and weather condition [44][45][46], monitoring of soil condition, disease control [47][48][49] and some work literature work were focused on precision agriculture [50]. Many works can be done in agriculture to make farmer benefit with better decision making and productivity. Application area which can be implied in agriculture are Monitoring, Tracking and Tracing, Agriculture machinery, Precision Agriculture and Greenhouse Production. Data analytics plays a major role in the agriculture which includes business intelligence analysis, massive, real-time analysis, and offline analysis [51]. The use of image processing with IoT has been widely used in agriculture for disease in stem, leaves, roots, fruits, detection of quality of fruits, weed, irrigation [52][53][54][55]. Drones were also used recently for better quality of productivity and reduce the failure of crops. Various data analytics method has been discussed briefly [56].

E. Forensic in IoT

Almost everything connected to internet and depending on wireless technology for connecting the things to the internet has created a lot of security, privacy, and authentication problems. So IoT has put a step forward toward the forensic department where by using recent technology it may resolve problems associated with security, privacy in many areas where internet has been used. Many recent works related to forensic has been done and much literature review has also been done in forensic IoT [61] [62] [63][64]. There are many applications where forensic can be used such as in smart transportation system, flood systems, middleware detection in smart traffic, heath monitoring, edge management and many more. Some of the issues in application area of IoT have been summarizes in the Table VIII with the protocols:

Table- VIII: Issues in application area of IoT

Applications	Protocol	Open research and security issues
AGRICULTURE	CoAP	Detection of diseases in crops, weed, fruits. Monitoring of weather condition Bridging gaps between demand and supply Energy issues, security attack, tracking, cloning
Lifesaver	CoAP MQTT	High energy consumption, privacy Interconnectivity

Smart City	MQTT CoAP	Denial of service attack, security Monitoring various application running in a city Waste management Transportation management Smart parking system
Medical Field	HTTP MQTT	New diseases identification Accuracy, privacy Flexibility in electronic gadgets Jamming and attacks of outsider
Industry	PROFINET OPC UA	Smart devices for sensing Energy consumption

VI. LIFE SAVER TOOL

Very few literature surveys have been done in lifesaver tool used in IoT environment. We put some focus in this field and mention some of life saver tool. Mainly lifesaving tools were used in for the road safety some of them were used in the medical field also and some in other smart application of IoT. Many new types of lifesaver tool were now used in health care such as Proteus Discover which is combination of smartphone application and sensors which can be edible by patients with their medicines. 3D pills recently been studies which can give experts the entire information of a particular patient so that they can give warning, precaution and treatment can be done inefficient way.

Many of life saver tools were used in homes such as smart AC, washing machine and dustbins. Some of them were listed in the Table IX giving the idea where these tools can be used:

Table- IX: Tools used in IoT

LIFESAVER TOOLS	APPLICATIONS/USES
Bumblebee	Designed for road safety which detect the issues or danger and send information to the nearby driver and controller of the area so that they resolve the issues based on priority.
HAPIfork	Is an electronic fork mainly designed for the patients which record eating habit of patients and send the notification to users if found something irregular eating habit and it also store the information online which can be used by expert.
BigBelly	Can be used in various applications such as in smart waste management which notify when the bins were full in area.
Airqualityegg and Air casting platforms	It records the quality of air pollution gives information when it reaches a certain level and shares the data of health a environment.
iGlucose	It provides care for diabetes patients having least cost and measures blood glucose information of patient and also record the pattern.
ADAMM	Used for asthma patients. It mainly records the heartbeat, breath pattern, body temperature, level of sugar, body temperature and warns the users if anything found abnormal.
Smart Traffic ParkSight	Guides the drivers to find out free lot for parking

VII. OPEN CHALLENGES AND ISSUES

Recently research work has been done in IoT and many new technologies were developed enabling the use IoT almost in every field. But there are many challenges and issues faced by the IoT which need be resolved in future. Many solutions were proposed to resolve the issues and challenges faced by IoT but they were all in their initial stage. Challenges were also faced in IoT environment when we implement some new technology or upgrade existing technology, we need to consider many things to design the infrastructure and if we are talking about the IoT we know that it is a dynamic environment it need vast adaptability and compatibility. As today the need of customer's, users, business changes regularly due to which we need to update the technology and proper maintenance should be maintain but these require large cost and affect the economy of country, so one should develop sensors in a way that they need less maintenance over the time with minimum cost. Another most important challenge in

Some of the issues in direction with future were discussed Table X:

Table- X: Issues in IoT

ISSUES	DESCRIPTION OF ISSUES REGARDING IT
Standards	• Many standard activities have been done in IoT environment but they were merged or implemented with framework.
Naming	• As we know objects connected to internet hence the need to be identified uniquely i.e. Object name server (ONS) which maps to description of particular objects

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Transport protocol	• Due to increase in connection and congestion on the network the protocols used in the transportation failed to fulfill the requirement of the connection. • And there is problem of buffering when we are analyzing or doing some important work over internet which needs to be resolved for connection and with no overhead. • Data buffering, connection control, traffic control.
Authentication	• It the most important issues which in current scenario fails in IoT environment because inappropriate infrastructure. • Lack of proper resources and their utilization dues to proper communication become a great problem. • Man in middle attack is also a serious problem
Data integrity	• Integrity of data should be maintain by keeping password over data but due to short address length data integrity is an important issue.
Mobility support	• As we say IoT covers entire areas but no one talking about its scalability and portability with different platforms, so these things need to be consider.
Digital forgetting	• As we know that storage cost has been decreased due to which large amount of data can be remember so there must be method to delete the data that are of no use periodically.
Traffic characterization	• As large numbers of data were generated so IoT will create many different patterns due to data traffic cause and it need to be solved.
Addressing	• Large numbers of devices were connected to the internet and day by day the ipv4 address decreases, so we need ipv6 addressing node so that we assign large number of nodes.

VIII. DISCUSSION

Internet has become the necessity of everyone, influenced the life of many people and most of the things were now done by using recent technologies. Recently IoT has become the revolutionary technology and connects everybody. As there are many advantages of using IoT there are many issues related to which need to be resolve. Many tools has been developed for experimental use and creating new applications for the users. But we need not to forget the while using the technologies and taking benefit from them, the very things is security and awareness of these technologies is necessary. Life saver tools which are grasping the eye of everyone today provide various tools such as Bumblebee, BigBelly, ADAMM, HAPIfork, Smart traffic parksight which helps to save the life and reduce the problems from day to day life. Many standards regarding the technologies and tools were defined so that proper standards should be maintained and proper work can be done. Many issues related security, addressing , authenticity , protocols , data integrity arises while working in any application so some proper and stable solutions need to be provided so that in future IoT can become a revolutionary technology. Many works were done related to energy optimization, performance increased of algorithm and prediction of some algorithms in data sets. ZigBee, IETF, IEEE 1588, CoAP, RPL, 6LoPAN, IEEE 15.1, IEEE 15.6, IETF SNMP WG, ITU-T SG 2 these are some standards which were defined for the communication and network so that we can we follow the standards. Many issues were needed to address in for better performance. Artificial intelligence together with internet of thing will be used as revolutionary technologies.

IX. CONCLUSION

To sum up, IoT has been widely used nowadays and changes a lot of things in our life ranging from working place to personal life. In this paper, we have discussed enabling and future propensity technologies and their smart applications were also discussed. We have also discussed different state-of-the-art prototypes. We have focused on the lifesaver tool that had been used in different field and addresses the challenges and issues that were faced in the IoT environment. From the above discussion, it was found that many works has been done for the smart city which is wider application of IoT. Many issues were found in the implementation of smart cities, some of them were addressed using Hadoop framework and various issues such as security, data integrity, protocols and standards still need to be addressed. Some of the works were also done in smart parking, automatic parking and payment systems were proposed but need some advancement. Much painting completed within the area of fitness care wherein many of lifestyles saver equipment have been also mentioned they were proved very friendly within the life of people. In smart agriculture many paintings inclusive of crop management, weed detection, water management and farm animals had been executed but these days some safety and protocols problems were need to be focused. Along with we've got located that if artificial intelligence is integrated with IoT then performance of the algorithms and advancement within the era can be advanced via which decision making criteria also can be improved. Our state-of--the-art helps to discover the diverse equipment and technology applied to implementation of the IoT to solve the issues related.

X. FUTURE SCOPE

We need to develop protocols which give solutions to the communication and networking issues which we are dealing with for our future generations.

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REFERENCES

1. Balaji, S., Nathani, K. and Santhakumar, R., 2019. IoT Technology, Applications and Challenges: A Contemporary Survey. Wireless Personal Communications, pp.1-26.
2. Marjani, M., Nasaruddin, F., Gani, A., Karim, A., Hashem, I.A.T., Siddiqa, A. and Yaqoob, I., 2017. Big IoT data analytics: architecture, opportunities, and open research challenges. IEEE Access, 5, pp.5247-5261.
3. Kambatla, K., Kollias, G., Kumar, V. and Grama, A., 2014. Trends in big data analytics. Journal of Parallel and Distributed Computing, 74(7), pp.2561-2573.
4. Hashem, I.A.T., Yaqoob, I., Anuar, N.B., Mokhtar, S., Gani, A. and Khan, S.U., 2015. The rise of "big data" on cloud computing: Review and open research issues. Information systems, 47, pp.98-115.
5. Porkodi, R. and Bhuvaneswari, V., 2014, March. The Internet of Things (IoT) applications and communication enabling technology standards: An overview. In 2014 International Conference on Intelligent Computing Applications (pp. 324-329). IEEE.
6. Atzori, L., Iera, A. and Morabito, G., 2010. The internet of things: A survey. Computer networks, 54(15), pp.2787-2805.
7. Katasonov, A., Kaykova, O., Khriyenko, O., Nikitin, S. and Terziyan, V.Y., 2008. Smart Semantic Middleware for the Internet of Things. Icinco-Icso, 8, pp.169-178.
8. Lunenfeld, P., 2010. Towards Visual Intellectuality: The Mediawork Pamphlet Series (An Interview by Elizabeth Guffey and Raiford Guins, Part 1). Journal of Visual Culture, 9(2), pp.139-161.
9. Culler, D., Chakrabarti, S. and Infusion, I.P., 2009. 6LoWPAN: Incorporating IEEE 802.15. 4 into the IP architecture. White paper.
10. Alam, F., Mehmood, R., Katib, I. and Albeshri, A., 2016. Analysis of eight data mining algorithms for smarter Internet of Things (IoT). Procedia Computer Science, 98, pp.437-442.
11. Berlian, Muhammad Herwindra, Tegar Esa Rindang Sahputra, Buyung Jofi Wahana Ardi, Luhung Wahya Dzatmika, Adnan Rachmat Anom Besari, Rahardhita Widyatra Sudibyo, and Sritrusta Sukaridhoto. "Design and implementation of smart environment monitoring and analytics in real-time system framework based on internet of underwater things and big data." In 2016 International Electronics Symposium (IES), pp. 403-408. IEEE, 2016.
12. Floerkemeier, C., Roduner, C. and Lampe, M., 2007. RFID application development with the Accada middleware platform. IEEE Systems Journal, 1(2), pp.82-94.
13. Gama, K., Touseau, L. and Donsez, D., 2012. Combining heterogeneous service technologies for building an Internet of Things middleware. Computer Communications, 35(4), pp.405-417.
14. Welbourne, E., Battle, L., Cole, G., Gould, K., Rector, K., Raymer, S., Balazinska, M. and Borriello, G., 2009. Building the internet of things using RFID: the RFID ecosystem experience. IEEE Internet computing, 13(3), pp.48-55.
15. He, W. and Da Xu, L., 2012. Integration of distributed enterprise applications: A survey. IEEE Transactions on industrial informatics, 10(1), pp.35-42.
16. Da Xu, L., 2011. Enterprise systems: state-of-the-art and future trends. IEEE Transactions on Industrial Informatics, 7(4), pp.630-640.
17. Bibri, S.E., 2018. The IoT for smart sustainable cities of the future: An analytical framework for sensor-based big data applications for environmental sustainability. Sustainable Cities and Society, 38, pp.230-253.
18. Al-Turjman, F. and Malekloo, A., 2019. Smart parking in IoT-enabled cities: A survey. Sustainable Cities and Society, p.101608.
19. Lu, R., Lin, X., Zhu, H. and Shen, X., 2009, April. SPARK: A new VANET-based smart parking scheme for large parking lots. In IEEE INFOCOM 2009 (pp. 1413-1421). IEEE.
20. Al-Turjman, F. and Alturjman, S., 2018. 5G/IoT-enabled UAVs for multimedia delivery in industry-oriented applications. Multimedia Tools and Applications, pp.1-22.
21. Idris, M.Y.I., Leng, Y.Y., Tamil, E.M., Noor, N.M. and Razak, Z., 2009. Car park system: a review of smart parking system and its technology. Information Technology Journal, 8(2), pp.101-113.
22. Srivastava, L., 2006, March. Pervasive, ambient, ubiquitous: the magic of radio. In European Commission Conference ''From RFID to the Internet of Things", Bruxelles, Belgium.
23. Gubbi, J., Buyya, R., Marusic, S. and Palaniswami, M., 2013. Internet of Things (IoT): A vision, architectural elements, and future directions. Future generation computer systems, 29(7), pp.1645-1660.
24. Ren, D., Chen, X. and Xing, T., 2011. A QoS architecture for Iot. In the proceedings of the 4th IEEE International Conference on Cyber, Physical and Social Computing Internet of Things (iThings/CPSCom).
25. Zhang, Y., Raychadhuri, D., Ravindran, R. and Wang, G., 2013. ICN based Architecture for IoT. IRTF contribution, October.
26. Marjani, M., Nasaruddin, F., Gani, A., Karim, A., Hashem, I.A.T., Siddiqa, A. and Yaqoob, I., 2017. Big IoT data analytics: architecture, opportunities, and open research challenges. IEEE Access, 5, pp.5247-5261. 'Need to reference later also big Iot'
27. Li, S., Da Xu, L. and Zhao, S., 2015. The internet of things: a survey. Information Systems Frontiers, 17(2), pp.243-259.
28. Xiao, G., Guo, J., Da Xu, L. and Gong, Z., 2014. User interoperability with heterogeneous IoT devices through transformation. IEEE Transactions on Industrial Informatics, 10(2), pp.1486-1496.
29. Li, L., Li, S. and Zhao, S., 2014. QoS-aware scheduling of services-oriented internet of things. IEEE Transactions on Industrial Informatics, 10(2), pp.1497-1505.
30. Alhnan, M.A., Okwuosa, T.C., Sadia, M., Wan, K.W., Ahmed, W. and Arafat, B., 2016. Emergence of 3D printed dosage forms: opportunities and challenges. Pharmaceutical research, 33(8), pp.1817-1832.
31. Ventola, C.L., 2014. Medical applications for 3D printing: current and projected uses. Pharmacy and Therapeutics, 39(10), p.704.
32. Mann, S., 2017. Big Data is a big lie without little data: Humanistic intelligence as a human right. Big Data & Society, 4(1), p.2053951717691550.
33. Haghi, M., Thurow, K. and Stoll, R., 2017. Wearable devices in medical internet of things: scientific research and commercially available devices. Healthcare informatics research, 23(1), pp.4-15.
34. Desai, S., Mantha, S.S. and Phalle, V.M., 2017, January. Advances in smart wheelchair technology. In 2017 International Conference on Nascent Technologies in Engineering (ICNTE) (pp. 1-7). IEEE.
35. Baker, S.B., Xiang, W. and Atkinson, I., 2017. Internet of things for smart healthcare: Technologies, challenges, and opportunities. IEEE Access, 5, pp.26521-26544.
36. Beißner, N., Lorenz, T. and Reichl, S., 2016. Organ on chip. In Microsystems for pharmatechnology (pp. 299-339). Springer, Cham.
37. Balijepalli, A. and Sivaramakrishan, V., 2017. Organs-on-chips: research and commercial perspectives. Drug discovery today, 22(2), pp.397-403.
38. Soumyalatha, S.G.H., 2016, May. Study of IoT: Understanding IoT architecture, applications, is-sues and challenges. In 1st International Conference on Innovations in Computing & Net-working (ICICN16), CSE, RRCE. International Journal of Advanced Networking & Applications.
39. Liu, Y., Seet, B.C. and Al-Anbuky, A., 2013. An ontology-based context model for wireless sensor network (WSN) management in the Internet of Things. Journal of Sensor and Actuator Networks, 2(4), pp.653-674.
40. Al-Turjman, F. and Malekloo, A., 2019. Smart parking in IoT-enabled cities: A survey. Sustainable Cities and Society, p.101608.
41. Elijah, O., Rahman, T.A., Orikumhi, I., Leow, C.Y. and Hindia, M.N., 2018. An overview of Internet of Things (IoT) and data analytics in agriculture: Benefits and challenges. IEEE Internet of Things Journal, 5(5), pp.3758-3773.
42. Benaissa, S., Plets, D., Tanghe, E., Trogh, J., Martens, L., Vandaele, L., Verloock, L., Tuyttens, F.A.M., Sonck, B. and Joseph, W., 2017. Internet of animals: characterisation of LoRa sub-GHz off-body wireless channel in dairy barns. Electronics Letters, 53(18), pp.1281-1283.

43. García-Lesta, D., Cabello, D., Ferro, E., López, P. and Brea, V.M., 2017. Wireless sensor network with perpetual motes for terrestrial snail activity monitoring. IEEE Sensors Journal, 17(15), pp.5008-5015.
44. Chieochan, O., Saokaew, A. and Boonchieng, E., 2017, July. IOT for smart farm: A case study of the Lingzhi mushroom farm at Maejo University. In 2017 14th International Joint Conference on Computer Science and Software Engineering (JCSSE) (pp. 1-6). IEEE.
45. Viani, F., Bertolli, M., Salucci, M. and Polo, A., 2017. Low-cost wireless monitoring and decision support for water saving in agriculture. IEEE Sensors Journal, 17(13), pp.4299-4309.
46. Kodali, R.K., Jain, V. and Karagwal, S., 2016, December. IoT based smart greenhouse. In 2016 IEEE Region 10 Humanitarian Technology Conference (R10-HTC) (pp. 1-6). IEEE.
47. Na, A., Isaac, W., Varshney, S. and Khan, E., 2016, October. An IoT based system for remote monitoring of soil characteristics. In 2016 International Conference on Information Technology (InCITe)-The Next Generation IT Summit on the Theme-Internet of Things: Connect your Worlds (pp. 316-320). IEEE.
48. Zhang, S., Chen, X. and Wang, S., 2014, August. Research on the monitoring system of wheat diseases, pests and weeds based on IOT. In 2014 9th International Conference on Computer Science & Education (pp. 981-985). IEEE.
49. Lee, H., Moon, A., Moon, K. and Lee, Y., 2017, July. Disease and pest prediction IoT system in orchard: A preliminary study. In 2017 Ninth International Conference on Ubiquitous and Future Networks (ICUFN) (pp. 525-527). IEEE.
50. Giri, A., Dutta, S. and Neogy, S., 2016, October. Enabling agricultural automation to optimize utilization of water, fertilizer and insecticides by implementing Internet of Things (IoT). In 2016 International Conference on Information Technology (InCITe)-The Next Generation IT Summit on the Theme-Internet of Things: Connect your Worlds (pp. 125-131). IEEE.
51. Chen, C.P. and Zhang, C.Y., 2014. Data-intensive applications, challenges, techniques and technologies: A survey on Big Data. Information sciences, 275, pp.314-347.
52. Jhuria, M., Kumar, A. and Borse, R., 2013, December. Image processing for smart farming: Detection of disease and fruit grading. In 2013 IEEE Second International Conference on Image Information Processing (ICIIP-2013) (pp. 521-526). IEEE.
53. Kapoor, A., Bhat, S.I., Shidnal, S. and Mehra, A., 2016, October. Implementation of IoT (Internet of Things) and Image processing in smart agriculture. In 2016 International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS) (pp. 21-26). IEEE.
54. Tripicchio, P., Satler, M., Dabisias, G., Ruffaldi, E. and Avizzano, C.A., 2015, July. Towards smart farming and sustainable agriculture with drones. In 2015 International Conference on Intelligent Environments (pp. 140-143). IEEE.
55. Cambra, C., Sendra, S., Lloret, J. and Garcia, L., 2017, May. An IoT service-oriented system for agriculture monitoring. In 2017 IEEE International Conference on Communications (ICC) (pp. 1-6). IEEE.
56. Marjani, M., Nasaruddin, F., Gani, A., Karim, A., Hashem, I.A.T., Siddiqa, A. and Yaqoob, I., 2017. Big IoT data analytics: architecture, opportunities, and open research challenges. IEEE Access, 5, pp.5247-5261.
57. Amendola, S., Lodato, R., Manzari, S., Occhiuzzi, C. and Marrocco, G., 2014. RFID technology for IoT-based personal healthcare in smart spaces. IEEE Internet of things journal, 1(2), pp.144-152.
58. Goudos, S.K., Dallas, P.I., Chatziefthymiou, S. and Kyriazakos, S., 2017. A survey of IoT key enabling and future technologies: 5G, mobile IoT, sematic web and applications. Wireless Personal Communications, 97(2), pp.1645-1675.
59. Alam, M.M., Malik, H., Khan, M.I., Pardy, T., Kuusik, A. and Le Moullec, Y., 2018. A survey on the roles of communication technologies in IoT-based personalized healthcare applications. IEEE Access, 6, pp.36611-36631.
60. Elijah, O., Rahman, T.A., Orikumhi, I., Leow, C.Y. and Hindia, M.N., 2018. An overview of Internet of Things (IoT) and data analytics in agriculture: Benefits and challenges. IEEE Internet of Things Journal, 5(5), pp.3758-3773.
61. Yaqoob, I., Hashem, I.A.T., Ahmed, A., Kazmi, S.A. and Hong, C.S., 2019. Internet of things forensics: Recent advances, taxonomy, requirements, and open challenges. Future Generation Computer Systems, 92, pp.265-275.
62. Clark, D.R., Meffert, C., Baggili, I. and Breitinger, F., 2017. DROP (DRone Open source Parser) your drone: Forensic analysis of the DJI Phantom III. Digital Investigation, 22, pp.S3-S14.
63. Ahmed, E., Yaqoob, I., Hashem, I.A.T., Khan, I., Ahmed, A.I.A., Imran, M. and Vasilakos, A.V., 2017. The role of big data analytics in Internet of Things. Computer Networks, 129, pp.459-471.
64. Ammar, M., Russello, G. and Crispo, B., 2018. Internet of Things: A survey on the security of IoT frameworks. Journal of Information Security and Applications, 38, pp.8-27.
65. Bashir, M.R. and Gill, A.Q., 2016, December. Towards an IoT big data analytics framework: smart buildings systems. In 2016 IEEE 18th International Conference on High Performance Computing and Communications; IEEE 14th International Conference on Smart City; IEEE 2nd International Conference on Data Science and Systems (HPCC/SmartCity/DSS) (pp. 1325-1332). IEEE.
66. Rathore, M.M., Ahmad, A. and Paul, A., 2016, October. IoT-based smart city development using big data analytical approach. In 2016 IEEE international conference on automatica (ICA-ACCA) (pp. 1-8). IEEE.
67. Arora, D., Li, K.F. and Loffler, A., 2016, March. Big data analytics for classification of network enabled devices. In 2016 30th International Conference on Advanced Information Networking and Applications Workshops (WAINA) (pp. 708-713). IEEE.
68. Rathore, M.M., Ahmad, A., Paul, A. and Rho, S., 2016. Urban planning and building smart cities based on the internet of things using big data analytics. Computer Networks, 101, pp.63-80.
69. Van Kranenburg, R., Anzelmo, E., Bassi, A., Caprio, D., Dodson, S. and Ratto, M., 2011. The internet of things. A critique of ambient technology and the all-seeing network of RFID, Network Notebooks, 2.
70. Juels, A., 2006. RFID security and privacy: A research survey. IEEE journal on selected areas in communications, 24(2), pp.381-394.
71. Sung, J., Lopez, T.S. and Kim, D., 2007, March. The EPC sensor network for RFID and WSN integration infrastructure. In Fifth Annual IEEE International Conference on Pervasive Computing and Communications Workshops (PerComW'07) (pp. 618-621). IEEE.
72. Pustejovsky, J., Lee, K., Bunt, H. and Romary, L., 2010, May. ISO-Time ML: An International Standard for Semantic Annotation. In LREC (Vol. 10, pp. 394-397).
73. Kushalnagar, N., Montenegro, G. and Schumacher, C., 2007. IPv6 over low-power wireless personal area networks (6LoWPANs): overview, assumptions, problem statement, and goals.
74. Weiser, M., 2002. The computer for the 21st century. IEEE pervasive computing, 1(1), pp.19-25.
75. Ketu, S. and Agarwal, S., 2015, August. Performance enhancement of distributed K-Means clustering for big Data analytics through in-memory computation. In 2015 Eighth International Conference on Contemporary Computing (IC3) (pp. 318-324). IEEE.
76. Ketu, S., Prasad, B.R. and Agarwal, S., 2015, September. Effect of Corpus Size Selection on Performance of Map-Reduce Based Distributed K-Means for Big Textual Data Clustering. In Proceedings of the Sixth International Conference on Computer and Communication Technology 2015 (pp. 256-260). ACM.

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